International Mobility Field Theory:
Extension of The Mobility Field Theory for Linking Internal and International Migration
by

Shekhar Mukherji

Professor and Head, Dept of Migration and Urban Studies
International Institute for Population Sciences, Bombay, India

Introduction

There has been a long felt need to apply concepts developed in analysis of spatial mobility to study international migration, and to unify internal and international migration or mobility into a single field of human spatial interaction. This IUSSP session has explicitly stated this as one main goals of finding new directions in mobility research. This paper does just that. It extends previous theory of the Mobility Field Theory of the present author – which was formulated and verified several times to analyze internal migration -- is now extended to explain international migration. In this sense, it makes a new and novel contribution to mobility research.

In this paper, first, Mobility Field Theory is briefly discussed; then in the second part, International Mobility Field Theory is very briefly presented.

Part I
MOBILITY FIELD THEORY

1. The Problems of Mobility

A. The Perspective
The main human problem associated with rural to urban movements in the Third World is that people are mostly moving from unemployment to underemployment, from green fields to dirty pavements, and from one poverty region to another, resulting in a colossal waste of human resources and perpetual human misery

Consequent to such movements, unemployment and disguised unemployment also shift from rural to urban areas. Since the available labour is limited, real wages in urban centers remain perpetually low and often swing downward. Many people, unable to find work in the town, are forced to return to the village. Such pattern of movement is neither creating a real transfer of population from the traditional agricultural t the urbanized industrial sector of a country's economy, nor is economic takeoff is occurring in spite of the fact that many such countries have launched centrally organized planning programmes.

Given such crucial problems, it is regrettable that few geographers and population specialists examine the issues entangled in people's mobility due to underdevelopment, view the act of movement in the total social context, or seek means of alleviating them through migration-mobility planning. The overriding purpose is just to develop and demonstrate a philosophical and empirical perspective that will enable human mobility problems to be viewed more closely and more intently, to better appreciate the magnitude of the problems involved and hopefully to establish a broad theoretical basis upon which migration planning for economic development and social change might build.

An attempt is made here to take a system theoretic perspective of the problem, and it is argued that need-attribute systems of the people, utility offerings of the places and different mobility behaviour that arise to satisfy those needs are interdependent parts of a system, called the mobility field, and it is postulated that any natural or induced change in any part of the system would generate corresponding changes in other parts. The most crucial aspect is that the need systems of the individual are regarded as the causal forces acting behind their movement behaviour, and consequently, it is suggested that if it is possible to induce desirable changes in the need-stress-attribute structure of the people, then it can bring changes in people's spatial behaviour, and vice-versa. It is also surmised that by inducing change in the spatial arrangement and the utilities of the places it is possible to induce changes in the behaviour of the people and in their attribute structure. In short, mobility can be planned to act as an agent of bringing socio-economic change.

As a part of this overall goal, a working model is developed that would be capable of (1) explaining some of the behavioural aspects of migration, circulation and other kinds of movement, (2) capable of viewing of mobility in the context of the social and spatial structure of the territory to be studied, and thus, (3) finally, capable of specifying the causal links between the needs of individuals, places offering to gratify these needs, and the resultant movement behaviour. From an understanding of such causal-functional links between the individual's need system and his movement behaviour, it would be possible to clearly specify what basic needs of the people ought be provided, what utilities of places ought to be augmented, and eventually, to lay out what may be and should be done to redress the problems in human spatial mobility in any specific region. Perhaps from such understanding, it will be possible to provide concrete clues for migration planning in a way which would facilitate better utilization of resources. In this monograph, certain behavioural, social, economic and spatial aspects of different kinds of mobility are considered, not in isolation, but rather in an organized framework, in a field theoretic-perspective, and a s a result, a field theory, is developed. The model is finally tested in the Indian situation and evaluated in regard to its usefulness in suggesting planning strategies to redress the human problems noted above.

B. An Alternative Approach

The formulation of the mobility field theory which lies at the core of this study, arose from dissatisfactions with such weaknesses of concept and methodology inherent in spatial behavioural studies. Consequently, the quest was for a philosophy of scientific explanation that would comprehend the complexity of spatial behavioural processes - a philosophical text that would organize and integrate all the territorial, behavioural and social aspects of the movement process into a general spatial theory of mobility. The goal, admittedly ambitious, is to develop a perspective in which theory, concepts, methodology and mathematical techniques were linked in a structured and tightly organised entity, capable on the one hand of providing operational definitions of the concepts and also of empirical verification of the theory on the other. the field theoretic perspective, first pronounced by Kurt Lewin, provided an alternative line of thinking. Thus a major effort of the present formulation of a spatial theory of mobility behaviour involved tracing the main ideas of Wolpert's model to their original source in Lewin's writings and starting all over again.

But, in so doing, an entirely different philosophical base has been evolved which emphatically focuses upon the basic needs of the individuals, not upon place utilities as such nor upon classificatory description of spatial patterns per se. since the overall goal is to provide a philosophical and theoretical basis for understanding problems in people's movements from rural poverty to urban slums, at the outset, intuitively the need was felt to evolve a perspective which will fundamentally and essentially focus upon the needs of the people and their stressful socio-economic-political conditions in which people are embedded, and view through them and integrate with them, everything else that is entangled in the people's movement behaviour. Evidently, needs must be given exclusive emphasis because, fundamentally, human problems are caused by unfulfilment or denial of the very basic human needs of food, sustenance, employment, education, and self-esteem. Understanding of the causal-functional links of people's need systems with their spatial-economic-social-demographic behaviour will urge us to focus directly on people's real problems, to face and solve them, and to undertake more relevant research issues.

Set against this quest for philosophy, the concept of the mobility field has been developed to provide a basis for such unifying and organising principle which may allow us a systematic understanding and to deal with such spatial processes and social structures, and to see them in causal relations.

It is desirable to understand, explain, and affect needs-aspirations-roles-traits-stress systems of the individuals (and households). These themselves are constantly changing within the context of the specific socio-economic-political systems, and are in fact delineating different configurations of individual mobility fields at a given space and time the purpose is to discover how such need stress systems determine the field's various componential structures (spatial extent of life-space and place utility considerations) and induce individuals' different kinds of movement behaviour.

Thus, the present formulation involves viewing individual mobility behaviour in the context of the structure of the field, giving operational definitions life space, place utility, need -attributes, stress situations, and movement behaviour in the context of the life of the individual, within the concept of the mobility field. This effort involves considerable conceptualization, first, inductively about an individual's behaviour, and second, deductively about aggregated behaviour. in this way, a mobility field theory is evolved by mathematically specifying the linkages of the need-stress-attributes of an individual and his subjective place utility considerations to the resultant mobility behaviour that arises to satisfy those needs. the mobility field theory is formulated in such a way as to permit empirical verification-a fundamental requirement that any theory must fulfil.

C. The Mobility Field

The mobility field is defined as a system which comprises the individual needs, aspirations, roles and traits including stresses in his specific location, his perception of utilities of all those discrete locations that define his subjectively relevant environment of life space, and his different kinds of movement behaviour, and their complex interrelationships. All these are interrelated parts of an individual's mobility field. they are co-existing facts of his life at a given space and time, and his particular mobility behaviour is a resultant manifestation of changing constellations of all these co-existing facts of his life-space in a given unit of time. (Mukherji, 1975, 99. 1-350, 1979, pp. 1-81)

The mobility field is dynamic in nature. it is an abstract spatial component of an individual's life. it expands from birth to maturity, and changes, moulds and organises as an individual's needs grow, aspirations alter, roles multiply, stresses occur, places develop, information flows, perceptions change and the individual's unique transaction with his own spatial system organises, as life cycle advances. In short, each individual has his own unique mobility field, his subjective environment, his world, a medium in which actions, movements, and living take place. His mobility field is spatial socio-economic-psychological organisation about and around himself.
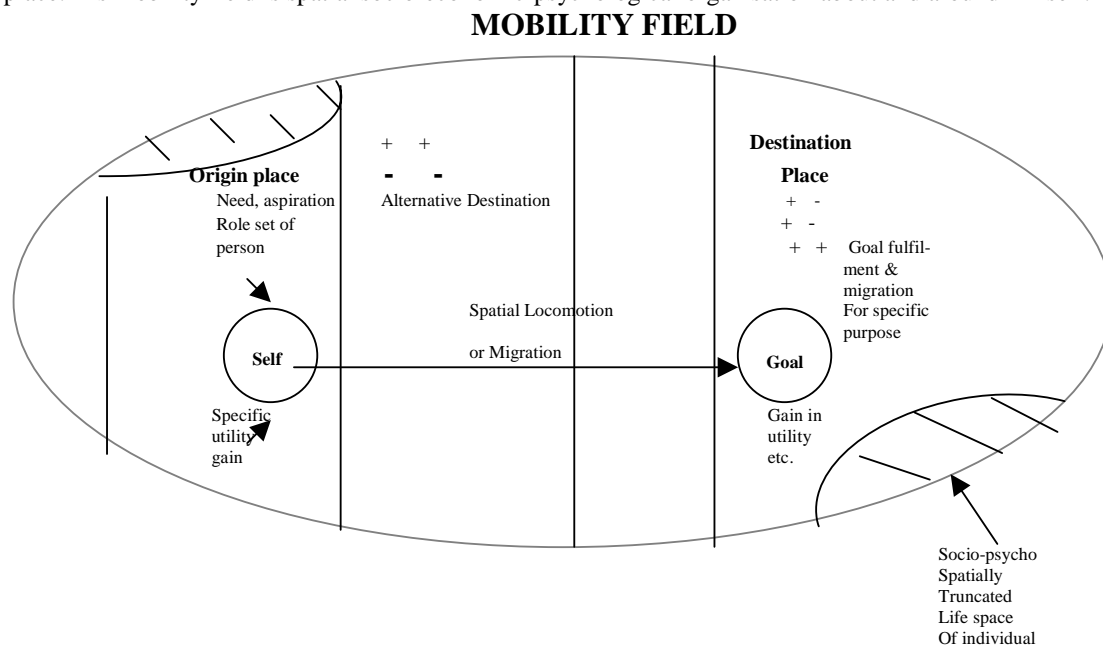
MOBILITY FIELD

Fig. 1: urge to satisfy specific needs and perception of specific utility gain elsewhere are motivating an individual to migrate or move from his present location in mobility field to a destination within the field in which the goal to gratify need is located

The most crucial to this field concept is that it regards the needs system of the individual as forming the nucleus around which the mobility field is structured (Fig 1). Needs are the sources of psychic energy-of social psychological tensions and stresses-generating driving forces which motivate an individual to move spatially, and to reach out within the mobility field for a specific need gratification. need-stress systems taint and pervade everything that would be subjectively relevant to the individual's environment. Thus, need systems determine and sample out the nature, content and spatial extent of the information that flow in-information about discrete locations-as a result of which the individual's life space or subjective spatial system is defined and delineated. This life space, in fact, delimits the utility space within which place utility considerations takes place and search for alternative destinations occurs. although this an abstract concept, this also indicates its importance as a tool for predicting search and movement behaviour.

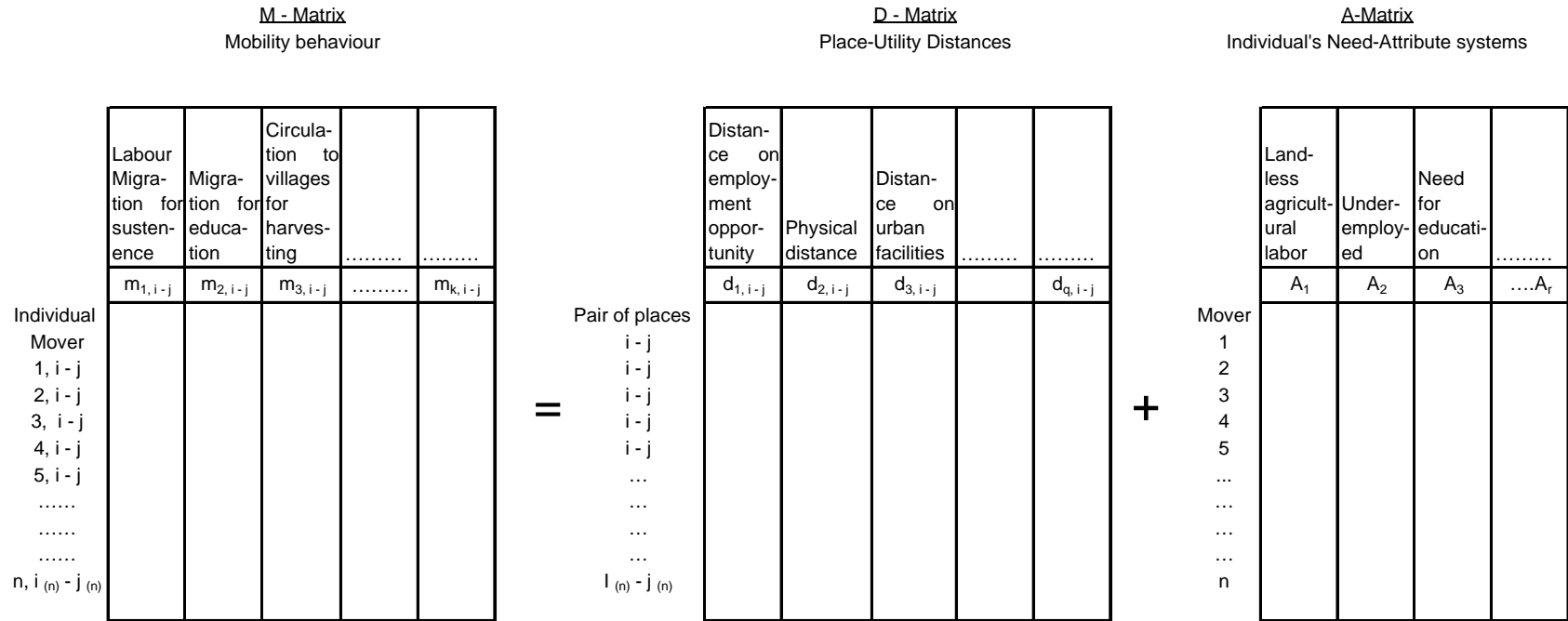## D. Field's componential structures and spaces

Both at the level of the individual and the aggregate system, the mobility field constitutes three basic structural components and correspondingly three abstract multi-dimensional spaces. Each of these spaces delineates and describes the configuration of corresponding componential structures and specifies each individual's specific location, relative to all others, on such spaces. Each of these spaces, in turn, is constituted by certain independent sub-components or dimensions which form the basis of the space. In simpler words, certain independent dimensions generate a space, which, in turn, constitutes one of the three spaces, and the three spaces together form the mobility field. These componential structures and spaces are:

1. **Need attribute structure**: this connotes individual's needs, aspirations, role; his social, economic and cultural traits, and also the stress conditions he undergoes due to his specific location in geographic space. Composites of these attributes would span the attribute space. These components specify an individual's relative location on this space.
2. **Subjective spatial System or structure of place utilities**: These imply a system of discrete locations, both rural urban, with their relative place-utilities, as perceived by different individuals. Composites of utility considerations would span the utility space. Similarly, such utility components define an individual's perception of a location's relative utility on this space.
3. **Mobility behaviour**: This connotes different general types of mobility behaviour. compositely these describe migration, circulation, and other kinds of movement made for different purposes by the individuals in a population. These behaviour types span the mobility behaviour space. An individual's specific movement behaviour vector can be precisely located in this space.

E. Matrix Design

The heart of the theory lies, then, in establishing the existing, but often overlooked, interrelationships between these three componential structures of the field, and thereby, to unfold the causal links of the need set and the place-utility considerations to movement behaviour that arise in attempting to satisfy these needs. These are explained in Table 1 (micro model). The design is self explanatory. Canonical analysis is to be performed between these three matrices, by taking migration matrix as the dependent set and the combination of the Need-attribute matrix (A) and Utility Distance matrix (D) as the predictor or independent set; and a series of canonical linkage equations are to be generated, linking each time a specific combination of variables from the dependent set (migration) with a specific combination of variables from the independent set (Need-attribute-cum-utility distances). These are exemplified in Table 5 (a test case of internal migration in India) (Mukherji, 2001, pp. 1-226)

4

Table 1
Mobility Field
MICRO MODEL

<u>M - Matrix</u>
Mobility behaviour

<u>D - Matrix</u>
Place-Utility Distances

<u>A-Matrix</u>
Individual's Need-Attribute systems

	Labour Migration for sustenence	Migration for education	Circulation to villages for harvesting	....	....
	$m_{1, i-j}$	$m_{2, i-j}$	$m_{3, i-j}$	....	$m_{k, i-j}$
Individual Mover					
1, i - j					
2, i - j					
3, i - j					
4, i - j					
5, i - j					
......					
......					
......					
n, i $_{(n)}$ - j $_{(n)}$					

=

	Distance on employment opportunity	Physical distance	Distance on urban facilities	....	....
	$d_{1, i-j}$	$d_{2, i-j}$	$d_{3, i-j}$		$d_{q, i-j}$
Pair of places					
i - j					
i - j					
i - j					
i - j					
i - j					
...					
...					
...					
...					
I $_{(n)}$ - j $_{(n)}$					

+

	Land-less agricultural labor	Under-employed	Need for education	....
	A_1	A_2	A_3	....A_r
Mover				
1				
2				
3				
4				
5				
...				
...				
...				
...				
...				
n				

$$\beta_1 m_{1, i-j} + \beta_2 m_{2, i-j} + \beta_3 m_{3, i-j} + \ldots = \alpha_1 d_{1, i-j} + \alpha_2 d_{2, i-j} + \alpha_3 d_{3, i-j} + \ldots + \alpha_1^* A_1 + \alpha_2^* A_2 + \ldots + \alpha_r^* A_r + \ldots$$

Example: Co-eff. (migration of labour for search of any manual job, from i to j place)   + … =   Co-eff. (higher utility of places j's providing jobs)   +   Co-eff. (perception of nearness)   + …+ Co-eff. (need for sustenence)   + …+ Co-eff. (severely under-employed)   + …

5

2. The Mobility Field Theory
A. General Statement

Mobility field theory states, in both verbal and mathematical form, that :
1. at the level of individual, movement behaviour of a person, located at place I, towards another place j, is a linear function of both that person's specific need-stress-attribute set and his perception of place utility distances between the pair of places (origin-destination) (Table1), and
2. at the level of aggregate system, the need0-stress-attribute structure of the individuals in a population, their perceived place utility distances between pair of places, and their resultant types of mobility behaviour, are interdependent parts of the mobility system, called mobility field, and any natural or induces change in one part would generate corresponding changes in other parts of the field. (Table 2 and Table 5)

B. Assumptions

Five basic assumptions underlie this theoretic model:

First, the assumption of co-existence: that is, an actor's attributes, his perception of place utilities and his mobility behaviour co-exist in a field, and the whole field is relevant to understanding of specific behaviour.

Second, the assumption of contemporaneity: that is, only the present is sufficient for explaining mobility behaviour, the past is presumed to operate through the behaviour, attributes and place utility considerations that are currently co-existing in the field. This concept of co-existence of facts in the life space of the actor is fundamental in Lewin's field theory and also in the present theoretical perspective. Conceptually and mathematically, this notion of co-existence permits picking-off only those specific attributes, utility considerations and behaviour which are really co-existing in a field, which have demonstrable effects upon behaviour, excluding all others which do not belong to that field.

Third, the assumption of interdependence: that is various parts of a given life space of the individual actor are to some degree interdependent, i.e., the person's needs, his place utility considerations and his behaviour are interdependent parts of a whole, called the mobility field.

Fourth, the assumption of relative functional distance: absolute magnitudes of place utilities are considered irrelevant to mobility behaviour; what is relevant is relative behaviour of a person, located at place I, towards another place j and the utilities of these places relative to each other (gains of losses)

Fifth, the assumption of need-stress-attributes: crucial to mobility field theory is the basic assumption that the absolute magnitude of need-stress-attribute systems of the individual person is relevant to his mobility behaviour, and his perception of relative utilities of places of origin and destination is coloured by and filtered through the prism of this need-stress-attribute system. Thus, in explaining mobility behaviour these two elements must be considered, not in isolation, but rather simultaneously.

C. Axioms
1. The mobility system is a field consisting of all attributes of persons and of places of all movement behaviour of persons towards places, and their complex inter-relationships.
2. The mobility field can be divided analytically into person's attribute, A, utility, U, and mobility0behaviour, M, spaces into which attributes of persons, perceived utility of places and movement behaviour of the person to places are projected, respectively, as vectors with length and direction.
3. The attribute, utility and mobility-behaviour spaces are spanned by dimensions which generate the spaces and which are finite and empirically determinant.
4. The attributes of places and attributes of the individual mover are required to be linked and subsumed in the notion of the individual mover's perception of place utilities. Thus, geographic units such as places and persons are located as vectors, respectively, in utility and attribute spaces and are coupled into dyads in mobility behaviour space, i.e. the dyad connoting a mover (P) located at a place i moving towards a place j.

6

5. Attribute vectors, A_1, A_2, in A space that describes the need systems of individual person and the distance vectors, d_1, d_2, in U space that connect a pair of geographical units (origin and destination) and which measure utility differences between them, are spatial behavioural forces determining the location, M, of dyads in M space according to the linear function :

$$M_{i\text{-}j} = \Sigma\alpha_q \ d_{q}, {}_{i\text{-}j} + \Sigma\alpha_r \overset{*}{A_r}$$

The basic axiom of the mobility filed theory is that the movement behaviour of a person, located a place I, towards another place j is a linear transformation of the person's specific need-stress-attribute set and in relation to these, his perception of place utility differences between that pair of places.

6. the direction and velocity of movement of time of dyad in mobility behaviour space is along the resolution vectors of the forces, d and A, as person's needs change, places multiply and perception of their utilities change over time.

7. Mobility behaviour space is a sub-space of combined A and U spaces. M space is completely contained in A-U space and the dimensionality of M-space is less than or equal to that of A-U space. That is, a basis of M-space is a linear combination of a basis of A-U space and that a basis of M space is also possible to find that is a subset of a basis of A-U space.

Field Explained

In this theory, "field" means causal relations between a specific set of dependent variables and a specific set of independent variables; and thus, producing a specific 'field", or a "system" within which those elements or those variables, co-exist together, excluding others which do not belong to that particular field or system. As we shall see later, a series of such fields can be generated in a singular canonical analysis. (Table 5)

TWO MODELS OF THE MOBILIY FIELD THEORY

1. MICRO MODEL : The above is a *micro model* of the Mobility Field theory, as it focuses on the individuals mobility behaviour. So, in Table 1, all the elements of the three matrices refer to the individual migrants, their need-attributes and their utilities, and the final canonical linkages also refer to the individuals. So, this is termed as Micro Model. It requires data of the individuals' mobility behaviour and their attributes and utilities. Evidently, data requirement of this model is tough and difficult to get., without specific survey. This model and its testing is fully elaborated in ealier studies (Mukherji, 1975, pp. 1-375; Mukherji, 1979, pp. 1-81, Mukherji, 1979, 1-50).

2. MACRO MODEL: On the other hand, *macro model* refers to aggregate systems, like regions or cities or districts or communities, and, as such , its data requirement is not that tough, as it involves to aggregate level of analysis. In table 2, such aggregated level of analysis is also suggested, which can be performed at state level, or district or city level. Such diverse levels of analysis were successively performed at state, district and city levels, using different Census of India data (of 1961, 1971, 1981, and 1991) and are elaborated in many earlier studies (Mukherji, 1980, pp. 42-125; 1985, 10-20; 1992, pp. 1-82; 1994, 50-120; 2000, pp. 50-175; and 2001, pp. 65-225). Table 2 illustrates this macro model-- where volume and rate of in-migration and out-migration at state level are analyzed in relation to the levels of socio-economic development of the states, and with the matrix of growth efforts and investments made therein Canonical analysis is performed between these three matrices, and causal canonical linkages are generated. between them.

CONCEPTUAL
AND
ANALYTICAL DESIGN
(Canonical Model)
MACRO MODEL

States | $M_1\ M_2\ .\ .\ .\ .\ .\ .\ .\ .M_m$

| 1 |
| 2 |
| . |
| . |
| . |
| . |
| N |

MIGRATION MATRIX

$=$

States | $S_1\ S_2\ .\ .\ .\ .\ .\ .\ .\ .\ .\ .\ .\ .\ S_Q$

| 1 |
| 2 |
| . |
| . |
| . |
| . |
| N |

SOCIO-ECONOMIC MATRIX

$+$

States | $I_1\ I_2\ .\ .\ .\ .\ .\ .\ .\ .\ .\ .\ .\ I_R$

| 1 |
| 2 |
| . |
| . |
| . |
| . |
| N |

INVESTMENT MATRIX

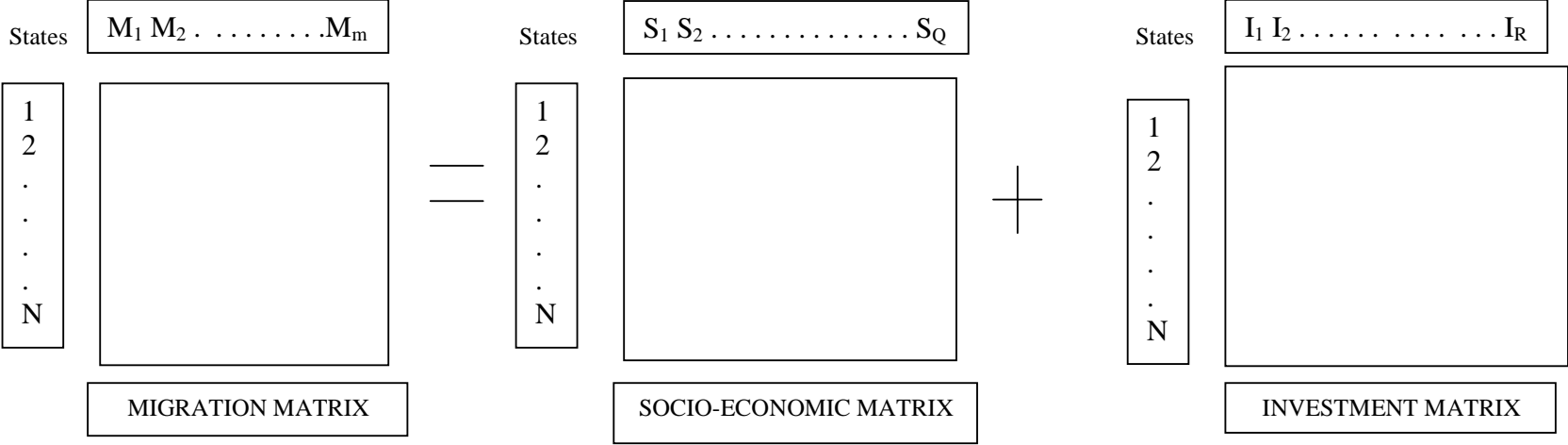$$\sum \beta_m\, M_m = \sum \alpha_Q\, S_Q\ +\ \sum \alpha^*_R\, I_R$$

Table 2

8

Macro Model of Analysis performed at State Level: Causal Canonical Linkages between volume and rate of in-migration variables at state level, in the one hand and socio-economic variables and investment variables of those states , on the other, is done according to the analytical strategy, as illustrated in Table 2:

First, the socio-economic matrix of Indian states is factor analyzed (see Table 3-4 for results of factor analysis), then the factor scores are generated for each state on each of those identified factors. Thence, these factor scores are taken as inputs for final linking Canonical analysis (as the Independent Matrix), and these are linked with migration variables (as Dependent matrix). (Tables 3-4). This model of analysis has yielded useful and meaningful results, shown in Table 5.

In short, Macro Model of Canonical analysis at State-Level is performed to connect Migration variables and Factors of Socio economic Matrix, and it has yielded following three Canonical Linkage equations (Table 5):

1. Where service sectors of the economy of the state are high, in-migration rate is also high (Canonical Correlation is 0.86).
2. Volume of out-migration is high from those states, where agricultural development is low, and proportion of landless agricultural labourers are comparatively more (Canonical correlation 0.72).
3. Volume of in-migration into those states is high and out-migration is low, where the level of economic development is comparatively high and level of urbanization is also high (Canonical Correlation 0.38). (The fourth relationship was not significant).

The canonical equations indicate that : a) volume of in-migration into these states are relatively high, where levels of economic development-cum-urbanization are comparatively more; b) in-migration rate is also high where tertiary sectors are more prevalent; and c) out-migration is occurring more from the backward and under-developed states. In short, these findings call forth for urgent measures to reduce widespread regional disparities in the levels of development.

The Trace correlation, or general statistical overlap between dependent and independent matrices,. is also high, 0.59. Respective canonical correlations are also high, generating meaningful linkage equations that are having useful policy import. It indicates the great need for reducing wide regional disparities in the level of agricultural and economic development between the states, and the need to a have a more balanced migration flows between them. Here , referring back to the concept of "field", three separate fields are identified and generated by the canonical analysis. every time, a specific combination of the dependent variable(s) is picked-off from the dependent set, and is linked with a specific set of independent variables from the independent set (both from socio-economic matrix and investment matrix), and thereby producing a specific field in which all those variables co-exist, excluding others which do not belong to that particular field. In short, canonical results verify the central notion of the Mobility Field theory and prove the concept of inter-dependence between dependent set and independent sets of variables.

Table 3: State-level analysis - Socio-Economic Variables and Investment Variables of Selected States, India 1991

SLNO	STATE	PCI	POPGRO	URBANISA	GLITERA	CULT	AGL	MNF	TC	TRANS	SERV	PERFAREA	PERNSA	FERTCON	VMCROPPH	PROFOOD	PCBCAGI	PCBCSSI	PCBCIND
1	Andhra P	4738	2.17	26.89	44.09	27.74	40.87	5.47	6.69	2.79	8.79	21.27	38.00	131	4392	150	338	131	525
2	Arun. P	5397	3.11	12.80	41.59	60.36	5.12	2.56	3.32	1.02	19.44	93.88	2.72	3	4167	210	82	71	607
3	Assam	4281	2.13	11.10	52.89	50.90	12.09	3.12	6.84	2.50	11.11	25.27	34.46	11	3875	119	112	90	332
4	Bihar	2665	2.13	13.14	38.48	43.58	37.13	2.26	4.00	1.28	7.72	16.87	44.43	58	3017	118	110	57	143
5	Goa	8797	1.49	41.01	75.51	14.84	9.11	13.02	15.10	8.33	22.40	28.41	23.96	350	3702	90	352	384	2102
6	Gujarat	5917	1.91	34.49	61.29	33.37	22.92	14.47	8.87	3.79	9.72	10.00	51.08	67	2446	77	227	309	1121
7	Haryana	7508	2.36	24.63	55.85	38.78	19.01	9.03	8.62	3.24	16.11	3.01	82.29	114	4564	474	505	307	888
8	Him. P	4910	1.79	8.69	63.86	63.24	3.32	3.71	4.38	1.91	14.39	27.19	18.12	35	2343	203	194	167	403
10	Karnataka	4605	1.90	30.92	56.04	34.21	28.92	8.84	7.98	2.63	8.84	15.90	53.40	82	3495	146	386	219	732
11	Kerala	4200	1.32	26.39	89.81	12.24	25.54	11.59	12.64	5.99	15.18	27.83	56.39	79	8034	37	276	188	563
12	Madhya P	4053	2.40	23.18	44.20	51.75	23.51	4.40	4.77	1.70	7.62	31.78	4.39	38	2170	208	181	97	317
13	Maha.	7367	2.29	38.69	64.87	32.81	26.81	11.60	8.57	3.74	10.38	17.36	58.62	61	2202	115	204	319	1784
15	Meghalaya	4530	2.80	18.60	49.10	55.31	12.43	1.82	5.31	1.40	14.80	38.01	8.75	15	2957	75	162	44	166
17	Nagaland	5498	4.60	17.21	61.65	72.80	1.37	1.37	3.13	0.98	17.22	25.69	16.37	4	2084	93	204	169	302
18	Orrisa	3077	1.80	13.38	49.09	44.31	28.69	3.51	5.38	1.74	9.55	38.32	40.69	22	2425	162	140	63	210
19	Punjab	8341	1.86	29.55	58.51	31.44	23.83	10.95	10.54	3.84	14.69	4.38	83.39	177	6856	827	599	466	1062
20	Rajasthan	4191	2.50	22.88	38.55	58.80	10.00	5.45	6.42	2.39	9.69	6.41	45.46	25	1559	163	198	98	288
21	Sikkim	5302	2.51	9.10	56.94	57.93	7.93	3.05	5.49	1.83	13.41	3.62	13.35	12	2108	217	79	132	225
22	Tamilnadu	5071	1.40	34.15	62.66	24.84	34.63	10.50	8.68	3.09	10.24	15.77	43.85	124	6622	124	365	312	1190
23	Tripura	3370	2.95	15.30	60.44	38.15	23.44	3.49	7.73	2.74	19.08	58.02	24.43	25	3431	156	120	57	163
24	Uttar P	3590	2.29	19.84	41.60	53.27	18.94	5.34	6.17	1.86	9.98	17.17	57.78	90	4502	220	159	101	271
25	W. Bengal	4710	2.22	27.48	57.70	28.40	24.56	12.06	10.72	4.22	10.75	12.34	60.37	95	5139	152	90	184	851

PCI - Per capita income

POPGRO - Population growth rate

URBANISA - Urbanisation

GLITERA - General literacy

CULT -Percent cultivators

AGL - Percent agricultural labourers

MNF -Percent workers in manufacturing

TC - Percent workers in trade/commerce

TRANS - Percent workers in transport

SERV - Percent service workers

PERFAREA -Percent forest area

FERTCON - Consumption of fertilizers

VMCROPPH - Value of crop per hectar

PROFOOD- Food production

PCBCAGI - per capita bank credit to agriculture

PCBCSSI - Per capita bank credit to SSI (Small Scale Industry)

PCBCIND - Per capita bank credit to industry

Table 4 : Factor analysis results: Rotated Factor Structure Matrix of Socio-economic Variables and Investment Variables, States, India 1991

Variables	FACTORS			
	1	2	3	4
Meaning of Factors	Urbanisation and Economic development dimension	Value of agriculture, agricultural labourers and trade/commerce dimension	Agricultural development dimension	Service sector as, significant aspect of economic structure of the city
Per capita bank credit to industry (PCBCIND)	**0.93**	0.00	0.15	-0.02
Percentage of workers in transport (TRANS)	**0.87**	0.38	-0.01	0.13
Urbanisation (URBANISA)	**0.85**	0.14	0.10	-0.30
Percentage of workers in ma nufacturing (MNF)	**0.84**	0.31	0.16	-0.25
Percentage of workers in trade/commerce (TC)	**0.82**	**0.48**	0.11	0.04
Per capita bank credit to SSI (PCBCSSI)	**0.79**	0.04	0.56	-0.08
Consumption of fertilisers (FERTCON)	**0.76**	0.26	0.27	0.03
Per capita income (PCI)	**0.74**	-0.24	0.54	0.22
General literacy (GLITERA)	**0.66**	0.31	-0.06	0.34
Value of crop per hectar (VMCROPPH)	0.18	**0.82**	0.36	0.15
Percentage of cultivators (CULT)	-0.66	-0.70	0.00	0.17
Population growth (POPGRO)	-0.40	-0.61	0.01	0.34
Per Capita food production (PROFOOD)	-0.07	0.05	**0.95**	0.02
Per capita bank credit to agriculture (PCBCAGI)	0.44	0.23	**0.75**	-0.11
Percent net sown area (PERNSA)	0.28	0.39	**0.55**	-0.48
percentage of workes in service (SERV)	0.28	-0.05	0.14	**0.92**
Percent forest area (PERFAREA)	-0.30	0.08	-0.35	0.67
Agricultural labourers (AGL)	0.02	**0.61**	-0.02	-0.65
Eigen Value	7.00	2.83	2.78	2.46
Percentage of Variance	38.87	15.74	15.43	13.68
Cumulative % of Variance	38.87	54.60	70.04	83.72

Table 4 contd.

SLNO	STATE	VINMIGM	INMIGRTM	VOMIGM	OMIGRTM	FS1	FS2	FS3	FS4
1	Andhra P	189714	0.56	173126	0.51	-0.289	0.755	-0.045	-0.940
2	Arunachal P	46526	10.01	8691	1.87	-0.987	-0.249	-0.106	2.276
3	Assam	82078	0.70	88092	0.76	-0.646	0.108	-0.394	0.181
4	Bihar	162590	0.36	454092	1.00	-1.200	0.461	-0.481	-1.242
5	Goa	37003	6.22	10576	1.78	3.106	-0.230	-0.571	1.494
6	Gujarat	203158	0.95	79481	0.37	1.257	-0.665	-0.583	-1.147
7	Haryana	309360	3.50	241631	2.74	0.228	-0.112	2.207	0.003
8	Himachal P	78458	3.00	46583	1.78	-0.406	-0.692	0.009	0.721
10	Karnataka	256825	1.12	251047	1.09	0.233	0.201	0.037	-1.052
11	Kerala	135000	0.94	91558	0.64	0.550	2.731	-0.772	0.937
12	Madhya P	378895	1.11	313605	0.92	-0.540	-0.560	-0.497	-0.625
13	Maharashtra	331876	0.81	303445	0.74	1.568	-1.087	-0.430	-1.022
15	Meghalaya	13882	1.53	9544	1.05	-0.659	-0.472	-0.539	0.661
17	Nagaland	10566	1.65	6649	1.04	-0.353	-2.053	0.215	1.109
18	Orrisa	98700	0.61	118494	0.74	-0.960	0.514	-0.570	-0.490
19	Punjab	226410	2.10	178719	1.66	0.276	0.697	3.550	0.141
20	Rajasthan	305754	1.33	304177	1.32	-0.301	-1.164	-0.070	-0.929
21	Sikkim	8505	3.93	5289	2.44	-0.439	-1.061	-0.091	0.223
22	Tamilnadu	91417	0.32	240469	0.85	0.563	1.132	0.016	-0.647
23	Tripura	12046	0.85	12509	0.88	-0.699	0.847	-0.665	1.426
24	Uttar P	378770	0.51	573453	0.77	-0.801	0.229	0.270	-0.556
25	West bengal	200635	0.56	172599	0.49	0.497	0.669	-0.491	-0.521

VINMIGM - Volume of in-migration, (males)

INMIGRTM - In-migration rate, (males)

VOMIGM - Volume of out-migration, (males)

OMIGRTM - Out-migration rate, (males)

FS 1 - Economic development-cum-urbanization dimension

FS 2 - Agricultural labourers, trade/commerce, moderately high agricultural productivity dimension

FS 3 - Agricultural development, high NSA, high food production dimension

FS 4 - Service sector of economy

Table 5: Canonical Structure Matrix: Canonical Linkages between Migration Variables and Socio-Economic Factors of States, India, Males 1991.

	CANONICAL VARIATE PAIRS			
	1.	**2.**	**3.**	**4.**
A. Dependent Matrix	**Canonical Loadings**			
(Migration Variables of States)				
1. Volume of In-migration	-0.34	-0.53	**0.70**	0.05
2. In-migration rate	**0.81**	0.24	0.17	-0.73
3. Volume of Out-migration	-0.46	**0.31**	**-0.63**	-0.60
4. Out-migration rate	-0.11	**-0.75**	-0.30	0.32
B. Independent Matrix				
(Socio-Economic Factors of States)				
1. Economic Development-cum-Urbanization dimension	0.13	-0.14	**0.95**	0.24
2. Agricultural labourers, Trade/Commerce, moderately high agricultural productivity dimension	-0.19	**0.42**	-0.13	0.88
3. Agricultural Development High NSA, high food production dimension	-0.10	**-0.90**	-0.21	0.38
4. Service sector of economy	**0.97**	0.01	-0.18	0.18
C.CANONICAL CORRELATIONS	**0.86**	**0.72**	**0.38**	**0.01**
D.Meaning of Canonical Linkages	Where Service is high in-migration rate also high	Vol. Of out-migration high where agri-cultural dev-lopment is low and agri-cultural labourers high more	Vol. of in-migration high and out-migration low, where economic development-urbanisation	Not sign-ificant

E. TRACE CORRELATION = 0.5931407
WILKS LAMBDA = 0.1045761
CHI SQUARE = 39.5122100
Significance = 0.001

Part II
INTERNATIONAL MOBILITY FIELD THEORY

The Issue of Explaining International Migration
and Linking it with Internal Migration

One of the basic issue of the mobility research now is to link and integrate both internal migration and international migration, and to achieve a unified theory of spatial mobility. Evidently, this is a very difficult task. Before this is attempted, it is surmised briefly to discuss the existing theories of international migration.

Existing Theories of International Migration

Massey et al (1994, pp 699-751) have provided a critical evaluation of existing theories of International migration. Broadly speaking, there exist four theories of international migration : (1) Neo-classical economics, (2) new economics of migration, (3) dual labour market theory, and (4) world systems theory. A critical evaluation of these theories are also presented in UN (1997, pp. 1541-164), and Martin (2001, pp.10-20). Neo-classical economics theory refers to push-pull factors, and differentials in wages and employment conditions between different countries as causes of international migration. The new economics theory of migration, on the other hand, refers to household decision-making which tries to minimize risks to family income or household production activities, and tries to make capital gain by relocating in a more advanced country. Dual labour market theory, on the other hand, emphasizes that there exists "… an inherent duality in the labour market (which) creates stable, permanent, well-paid jobs in the primary economy and unstable, temporary, poorly-paid jobs in the secondary sector. Natives tend to be attracted to the stable jobs, whereas the immigrants are willing to take the less secure one" (Martin, 2001, p. 19). The World systems theory on the other hand views that "immigration as a natural consequence of economic globalization and market penetration" (ibid, p. 19); so more economic development of a country, new skill acquirement of persons, and increased income potentials of people in many countries may attract them to new vistas in a foreign country.

However, it can be argued that none of these theories have strong mathematical and structural organization, nor strong theoretical underpinnings, and nor vivid empirical support. Nor are they mutually exclusive. Some elements of all these factors may impinge upon the lives of the individuals and families to opt for international relocation. So, in the present formulation, attempts are made to make it as much comprehensive as possible.

Extension of The Mobility Field Theory to International Migration
Methodology Adopted

Original Mobility Field Theory states, in both verbal and mathematical form, that (1) at level of individual, movement behavior of a person located at place i, towards another place j, is a linear function of both that person's specific need-stress-attribute set and his perception of place utility distances between that pair of places (origin-destination); and (2) at level of aggregate system, need-stress-attribute structure of population, their perceived place utility distances between pairs of places, and resultant types of mobility behavior, are interdependent parts of mobility system, called Mobility Field, within which any change in one generates changes in other. Crux of MF theory lies in mapping out bases of Mobility behavior space (M) on to that of combination of Utility distance-cum-Attribute space (AU), and ascertaining degree of interdependence between structure of attribute-cum-utilities and patterns of mobility. MF Theory thus indicates causal relations between people's need, as filtered through place utility, and resultant mobility that arises to satisfy those needs. Canonical analysis (a higher form of regression) was performed to ascertain causal linkages between three system (mobility, utility, attributes). MF Theory was several times verified with survey and census data and was found generating statistically highly powerful linkages, and practically highly meaningful findings. (Mukherji, 1980, 1985, 1992, 1997, 2001)

Now, this MF theory can be easily extended to explain International Migration. Original MF Theory was formulated to focus on basic needs-stresses of individual, his utility perception of origin and destination, and resultant internal migration. This can be easily extended to explain international migration, as it may refer to basic needs-stresses-attributes of that person in origin country, his/her utility considerations of different countries (to fulfill that needs/goals), and resultant international migration that arises from satisfying those basic needs-aspiration-goals.

So, causal linkages between these three systems of the individuals can be easily ascertained, at the level of international migration of the individual movers,. This is illustrated in Table 6. Here, the focus is on (1) international

migration behaviour of the individuals, (2) their inter-country utility gains (between the origin and destination countries), and (3) the needs, aspirations, and desire for betterment of the individual international migrants. Although, the data requirements for testing and verifying this micro model of International migration is tough; but it is not impossible. This is termed as Micro model of international migration (see Table 6). Canonical linkage analysis, then, can be performed to obtain causal linkages between various elements of those three matrices — that is, .the resultant patterns of international migration, the utility considerations, and the need-attribute-aspiration structure of the individuals. Table 6 elaborates on various elements of these three matrices. The final linking canonical equation is also given, with examples. These are all very self explanatory.

Likewise, the same idea can be extended to explain the *aggregate system of international migration* between various countries, by performing canonical linkage analysis between three matrices: (1) Matrix of inter-country international migration (M) (dependent matrix), and (2) Socio-economic differences or distances between those origin-destination countries (S); and (3) Emigration/Immigration policies of those countries (P) (last 2 as independent matrices). This is illustrated in Table 7. The ensuing canonical linkages will emerge in the same way as demonstrated in Table 5 (as done for macro model of internal migration). This is termed as Macro model of International Migration. In Table 7, details of macro model are presented, along with final canonical linkage equation, and with examples. These are very self explanatory models.

Elegance of International Mobility Field Theory

In the present attempt, thus, both focus upon the individual personal factors (their needs, roles, aspirations, and desire for betterment, etc), inter-country differences in the levels of development (socio- economic differences or distances), and emigration and immigration policies of respective countries are duly emphasized. In these sense, the present formulations is more comprehensive. More importantly, it views all these factors, not in isolation, rather in an organized manner, and presents the theoretical model in mathematically verifiable and testable manner.

The structural organization of thoughts and integration of all various elements of the process of international migration manifest the elegance of the present International Mobility Field Theory

Micro and Macro Models of International Mobility Field Theory

In this paper, both micro and macro models of internal migration are presented (Tables 1 and 2). Likewise, micro and macro models of international migration are also presented (Tables 6 and 7). Theoretical underpinnings of these models are also considerably illustrated through the Tables. However, due to lack of specific data of volume of inter-country international migration, neither macro model, nor micro model of international migration can be presently tested and verified. These will be the issues for further research.
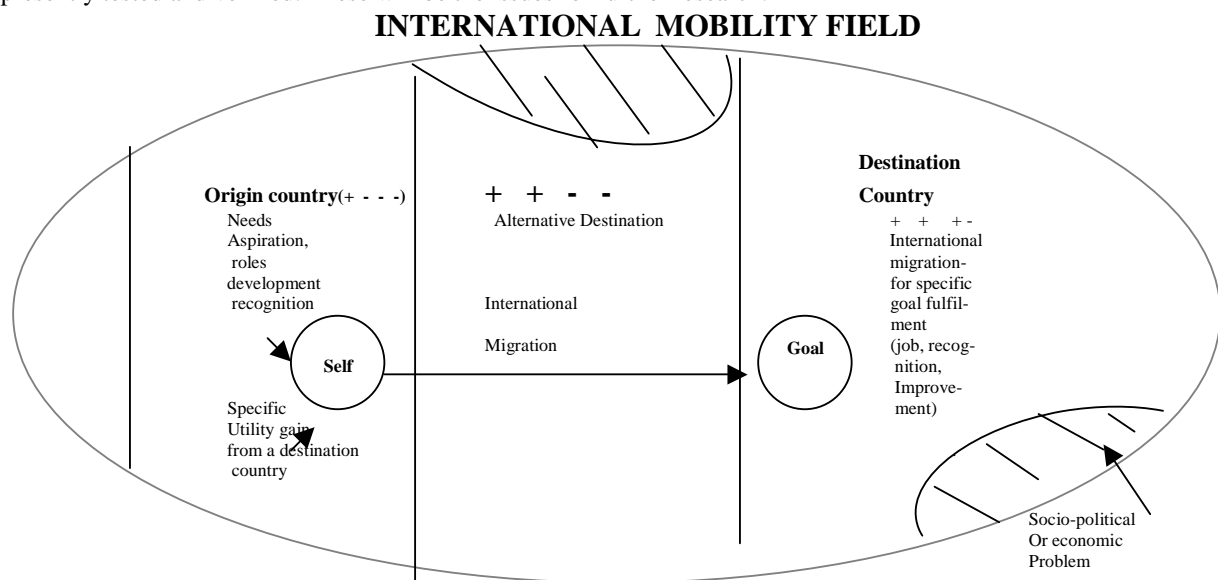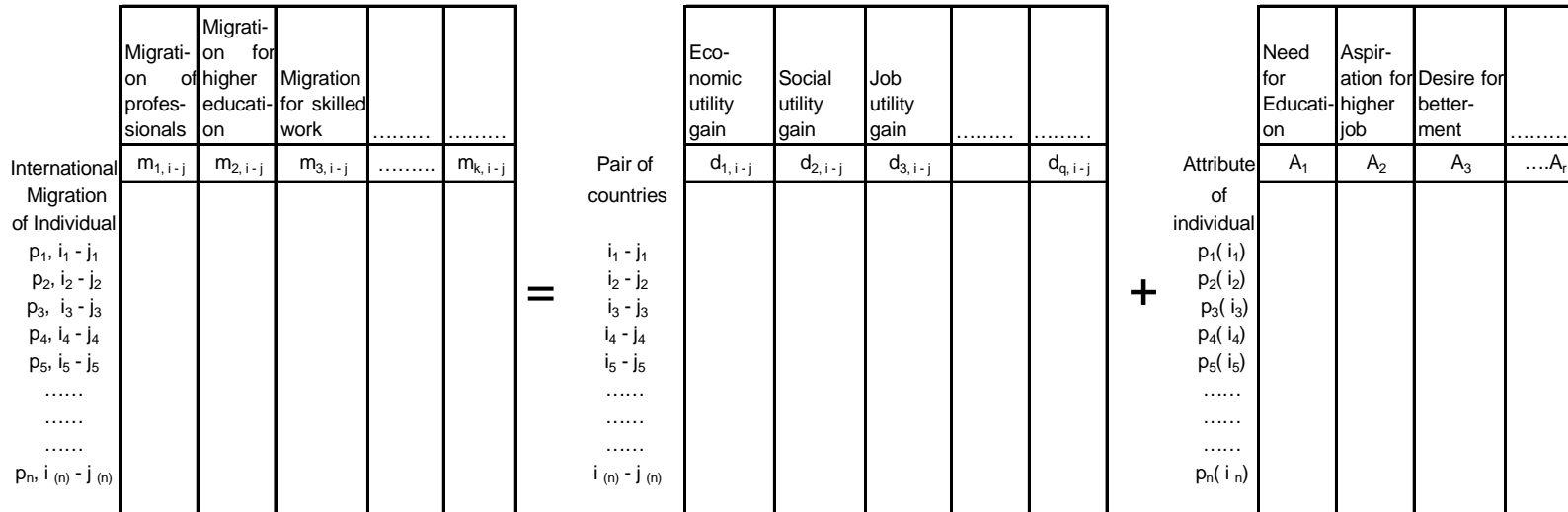
INTERNATIONAL MOBILITY FIELD

Fig 2 : Mobility field for international migration--specific need – aspiration and role of a person and specific utility gain in a destination country, together motivate him/her to migrate to that country

Table 6
International Mobility Field Theory Design
MICRO MODEL

M - Matrix
International Mobility behaviour

	Migration of professionals	Migration for higher education	Migration for skilled work	....	....
International Migration of Individual	$m_{1,\,i-j}$	$m_{2,\,i-j}$	$m_{3,\,i-j}$	....	$m_{k,\,i-j}$
$p_1,\, i_1 - j_1$					
$p_2,\, i_2 - j_2$					
$p_3,\, i_3 - j_3$					
$p_4,\, i_4 - j_4$					
$p_5,\, i_5 - j_5$					
......					
......					
......					
$p_n,\, i_{(n)} - j_{(n)}$					

=

D - Matrix
Country-Utility Distances

	Economic utility gain	Social utility gain	Job utility gain	....	....
Pair of countries	$d_{1,\,i-j}$	$d_{2,\,i-j}$	$d_{3,\,i-j}$		$d_{q,\,i-j}$
$i_1 - j_1$					
$i_2 - j_2$					
$i_3 - j_3$					
$i_4 - j_4$					
$i_5 - j_5$					
......					
......					
......					
$i_{(n)} - j_{(n)}$					

+

A-Matrix
Individual's Need-Aspiration - Attributes

	Need for Education	Aspiration for higher job	Desire for betterment	....
Attribute of individual	A_1	A_2	A_3	....A_r
$p_1(i_1)$				
$p_2(i_2)$				
$p_3(i_3)$				
$p_4(i_4)$				
$p_5(i_5)$				
......				
......				
......				
$p_n(i_n)$				

$$\beta_1 m_{1,\,i-j} + \beta_2 m_{2,\,i-j} + \beta_3 m_{3,\,i-j} + \ldots = \alpha_1 d_{1,\,i-j} + \alpha_2 d_{2,\,i-j} + \alpha_3 d_{3,\,i-j} + \ldots + \alpha_1^* A_1 + \alpha_2^* A_2 + \ldots + \alpha_r^* A_r + \ldots$$

Example: Co-eff. (migration of profesional for job, from i to j country) + ... = Co-eff. (higher utility of country j's in providing jobs) + Co-eff. (social utility) + ...+ Co-eff. (need for education) + ...+ Co-eff. (desire for betterment)

Table 7
International Mobility Field Theory Design
MACRO MODEL

<u>M - Matrix</u>
International migration

<u>D - Matrix</u>
Socio-economic Distances
between countries

<u>P-Matrix</u>
Emigration-Immigration Policies

Pair of Countries (Vol. Of Mig.)	Migration of professionals $m_{1,\,i-j}$	Migration for higher education $m_{2,\,i-j}$	Migration for skilled work $m_{3,\,i-j}$	....	.... $m_{k,\,i-j}$
$i_1 - j_1$					
$i_2 - j_2$					
$i_3 - j_3$					
$i_4 - j_4$					
$i_5 - j_5$					
......					
......					
......					
$i_{(n)} - j_{(n)}$					

=

Pair of countries	Economic distance $d_{1,\,i-j}$	Social distance $d_{2,\,i-j}$	.... $d_{3,\,i-j}$	....	.... $d_{q,\,i-j}$
$i_1 - j_1$					
$i_2 - j_2$					
$i_3 - j_3$					
$i_4 - j_4$					
$i_5 - j_5$					
......					
......					
$i_{(n)} - j_{(n)}$					

+

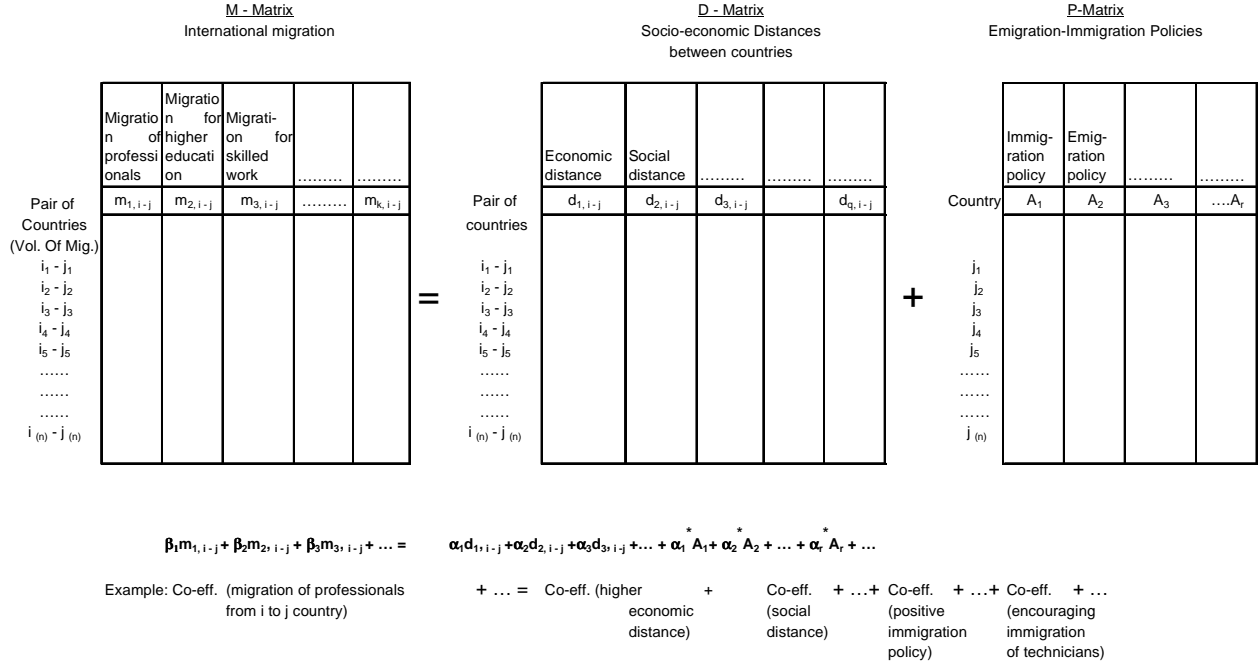| Country	Immigration policy A_1	Emigration policy A_2	.... A_3	.... $....A_r$
j_1				
j_2				
j_3				
j_4				
j_5				
......				
......				
......				
$j_{(n)}$				

$$\beta_1 m_{1,\,i-j} + \beta_2 m_{2,\,i-j} + \beta_3 m_{3,\,i-j} + \ldots = \alpha_1 d_{1,\,i-j} + \alpha_2 d_{2,\,i-j} + \alpha_3 d_{3,\,i-j} + \ldots + \alpha_1{}^* A_1 + \alpha_2{}^* A_2 + \ldots + \alpha_r{}^* A_r + \ldots$$

Example: Co-eff. (migration of professionals from i to j country) + … = Co-eff. (higher economic distance) + Co-eff. (social distance) + …+ Co-eff. (positive immigration policy) + …+ Co-eff. (encouraging immigration of technicians) + …

Expected Outcomes

As illustrated in Table 7, this research design will generate causal linkages between International migration between countries and socio-economic differences between those countries and variations in their immigration /emigration policies. (macro Model).

Separate Canonical linkage analyses can be performed at all *four* levels: (1) at individual levels for internal migration (micro model, Table 1), (2) at state or aggregate system level for internal migration (macro model, Tables 2 and verified in 5), (3) at the level of the individual migrants for the study of international migration (micro model, Table 6), and (4) at the level of inter-country international migration (macro model, table 7). All these Tables are self explanatory.

Every-time very highly statistically powerful and practically very meaningful canonical linkage equations can be generated, as has been demonstrated (Table 5), with reference to internal migration of Indian states, and earlier studies. (Mukherji, 2001, pp. 1-225)

Similarly, canonical linkages can also be generated at the international level for international migration, given the specific kind of inter-country data for international migration, and corresponding socio-economic correlates of those countries are available. These will show specific causal relationships between the mobility behavior at international level and differences in socio-economic system of countries, and immigration/emigration policies their-in.

At present, intensive search for specific kind of inter-country data of international migration (as needed) were made, but it is very much lacking currently (UN, 1995; UN, 2001, pp. 1-286; Shah, 2001, pp. 105-135). Search

for relevant data also through the internet did not generate relevant kind of data required. Further research in this directions will be required to be made.

CONCLUDING REMARKS

The Mobility Field Theory was tested and verified several times, both in the developed and developing countries, and were found highly successful and meaningful.

Now, International Mobility Field theory is evolved and briefly presented here, based on extension of highly successful Mobility Field Theory formulated earlier for internal migration.. MF Theory has yielded many meaningful and statistically significant canonical linkages for India's internal migration.

International Mobility Field Theory, is also formulated along the similar lines of structural and systematic thinking and organized thoughts. If relevant and specific kind of data of international migration between various countries are available (not easily available now), thence, it can be easily empirically tested and is expected to yield meaningful empirical results. The thoughts are evolving, and, such attempts of linking two different aspects of spatial mobility will surely provide new directions of mobility research .

REFERENCES

1. Lewin, Kurt (1951), **Field Theory in Social Science**. New York
2. Massey, Douglas et al (1994), "An Evaluation of International Migration Theory : the North American Case", **Population and Development Review,** 20, N0. 4, pp. 699-751.
3. Martin, Susan (2001), "An Era of International Migration," **in World Migration Report 2000**, by UN-IOM, New York, pp. 18-19.
4. Mukherji, Shekhar (1975), **The Mobility Field Theory of Human Spatial Behaviour: A Spatial Behavioural Approach to the Study of Migration and Circulation in the Indian Situation**. Ph D dissertation, Department of Geography, University of Hawaii (Xeroxed University Microfilms, Ann Arbor, Michigan), pp. 10-365.
5. Mukherji, Shekhar (1979), **The Mobility Field Theory: A Spatial-Behavioural Foundation to the Movement Dynamics, With Application to Indian Situation.** International Geographical Union's and National Geographical Society of India's Research Monograph No. 25, Dept.of Geography, Banaras Hindu University, Varanasi, pp. 1-80.
6. Mukherji, Shekhar (1981), **Mechanisms of Underdevelopment, Labour Migration and Planning Strategies in India.** Prajna, Calcutta, pp. 1-265.
7. Mukherji, Shekhar (1985c), "A Canonical Model of Migration to Cities", **Espace, Population, Societies, Migrations and Cities,** International Geographical Union's Symposium, Rouen, August, Vol.I, pp. 54-61.
8. Mukherji, Shekhar (1992b), **Migration, Regional Disparities and Urbanization in India.** Research Monograph, International Institute for Population Sciences, Bombay, pp. 1-86.
9. Mukherji, Shekhar (1995), **"Poverty-Induced Migration and Urban Involution in ESCAP Countries**", Paper presented at UN-ESCAP, Expert Group Meeting on Poverty and Population in EScAP Region, Bangkok, Sept 1995. pp 1-45.
10. Mukherji, Shekhar (2000), **Poverty-Induced Migration and Urban Involution in ESCAP Region: Needed Planning Strategies.** IIPS Research Monograph 25, Bombay, pp. 1-181.
11. Mukherji, Shekhar (2001**), Linkages between Migration, Urbanization and Regional Disparities in India: Required Planning Strategies**. IIPS Research Monograph, Bombay , pp. 1-226.
12. Shah, Nasra (2001), "International Migration in Middle East and South Asia", in **World Migration Report 2000**, by UN-IOM, New York, pp. 105-119
13. United Nations (1996), "International Migration and Development," **in World Population Monitoring Report 1996,** UN. New York, pp. 141-164.
14. United Nations (1996), "International Migration Policies -- 1995**", Population Division, U.N.,** Population Chart on International Migration Policies., New York.
15. UN.(1998**), Demographic Year Book**. United Nations, New York, Tables on International Migration, pp. 1075-1196.
16. United Nations (2001), **World Migration Report 2000**. U.N. International Organization for Migration (IOM) New York, pp. 3-56.
17. Wolport, Julian (1966), "Behavioural Aspects of the Decision to Migrate", **General System** , 1966, 20, pp. 45-65.