

The Labour Force Matrix of Pakistan: Selected Applications

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1. INTRODUCTION

Development can be viewed from many angles. To some it means progress in creating a credible and viable political system. Others view it as a process of social modernization. To most economic planners, development is growth in the national income. This paper follows the view that the ultimate aim is the development and utilization of human capabilities.¹ More generally, the human angle should gain a special position among alternative viewpoints in the light of the substantial evidence that strengthening of the capabilities of human beings to produce, choose and innovate is the most effective means of achieving economic, political and social development.

Basically, the human-resources point of view stresses the broadening of opportunity for all elements of the population, and progress is conceived to be a movement towards a multi-option society. If people – in the present context, those who constitute the labour force – become the units of analysis, then significant attention needs to be given to classifying the labour force into relevant cells and to identifying the profile, problems and prospects for each cell.

With this purpose in mind, this paper develops and estimates in the next section a labour force matrix (LFM) for Pakistan which will be shown to be a new and very helpful tool in describing the multi-dimensional nature of the work force and its dynamic characteristics over time. In the remainder of the paper we shall use the LFM as a guideline in the simulation of the labour force in the Sixth Five-Year Plan.

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¹This theme is as old as intellectual history. More recently it was revived among economists, by Harbison, Meyer and Ginsburg.

2. THE LABOUR FORCE MATRIX OF 1982-83

A student of economics in the country knows that 29 percent of the labour force participants work in urban areas, that 15 percent work in manufacturing, that 28 percent are employees, that 72 percent are illiterate or below primary school, and that perhaps 25 percent are production workers. What the student, nor his teacher, would not know is the combined percentage of illiterate production workers functioning as employees in manufacturing in urban areas. Similarly, for various purposes one may desire to know how many persons work in various types of cross-combinations in terms of location, age, sex, activity, occupation, education and status, but this information is not readily available. However, bits of information can be gathered and organized in what we call a labour force matrix (LFM), which will exactly meet such desires. Table 1 gives such a matrix for Pakistan.

Table 1 is a matrix of 70 rows by 63 columns, giving in total 4410 cells. We utilize the rows for classifications of location, status and education, while the columns are reserved for sectors of activity and occupation. One can read that the above-mentioned group falls in Row 8 and Column 21. This group counts 481732 persons out of a total of 26.1 million persons, or 18 percent of the total labour force. In the same way the absolute or relative size of other groups in the labour force can be directly calculated. The matrix is flexible and can be aggregated to whatever classifications are thought desirable. For instance, Table 2 gives an arbridged matrix for the whole country in 15 rows and 16 columns. The rows contain three status groups and seven educational levels. The columns contain four sectors and four occupational groups. Furthermore, such a matrix can be expressed in percentages which add to 100.0 percent, as in Table 3. We shall devote the rest of this section to a discussion of the methodology for calculation of the matrix and the uses to which such a matrix can be put.

In principle, an LFM can be directly programmed from the labour force survey. So far, this has not been done. Instead, the survey results are usually described through simple cross-tabulations by sector/occupation, sector/status and the like. Under certain assumptions, an appropriate LFM can be constructed from published cross-tabulations. The procedure, which is described in Appendix 1, makes use of joint probabilities of cross-tabulations and the RAS method. In view of the lack of verification, the results should be seen as tentative approximations of the real figures.

The size of the matrix is determined by the available data and the chosen disaggregations. As was mentioned above, the rows count 70 lines which represent two locational disaggregations (rural and urban), four status types and five educational types. The columns count 63 which is the result of including 9 sectors and 7 occupations. It is noted that the choice regarding what should come in the rows and columns does not affect the results. Our particular choice here has been governed by the consideration that employment by sector and occupation is determined primarily by demand factors, while the labour force by location, status and

Table 2
Abridged LFM, 1982-83, in persons
Status and Education by Activity and Occupation Aggregated Matrix, 1981

	AGRICULTURE				MINING/MANUF./ELECTR			
	PROF	ADM/CLE	SAL/SER	AGR/PRO	PROF	ADM/CLE	SAL/SER	AGR/PRO
WAGE								
BPRI	207	293	454	1465016	7722	15719	37487	943044
PRIM	96	294	121	165647	5206	13184	8838	235931
MSEC	183	302	84	93313	7868	15320	6984	156300
HSEC	625	1487	80	49023	30385	78496	3357	111855
INTE	261	578	21	8369	16583	35597	553	48235
DEGR	321	298	11	3775	29908	25316	331	10792
POST	303	63	3	3535	28149	8279	18	2587
NON-WAGE								
BPRI	317	31	1131	9252945	461	1734	18468	1216808
PRIM	145	30	315	1035907	272	970	4340	292363
MSEC	278	33	228	580340	414	1273	3611	183353
HSEC	951	171	222	300636	1649	4152	1503	116790
INTE	393	71	59	45432	830	2203	203	74132
DEGR	476	38	31	17137	1365	3782	135	10211
POST	449	7	9	18399	1286	2496	12	3264
UNEM	382	821	219	454161	1606	7529	2842	160073
TOTAL	5387	4517	2988	13493665	133734	216050	88682	3565738

Continued -

Table 2 - (Continued)

	CONSTRUCTION				TRADE/TRANSP/FINANCE/SERV				TOTAL
	PROF	ADM/CLE	SAL/SER	AGR/PRO	PROF	ADM/CLE	SAL/SER	AGR/PRO	
<i>WAGE</i>									
BPRI	516	5588	5421	561524	58565	54746	550814	877718	4384834
PRIM	365	3054	1275	132669	28145	45257	148584	167325	955991
MSEC	537	4012	818	81206	52156	53939	118335	110084	701471
HSEC	2106	12438	638	48782	181034	286964	82692	77747	967709
INTE	1182	6759	148	36415	77824	133784	19415	35017	420741
DEGR	2193	12093	76	4026	101529	92637	10198	7516	301020
POST	2063	7874	0	1495	95604	26778	3195	1914	181860
<i>NON-WAGE</i>									
BPRI	110	890	1165	168858	13472	3686	1471943	491509	12643528
PRIM	79	473	274	40698	6535	2200	485210	120306	1990117
MSEC	115	628	177	25622	12038	2892	393454	78259	1282745
HSEC	452	1816	136	16466	41909	10996	292764	54010	844623
INTE	253	975	31	10187	18159	5626	81693	26392	266639
DEGR	471	2009	16	1451	24025	8144	37242	5113	111646
POST	443	1454	0	153	22623	5223	15775	1369	73262
<i>UNEM</i>	494	1468	505	55999	31518	38181	175671	86192	1017661
TOTAL	11379	61531	10680	1185851	765136	771053	3886985	1940471	26143847

Table 3
Abridged LFM, 1982

Activity / Occupation Status / Education	AGRICULTURE				MINI/MANU/ELEC				CONSTRUCTION				TRADE/TRAN/SERV				TOTAL
	PROF	AD/CL	SA/SE	AG/PR	PROF	AD/CL	SA/SE	AG/PR	PROF	AD/CL	SA/SE	AG/PR	PROF	AD/CL	SA/SE	AG/PR	
<i>Wage Employment</i>																	
Below primary	5.60	.03	.06	.14	3.61	.02	.02	2.15	.22	.21	2.11	2.59	.17	.57	.64	3.66	16.77
Primary	.63	.02	.05	.03	.90	.01	.01	.51	.11	.31	.20	.42	.21	.45	.42	2.68	3.66
Middle secondary	.36	.03	.06	.03	.60	.02	.02	.31	.20	.19	.69	.30	1.10	.32	.30	3.70	2.68
High secondary	.19	.12	.30	.01	.43	.01	.05	.19	.69	.14	.30	.51	.07	.13	.13	1.61	3.70
Intermediate	.03	.06	.14	.01	.18	.03	.03	.14	.30	.02	.39	.35	.04	.03	.03	1.15	1.61
Degree	.01	.11	.10	.04	.04	.01	.05	.02	.39	.01	.37	.10	.01	.01	.01	1.15	1.15
Post-graduate	.01	.11	.03	.01	.01	.01	.03	.01	.37	.01	.37	.10	.01	.01	.01	1.15	.70
<i>Non-Wage</i>																	
Below primary	35.39	.01	.07	.07	4.65	.01	.01	.65	.05	.01	5.63	1.88	.01	5.63	1.88	48.36	48.36
Primary	3.96	.02	.02	.01	1.12	.02	.02	.16	.02	.10	1.86	.46	.01	1.86	.46	7.61	7.61
Middle secondary	2.22	.01	.01	.01	.70	.01	.01	.10	.05	.01	1.50	.30	.01	1.50	.30	4.91	4.91
High secondary	1.15	.01	.02	.01	.45	.01	.01	.06	.16	.04	1.12	.21	.04	1.12	.21	3.23	3.23
Intermediate	.17	.01	.01	.01	.28	.01	.01	.04	.07	.02	.31	.10	.03	.31	.10	1.02	1.02
Degree	.07	.01	.01	.01	.04	.01	.01	.01	.09	.03	.14	.02	.02	.14	.02	.43	.43
Post-graduate	.07	.01	.01	.01	.01	.01	.01	.01	.09	.02	.06	.01	.02	.06	.01	.28	.28
<i>Unemployed</i>	1.74	.01	.03	.01	.61	.01	.01	.21	.12	.15	.67	.33	.15	.67	.33	3.89	3.89
TOTAL																100.00	100.00

PROF = Professional; AD/CL = Administrative and Clerical; SA/SE = Sales and Services Workers; AG/PR = Agriculture and Production Workers

education is largely a matter of supply factors. Registering demanders in the columns and suppliers in the rows is similar to input-output accounting in which the row items are deliverers to the column items. This particular arrangement of rows and columns can be shown to increase the flexibility of the LFM for purposes of forecasting and policy making where a specific shape of demand for labour is given and a solution of the supply pattern is sought, or otherwise.

What are the uses of the LFM? We may postulate that, in principle, the degree of attention which may be devoted by the economists, and the public authorities, to a particular group, on purely theoretical welfare grounds, should be in accord with the proportion of the group in the whole labour force. In a simple application of this rule, cells 50 by 6, and 57 by 6, which have the largest number of persons, about 4 millions each, should get in accordance with their shares, around 15 percent each of the research and planning effort in the nation. Actually the attention which such groups receive is likely to be very minor and much below 15 percent. Only in the presence of positive linkages, whereby the benefit which accrues to group A may trickle down to groups B, C, and D through expenditure by A or taxation of A followed by differentiated public spending, will it be legitimate to increase the development effort in A at the cost of B, C, and D in spite of a smaller share of A than that of B, C or D in the labour force. In this respect, a social accounting matrix can supply the relevant information on the strength and direction of the linkages.² The strict observation of the LFM in combination with information on linkages contributes, therefore, to a more democratic application of the development effort.

The LFM can be a helpful guide to relevant policy research in a related aspect. Not only can a particular group be located in the LFM but its multi-dimensional characteristics can also be made more apparent. The matrix indicates the kind of characteristics which decision-makers have to cope with in their encounters with particular groups. The type of problems faced by a specific group may be even anticipated on the basis of the apparent characteristics.

Besides being an essential tool for a people-oriented development policy the LFM is functional in highlighting several aspects of development and planning.

Although the LFM gives a static picture, yet the availability of the LFM for more countries and more years would allow one to detect and analyse structural patterns in the labour force which can in turn be helpful in assessing manpower plans and performances. We have computed the LFM for 1978-79 and 1982-83 – the last two surveys – and used them to project an LFM for 1988, as in Table 4. The projected LFM becomes a check tool for manpower planning in the medium term.³

² Cf. Cohen [1]. The completion for Pakistan of a social accounting matrix at Pakistan Institute of Development Economics would allow an analysis of inter-group income linkages.

³ Given LFM for t-1 and t, a projected LFM for t+1 is obtainable from a cell-wise application of the growth rate between t-1 and t to t. The obtained values can be converted in a percentage distribution as is done in Table 4.

Table 4
Prolonged LFM, 1988

Activity/ Occupation	Percentage distribution																	
	AGRICULTURE			MINI/MANU/ELEC			CONSTRUCTION			TRAD/TRAN/SERV								
	PROF CL	AD/ SE	AG/ PR	PROF CL	AD/ SE	AG/ PR	PROF CL	AD/ SE	AG/ PR	PROF CL	AD/ SE	AG/ PR	TOTAL					
Wage Employment																		
Below primary			5.43		.09	.13		.09	.13		.04	.03		.19	1.86	2.51	15.90	
Primary			.67		.06	.04		.07	.04		.01	.01		.15	.59	.79	4.20	
Middle secondary			.40		.08	.02		.07	.02		.02	.02		.15	.42	.44	2.78	
High secondary			.23	.02	.61	.01		.44	.01		.06	.06		.84	1.03	.34	4.71	
Intermediate			.04		.34	.19		.19	.61		.03	.03		.30	.50	.09	4.44	
Degree			.04		.66	.12		.12	.09		.06	.06		.42	.36	.04	3.42	
Post-graduate			.02		.55	.04		.04	.01		.05	.05		.35	.12	.02	1.92	
Non-Wage																		
Below primary			31.67		.09	.07		.01	.07		.01	.01		.04	.02	5.30	1.70	42.39
Primary			3.83		.08	.02		.02	1.08					.01	.01	1.87	.56	7.50
Middle secondary			2.29		.08	.01		.01	.68					.03	.01	1.55	.34	5.00
High secondary			1.28	.01	.47	.02		.02	.47		.01	.01		.18	.05	1.18	.27	3.52
Intermediate			.17		.17	.01		.01	1.25					.07	.02	.37	.40	2.43
Degree			.16		.10	.01		.01	.10		.01	.01		.10	.04	.15	.05	.63
Post-graduate			.08		.08	.01		.01	.02		.01	.01		.08	.04	.10	.01	.34
Unemployed																		
					.01	1.78		.01	.03		.01	.01		.25	.14	.67	.36	4.06
TOTAL																		100.00

PROF = Professional; AD/CL = Administrative and Clerical; SA/SE = Sales and Services Workers; AG/PR = Agriculture and Production Workers

The matrix can also function as a reference for labour market information, monitoring and matching in the short-term as well as a sampling framework for labour force surveys. The next section assesses the manpower targets of the Sixth Plan against the background of the LFM.

There are other conceivable elaborations which are capable of converting the LFM from a static to a dynamic matrix, allowing basic questions relating to labour mobility to be treated in the dynamic context.⁴ Finally, the matrix can be indispensable in a micro-analytic modelling of social systems.⁵ These elaborations are not tested yet, and it is hoped that subsequent work may be done on them.

3. THE SIXTH PLAN AND THE LABOUR FORCE MATRIX OF 1988

In this section we develop and simulate an integrated manpower planning framework which simulates the Sixth Five-Year Plan [3] and rearrange the resulting plan simulations in the form of a target LFM for 1988. The target LFM (Table 6) will be confronted with the simple projection of the LFM for 1988 (Table 4). The differences between the target LFM and the prolonged LFM would throw light on the induced changes which are likely to take place in the future as a result of planning decisions and provide some basis for assessing the ambition and feasibility of the plan.

Manpower planning, understood as an exercise which balances the demand for and supply of labour types in the medium term in an integrated framework which fulfils the maximum attainable development and utilization of human resources, has been pursued in Pakistan at intervals of about five years which coincided with the preparation of development plans. Although the underlying frameworks have appreciably improved, they are not yet institutionalized in a manner which allows them to produce rolling forecasts on a regular basis or to permit the monitoring of their implementation. The institution of such activities requires a collaborative effort by research and monitoring units in the Ministries of Planning, Labour and Education. Such collaborative efforts are still lagging behind.

The plan simulations in this section are based on tentative assumptions regarding future government policy as of early 1983. These policies were given a more definitive form by the publication of the Sixth Five-Year Plan (1983-88). As will be apparent for the knowledgeable reader, the official plan targets vary only slightly from the utilized tentative assumptions. At the time, and in their own way, the calculations presented in this section formed one input, among other inputs, of the Planning Division's endeavour to prepare the manpower part of the Sixth Plan. It is noted that the published plan itself devotes only a few pages to the manpower part and its manpower targets are limited to sectoral aggregates.

⁴ Cf. Stone [4].

⁵ Cf. Orcutt *et al.* [2].

The Sixth Plan considers a domestic labour force (excluding net migration) of 27.5 millions in mid-1983 which is expected to grow to 30.8 millions in mid-1988. With a terminal unemployment figure of 1.0 million, a target employment of about 29.8 million is obtained. The model we utilize for breaking up these unemployment and employment figures by destination is found in Appendix 2. The model consists of a demand part and a supply part. The results which are disaggregated by status, sector, occupation and education are expressed as proportions of the total labour force in an abbreviated form in Table 5.

Table 5

Plan Simulations of Imbalances by Occupation and Education for 1988

Category	National Supply (in Thousands)	Domestic Supply (in Thousands)	Employment (in Thousands)	Unemployment (in Thousands)	National Imbalance (Percentage)	Domestic Imbalance (Percentage)
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Occupational</i>						
Professional	958	888	854	34	3.55	3.83
Administrative	253	253	222	31	12.25	12.25
Clerical	928	918	824	94	10.13	10.24
Sale	3631	3631	3443	188	5.18	5.18
Service	1467	1457	1401	56	3.82	3.84
Agriculture.	16118	16118	15421	697	4.32	4.32
Production	7995	7535	7635	-100	-1.25	-1.33
Total	31350	30800	29800	1000	3.19	3.25
<i>Educational</i>						
Below primary	22458	22078	21460	618	2.75	2.80
Primary	3246	3175	3248	-72	-2.22	-2.27
Middle secondary	2333	2293	2224	69	2.96	3.01
High secondary	2070	2035	1818	217	10.48	10.66
Intermediate	632	622	530	92	14.56	14.79
Degree	419	417	365	52	12.41	12.47
Post-graduate	192	179	155	24	12.50	13.41
Total	31350	30800	29800	1000	3.19	3.25

Sources of Cols. (1), (2), (3) are the model applications, whereby Col. (2) = Col. (1) - net migration over plan period. Distribution of net migrants in Sixth Plan is assumed the same as in Fifth Plan.

Col. (4) = Col. (2) - Col. (3)

Col. (5) = $100 \times \text{Col. (4)} \div \text{Col. (1)}$

Col. (6) = $100 \times \text{Col. (4)} \div \text{Col. (2)}$

Very briefly described, the demand part calculates future employment-output elasticities by sector of activity for two types of the work force: the wage type

(employers and employees) and the non-wage type (the self-employed and family workers). Those two types correspond roughly to the organized and unorganized segments. Given the growth targets, the model finds out the wage employment and computes the non-wage employment in a residual-like manner (Appendix 2). The projected employment by status and sector is then converted into employment by occupational categories and, in turn, into educational levels.

In these various steps the distinction between wage and non-wage employment is considered to be very vital for the following reasons:

- (a) Employment elasticities are different for the organized and unorganized economies, as is shown in Appendix 2.
- (b) While workers in the organized economy are, relatively speaking, effectively employed, unorganized unemployment usually experiences a hidden underemployment which is subject to erratic fluctuations. Our plan estimates imply that underemployment in the unorganized sector in the near future would fall. Demand, as calculated from growth targets and employment elasticities, moves ahead of supply in the unorganized economy by about 4 percent. Such an excess of demand over supply among the self-employed and family helpers usually materializes in the form of a reduction in underemployment and, therefore, an improvement in earnings.
- (c) The occupational distribution within sectors in the organized economy is much more differentiated than in the unorganized economy.
- (d) Finally, the educational input into occupations is much more sophisticated in the organized than in the unorganized economy.

The supply part projects enrolments, graduates and labour stock by educational levels and converts these into occupational categories. By deducting demand from supply as far as occupation and education are concerned, and accounting for net migration, one obtains the unemployment figures.

The plan simulation, as found in Table 5, forecasts the following growth of *employment* by occupation over the plan period: professional 12 percent, administrative 16 percent, clerical 14 percent, sales workers 25 percent, service workers 16 percent, agricultural workers 15 percent, and production workers 15 percent. As for employment by education, the growth rates are: less than primary 16 percent, primary 17 percent, middle 16 percent, high 17 percent, intermediate 16 percent, degree 15 percent, and post-graduate 13 percent. It is noted that the variation in growth is much less with regard to educational levels than with regard to occupational groups.

Turning to the *supply* forecasts, the percentage increases by occupational groups over the plan period would amount to: professional 17 percent, administrative 21 percent, clerical 21 percent, sales workers 27 percent, service workers 16 percent, agricultural workers 14 percent, and production workers 15 percent. The percentage increases in the labour force by educational levels are: level 1 = 13 percent, level 2 = 18 percent, level 3 = 23 percent, level 4 = 29 percent, level 5 = 29 percent, level 6 = 9 percent and level 7 = 23 percent.

Regarding the future imbalance, it is noted from Table 5 that there will remain some shortages of production workers. It is also likely that there will be shortages for workers with primary education partly owing to a lagging supply associated with the particularly high rates of drop-outs in primary education, and partly owing to migration. Generally speaking, the labour market for the lower skill and educational levels would continue to be tighter than for upper skill and educational levels. The exhaustion of the forecasted surpluses at the upper skill and educational levels would ultimately require an upgrading of jobs in terms of educational qualifications. Such an upgrading will not leave untouched the future patterns of job expectations, remunerations and productivities.

What are the implications of the plan for the future structure of the labour force? The plan simulations can be arranged to give the percentage distribution of the respective cells of the labour force in 1988, as in Table 6, which can be compared with the prolonged LFM for 1988, Table 4. Table 6 does not show any significant progress in the upgrading of less productive labour groups, suggesting that the plan does not break with the past structural trends.

4. CONCLUDING REMARKS

A labour force matrix allows one to read the number of persons who belong to a specific combination of location, status, sector, occupation and education, and is, therefore, superior to two-dimensional cross-tabulations. Moreover, the LFM is a flexible tool, extendible to dynamic analysis and social-system modelling and can serve as a neutral guide in the allocation of research and planning efforts for competing groups of the population.

Under plausible assumptions, such matrices have been constructed from published data of the labour surveys of 1977-78 and 1982-83 and *projected* to 1988. From the many interesting experimentations with the LFM, we chose to simulate the Sixth Plan by means of a model which forecasts demand and supply and generates a *planned* LFM for 1988. A comparison between the two matrices shows that on the whole the plan does not predict major surprises in the structure of the labour force. Concurrently, the results suggest some future unresolved shortage-imbances for production workers and the lowest educational levels and some surpluses of a frictional nature in the upper skills and educational levels. Even though the apparent

Table 6
Plan Simulations of the Labour Force Matrix for 1988

Activity/ Status/ Education	AGRICULTURE			MINI/MANU/ELEC			CONSTRUCTION			TRAD/TRAN/SERV			Percentage distribution				
	PROF	AD/ CL	SA/ SE	AG/ PR	PROF	AD/ CL	SA/ SE	AG/ PR	PROF	AD/ CL	SA/ SE	AG/ PR		TOTAL			
<i>Wage Employment</i>																	
Below primary	b	a	.01	4.95	.02	.05	.38	5.55	b	.01	.03	3.32	.31	1.19	1.87	2.68	19.37
Primary	a	a	b	.62	.01	.05	.11	.70	b	b	b	.42	.15	.17	.53	.34	3.10
Middle secondary	b	a	b	.37	.01	.15	.09	.42	a	.01	b	.25	.21	.21	.44	.20	2.36
High secondary	b	b	b	.20	.03	.26	.06	.22	.01	.05	b	.13	.46	.94	.31	.11	2.78
Intermediate	b	b	a	.03	.02	.12	.01	.03	b	.03	b	.02	.24	.44	.07	.02	1.03
Degree	b	b	a	b	.02	.09	b	a	b	.02	a	b	.29	.34	.04	b	.80
Post-graduate	b	a	b	b	.02	.03	a	a	b	b	b	b	.22	.11	b	b	.38
<i>Non-Wage</i>																	
Below primary				35.12		b	b	5.28		b	b	.80	.11	.01	6.90	2.23	50.45
Primary				4.43		b	a	.67		b	a	.10	.06	b	1.95	.28	7.49
Middle secondary				2.63		b	a	.40		b	a	.06	.08	.01	1.62	.17	4.97
High secondary				1.40		b	a	.21		.02	a	.03	.17	.05	1.13	.09	3.10
Intermediate				.22		b	a	.03		b	b	b	.09	.03	.26	.01	.64
Degree				.04		b	b	b		b	b	b	.11	.02	.14	b	.31
Post-graduate				.04		b	b	b		b	b	b	.08	b	.01	b	.13
<i>Unemployed</i>																	
TOTAL								3.25									3.25
																	100.00

PROF = Professional; AD/CL = Administrative and Clerical; SA/SE = Sales and Services Workers; AG/PR = Agriculture and Production Workers
a = .001 .001, b = .001 .01.

recommendations for balancing the labour force may be more vocational training, more primary school enrolment and less primary school drop-out, and job upgrading at the higher end of skills and education, a complementary analysis is required before sensible conclusions can be drawn. Besides, a disaggregation into many more occupations and short-term labour market signals as regards trends in vacancies and relative earnings are indispensable in complementing the obtained picture.⁶

Appendix 1

METHODOLOGY FOR THE CONSTRUCTION OF A LABOUR FORCE MATRIX (LFM)

The available cross-tabulations consist of the following:

XY , XZ , ZY and ZW

where X = sector, Y = status, Z = occupation and W = education.

A step-wise use of these cross-tabulations would necessarily imply working first with XY , XZ , and ZY , while ZW is to be entered at a later stage.

For XY , XZ and ZY determine which cross-tabulation is the most independent, i.e. least dependent, on the basis of the lowest χ^2 . The test shows XY and XZ to have the highest χ^2 , while ZY shows the lowest χ^2 . As a result, an initial tableau can be worked out from XY and XZ , assuming ZY to be initially irrelevant. The joint probabilities of the elements of Z and Y in X can be determined, for instance, by $P(Z \wedge Y \parallel X)$, i.e. $\frac{Z1}{X1} * \frac{Y1}{X1}$ gives probability of $Z1Y1$ in $X1$, and so for $Z2 Y2$ in $X2$, etc. The initial tableau can be constructed on the basis of these probabilities and the given values of X . The given sub-totals from ZY may be inserted now and the RAS method can be applied to obtain a consistent matrix of XYZ .

Finally, XYZ can be extended to W by splitting up relevant cells using information on ZW . The result is a labour force matrix in the dimensions $XYZW$.

⁶ Here is an opportunity to mention several studies undertaken at the Manpower Division, in which the author participated, with the purpose of providing more details on occupational distribution and elaborating on policy research on labour markets.

Appendix 2

MODEL FOR PLANNING DEMAND AND SUPPLY OF THE LABOUR FORCE

Demand for manpower is distinguished by employment status, s . The two categories of status are (i) wage employment and (ii) non-wage employment. Manpower demand by sector i and status s , that is, DEM_i^s , can be related to GDP_i through elasticities els_i^s , as in equation (1).

$$\frac{DEM_{i,t}^s - DEM_{i,t-1}^s}{DEM_{i,t-1}^s} = els_i^s \frac{GDP_{i,t} - GDP_{i,t-1}}{GDP_{i,t-1}} \quad \dots \quad (1)$$

Equation (1) computes DEM_i^1 and DEM_i^2 , but DEM_i^2 is liable to adjustment so as to meet the restriction, $\sum DEM_i^2 = (1-ump) EAP - \sum DEM_i^1$... (2)

where ump and EAP are the unemployment rate and the economically active population. The coefficient ump is a target and the variable EAP is a given figure.

To obtain occupational demand by q , and educational demand by k , we have

$$DEM_{qi}^s = lab_{qi}^s DEM_i^s \quad \dots \quad (3)$$

$$DEM_q^s = \sum_i DEM_{qi}^s \quad \dots \quad (4)$$

$$DEM_{kq}^s = lab_{kq}^s DEM_q^s \quad \dots \quad (5)$$

$$DEM_k^s = \sum_q DEM_{kq}^s \quad \dots \quad (6)$$

$$DEM_q = \sum_s DEM_q^s \quad \dots \quad (7)$$

$$DEM_k = \sum_s DEM_k^s \quad \dots \quad (8)$$

The national supply forecasts are the result of applying the following equations. Enrolments in the first class of primary education are projected on the basis of a growth rate. Enrolments in the other classes are projected on the basis of transition rates.

$$ENR_{1,t+1} = ENR_{1,t} (1 + gfp) \quad \dots \quad (9)$$

$$ENR_{c,t+1} = trn_{c-1} ENR_{c-1,t} \quad C = 2, \dots, 16 \quad \dots \quad (10)$$

$ENR_{c,t}$ = enrolment by class by year (\pm beginning of school year, end of calendar year)

trn = transition rate

gfp = growth rate of first class primary enrolments

c = class, sixteen in total

t = year

School leavers consist of those enrollees who are not retained in the school system.

$$SLV_{c,t} = (1-trn_c) ENR_{c,t} \quad c=1, \dots, 16 \quad \dots \quad (11)$$

$SLV_{c,t}$ = school leavers: these can be drop-outs or graduates.

Supply of the labour force by educational level in year t is previous supply in $t-1$, less attrition due to death and retirement, plus new entrants made dependent on school leavers, participation rates and conversion rates.

$$SUP_{k,t} = (1-atr_k) SUP_{k,t-1} + par_k con_{ck} SLV_{c,t} \quad K=2, \dots, 7 \quad \dots \quad (12)$$

$SUP_{k,t}$ = supply of labour by educational level

atr = attrition rate including death and retirement

par = participation rate of school leavers in the labour force

con = conversion rate of school leavers by class c into education k

k = educational level, $k = 2, \dots, 7$

Deducting the above supplies from projections of the economically active population gives the supply of labour with less than primary education.

$$SUP_{1,t} = EAP_t - \sum_{k=2}^7 SUP_{k,t} \quad \dots \quad (13)$$

$SUP_{1,t}$ = supply of labour with less than primary education including illiterates

EAP_t = economically active population

The supply by education SUP_k is converted to a supply by occupation SUP_q :

$$SUP_{q,t+1} = SUP_{q,t} + \sum_k lab_{qk} (SUP_{k,t+1} - SUP_{k,t}) \quad \dots \quad (14)$$

Finally, domestic supply is obtained by deducting net migration from national supply.

Regarding the application of the model, our assumed employment elasticities for the Sixth Plan, which are projections of past trends, are found below in the 2nd and 3rd columns. Annual growth targets are in the first column.

Sector	Growth targets	Employment elasticities	
	Percent	Organized	Unorganized
1. Agriculture	4.9	.37	.68
2. Mining	7.5	.14	0
3. Manufacturing	9.3	.48	.07
4. Electrical	8.0	.66	1.02
5. Construction	8.5	.72	0
6. Trade	7.5	.50	.62
7. Transportation	6.8	.37	0
8. Services	4.7	.31	.81

As regard lab_{qi}^s and lab_{kq}^s , these are available without a distinction by status s , but as was explained and applied in Appendix 1, it was possible to derive realistic sets of lab coefficients for the wage and non-wage employment status from the labour force survey of 1982-83. Finally, the coefficients in the supply equations are based on the implicit estimates of the Fifth Plan, adjusted with regard to gfp and turn to reflect Sixth Plan policies of higher enrolment targets.

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Comments on "The Labour Force Matrix of Pakistan: Selected Applications"

By working out his labour force matrix of Pakistan, the author has given us more detailed information about the labour force than we had before. I suppose we can all agree that this kind of statistics may be useful for analyses of the labour force. However, at this early stage of working out more detailed information about the labour force in Pakistan it is not completely clear what analytical uses can be made of this information. This makes it somewhat difficult for me to comment on the paper. However, the author himself indicates that if, for example, a cell constitutes 15 percent of the labour force, this group of labour should get around 15 percent of the research and planning effort of the nation. To the best of my knowledge it may not be easy to justify this from any form of theory that I know of. I suppose that if 15 percent of the labour force was unemployed many politicians and economists would argue that this group of labour should get more than 15 percent of the research and planning effort of the nation.

At the end of the paper the author uses this matrix for estimating the demand for each type of labour in each industry in 1988. In estimating the demand for each type of labour the equations in the appendix imply that he is using elasticities of demand for labour with respect to GDP for each industry. In estimating the supply of each category of labour he estimates the enrolments in the first class on the basis of a growth rate. Enrolments in the other classes are projected on the basis of transition rates. On the basis of these projections he estimates whether we will have excess supply of or demand for labour of different categories in 1988. Needless to say these results may, of course, be quite sensitive to the magnitude of the parameters. Unfortunately, the author does not discuss these problems. Also, his estimates of excess supply of and demand for the different categories of labour will only be relevant if some kind of wage rigidities existed. Therefore, one would have appreciated some discussion of the relevance of such rigidities and the likely development of the future wage structure. However, I suppose that this paper is to be considered a starting point for further analyses. I hope that these comments may be of some help for the author's future work.

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