Manpower Planning in Pakistan:
Statistical Pitfalls

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INTRODUCTION

There have been manpower planning exercises in Pakistan with varying levels of quality and rigor. These exercises are reviewed in Herman and Irfan (1989) and Kemal (1987). For a comparison with other countries, one can also refer to Amjad (1987) wherein these exercises carried on in various Asian developing countries are reviewed. Most of the exercises suffer from predictive errors as revealed by post-fact comparison and the studies in this field generally lament about the non-availability of adequate data, which could be considered as a major limitation in this respect.

In this paper, an attempt is made firstly to *extend* the past simulations such as to correspond with the time horizon of the Perspective Plan, i.e., by the year 2003. Secondly, in order to demonstrate the *usefulness* of these exercises, some policy simulations are made and their effect on unemployment is assessed. Finally, rather than warning the reader about the inadequacy of the data, this paper *tries and identifies* the main areas wherein statistical efforts must be concentrated upon for improvement. In order to indicate clearly to the reader where, in the authors' opinion, are the statistical shortcomings of a simulation exercise such as the one described in this paper, it is deemed better to present first of all the general framework supporting the simulation. On the basis of this scaffolding, the location of the pitfalls will manifest themselves.

The structure of this type of model is most simple and it can be graphically visualized through Fig. 1.

THE DEMAND SIDE

The Demand side recognizes two sorts of labour demands, namely, labour demanded for productive activities such as agriculture, manufacturing, etc. (to be called workers hitherto), and labour demanded by the educational sector, (to be called teachers hitherto).

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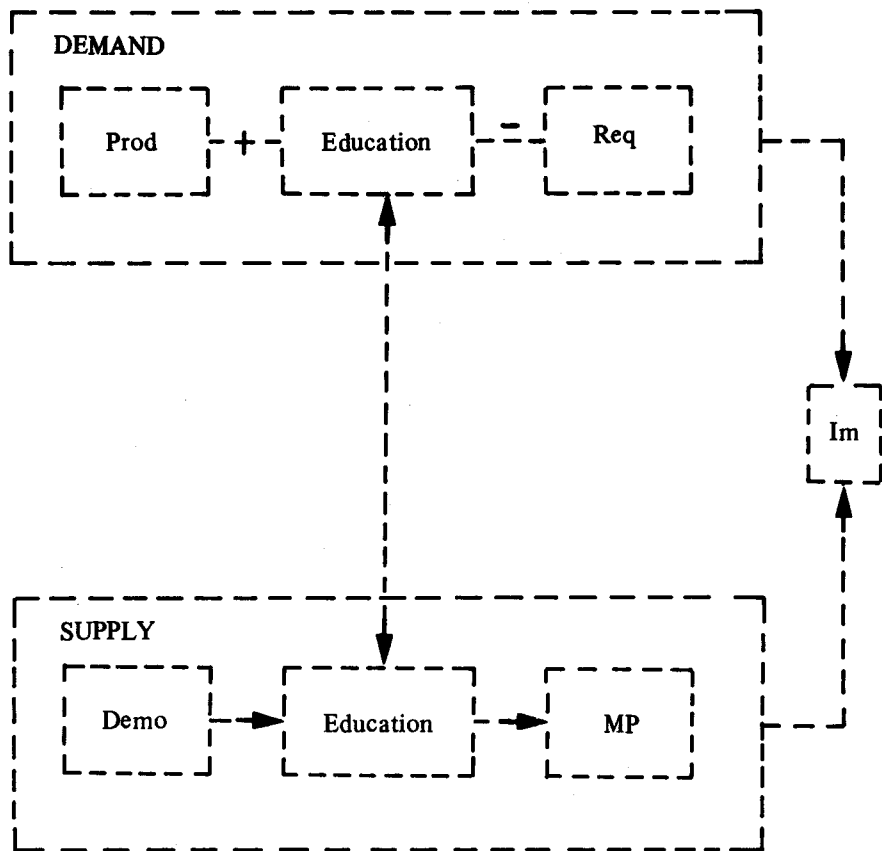
Figure 1.–Schematic Structure of a Manpower Planning Model

Labour requirements, in both instances, are considered to be technically given; in case of productive labour, the number of workers required by the various sectors for the various occupational classes are determined by sectoral value added while the number of teachers required by the various levels of the educational system are determined by the enrollments at each level.

For simulation purposes, in case of workers, the value added of the various sectors is supposed to be growing according to the sectoral growth rates indicated in the Seventh Five-Year Plan; in case of teachers, enrollments can be variously supposed to be growing according either to demographic growth or to growth planned by the Ministry of Education or alternative plans.

THE SUPPLY SIDE

In contradistinction with the Demand side, the Supply side is supposed to be behaviouristically instead of technically determined. The modelling of the supply side consists of three sub-models, namely, a demographic sub-model (indicated in the lower box of the above Graph as Demo), an educational sub-model (indicated in the lower box as Education) and a labour market sub-model (indicated in the lower box as MP).

The demographic sub-model calculates per cohort the number of children delivered by society to the educational system. Societal behaviour is reflected in the various demographic rates.

The educational sub-model is an algorithm describing the educational pipeline. It is based on a parametric infrastructure consisting of the following parameters: enrollment rates, internal efficiency of the system rates (namely, drop-out, repetition and graduation rates) and the forward rates. On the basis of all these various rates, the transition and the retention rates are obtained *ex-post* instead of being imposed *ex-ante*, procedure which permits more sensitive and more varied simulations.

The labour market sub-model calculates the gross potential new entrants into the labour force and on the basis of parametric descriptions of the labour market mechanism (i.e., participation rates, etc.), it delivers the simulated labour supplies by level of education. These labour availabilities are then to be compared with the requirements described above.

PROJECTIONS OF LABOUR AVAILABILITIES
AND REQUIREMENTS

Concerning population growth, recent information provided by the last Economic Survey indicate that actual rates are higher than 3.15 percent per annum and growing. For the purpose of these simulations, population was supposed to grow at 3.15 percent per annum in the DEMO version and at 3.35 percent per annum in the UPE version.

The basic run assumes that while the parametric infrastructure of the model remains unchanged, the educational system increases only because of demographic growth (henceforth referred to as DEMO version).

The above sub-model delivers the gross potential new entrants into the labour force. Information on participation rates per age cohort and educational attainments are simply not available. Recent information published in the last issue of the Economic Survey points out towards the fact of decreasing participation rates of those age cohorts of school-going youth. After discussions and consultations it was decided to adhere to purely fictitious rates, namely, 0.27 for younger and 0.47 for older boys. Table 1 provides the labour availability for different years by broad

Table 1

Labour Supply per Educational Attainments (DEMO)

Year	Stocks (Millions)			Flows (Thousands)		
	L	<M	M&up	L	<M	M&up
1988-89	31.9	28.3	3.58	902	757	145
1992-93	35.8	31.6	4.16	1003	857	146
1997-98	41.2	36.3	4.92	1159	1002	156
2002-03	47.5	41.8	5.73	1338	1170	167

L   =   Total supply of workers, of which.
<M   =   Workers with less than Matric.
M&up   =   Idem with Matric and above.

educational groups, under DEMO version assumptions.

LABOUR REQUIREMENTS

In a nutshell, sectoral labour demands per occupational class are estimated as a function of sectoral value added. For matters related to regression analysis, estimation, significance and plan simulations by means of the RAS method, the interested reader is referred to Herman (1989), where labour demands per sector and occupation as well as sectoral labour demands and national labour demands per occupation are given.

Recent information delivered by the last issue of the Economic Survey indicate achievements in labour productivity. This means that labour absorption is declining. Labour absorption is easily captured by the income elasticities of employment; indeed, these indicate the growth of employment which corresponds to one percent growth of income. Elasticities, which secularly remained above 0.4, are now around 0.35. In order to incorporate this new information, the matter arises whether these are to be interpreted as cyclical or structural changes and, in case of the latter, whether they are to be interpreted as short or as long-run structural changes.

An eclectic approach is followed in the simulation reported here below, by which, resulting elasticities will steadily decrease from 0.49 in 1988-89 through 0.4 around 1990 and 0.38 in 1991-92, to stabilize on 0.34 from the end of the Seventh Five-Year Plan period onwards.

Labour demands for productive activities per educational attainments aggregated over occupations are shown below, in the Appendix, as stocks as well as in

terms of annual increments.

Concerning demand for teachers, it was mentioned already that it is determined as a function of enrollments. The functional relationship is most simple; indeed, the number of teachers is obtained multiplying the number of those enrolled by the student/teacher ratio. For the Primary level, this ratio is taken to be equal to 35 and for Secondary and higher levels, to be equal to 30. Although these values might seem to be too low, the rationale was that for improvements of the educational system as well as for increasing the absorption of educated youth, a reduction of the student/teacher ratio was deemed to be desirable.

The resulting numbers of teachers required per educational level are available on request. Adding over educational levels, one obtains that by 1989 about 320 thousand teachers are required and that by the end of the plan period these numbers, in the DEMO version, will have to increase by 50 thousand more, that is, roughly speaking, an annual increment of 10 thousand teachers per year. The UPE version, of course, shows a completely different picture since enrollments, besides demographic growth, are simulated to increase because of policy. Indeed, were all 5-year-olds enrolled in first class Primary school by 1995, the number of teachers will have to increase from 320 thousand at the beginning of the Seventh Five-Year Plan to 460 thousand at the end of the plan period and up to 660 thousand four years later which implies annual increments of about 45 thousand extra teachers per year.

IMBALANCES

In order to reflect the imbalances, a measure was built equal to the difference between supply and demand expressed as percentage of supply. This is roughly speaking equivalent to the so-called unemployment rate. The imbalances yielded by the basic DEMO run are provided in Table 2. (Teachers demand included in total

Table 2

Imbalances = (Supply − Demand)/Supply; (%). (DEMO)

Year	Stocks		Flows	
	I.	M&up	L	M&up
1989	5.2	−1.5	−2.0	23.9
1993	7.0	3.5	29.8	39.5
1998	10.7	9.3	36.1	40.1
2003	14.1	13.4	38.7	37.6

demand; further, usual DEMO version assumptions).

It needs to be mentioned that the imbalances have been arrived at by incorporating in the demand side the requirements for teachers assuming a teacher/ student ratio which does not prevail at the moment. In other words, these imbalances reflect already a policy measure. It may, however, be observed that the overall unemployment level rises from 5 percent in 1989 to 14 percent in the year 2003. In terms of flows, it means that 40 percent of the new entrants into the labour force will not be absorbed. A slightly lower level of unemployment among the educated than the overall employment rate reflects the effect of the assumptions made regarding the teacher/student ratio. In case one ignores the impact of demand for teachers and considers only the productive system's demand for educated labour, the unemployment rate for the educated jumps from 13.4 to 22.1 percent while 47 percent of the new entrants will be unemployed by 2003, instead of 37.6 percent.

POLICY SIMULATIONS

Another interesting policy simulation to highlight the divergence between the growth pattern and rising unemployment among educated youth was made wherein the system was forced to absorb the educated unemployed to the extent that for this group, the 4 percent unemployment rate is not exceeded in 1992-93. Interestingly, the required growth rate of the economy would be 15 percent per annum rather than 6 percent as planned for the Seventh Five-Year Plan. Unfortunately, neither the resulting combination of workers nor the implied sectoral growth rates can be obtained as yet unless the model is made to be reversible.

Effect of Universalizing Primary Education, on Unemployment

In this paper we are presenting results of still another policy simulation which reflects the achievements of an hypothetical universalization of primary education. Under this policy, there is an increase in enrollments as well as in the teacher requirements. It might be remembered that in the basic rum, while the parametric infrastructure of the model remains unchanged, the system increases only due to demographic growth (referred to as DEMO version). Under universalization of primary education (UPE version), one of the many possible simulations was tried out, namely, what the authors want to call the Baqai simulation in honor of Dr Moinuddin Baqai. The policy implied lets enrollment of 5-year-olds to steadily increase from 53 percent in 1989 to 100 percent in 1995. All other rates and parameters are left untouched.

The resulting UPE version shows a different picture. While labour demands of both types are shown in Appendix Table 3, here below in Table 3 the implied imbalances are presented.

A comparison of Table 3 with Table 2 suggests that unemployment both amongst illiterates as well as educated, is significantly reduced (from 13.4 to 6 percent for the educated). However, increasing the number of teachers only for absorption of educated labour, even in the extreme case of UPE, is a remedy that

Table 3

Imbalances = (Supply − Demand)/Supply; (%). UPE

Year	Stocks		Flows	
	L	M&up	L	M&up
1989	5.2	−1.5	−1.7	23.7
1993	6.8	1.4	27.2	16.2
1998	9.9	3.5	29.6	19.1
2003	12.4	6.0	32.6	22.5

exhausts itself in a decade or so (educated unemployment decreases up to a minimum around 1995 and then increases again). This underscores the need for recognizing these measures as mere palliatives which simply provide a short-term breathing space. Still, one cannot underrate these measures, if not to solve educated unemployment, indeed to improve the educational system, even at the risk of generating more educated youth. Actually, only by engaging more educated workers in the production process, can unemployment be tackled significantly. It is a curious fact that although educated unemployment seems to be a problem bound to stay, the absolute numbers of educated youth generated by the educational system are extremely low (150 thousand in a country of 110 million!).

STATISTICAL PITFALLS

The foregoing discussion amply demonstrates that manpower planning is a useful and policy relevant exercise. In order to enhance its reliability and minimize predictive errors, one needs to concentrate efforts to make available a more reliable set of data than that now at our disposal.

Without aiming at an exhaustive treatment, for the purposes of this paper four areas urgently requiring improvement are to be singled out. These are, one on the supply side of the model, one on the demand side, another affecting both the demand as well as the supply sides and, finally, still one more concerning the imbalances block. (See Fig. 1).

PARAMETRIC BASIS OF SPLIT PIPELINE

The educational sub-model located on the supply side consists essentially of a pipeline receiving children on the one hand and delivering potential entrants into the labour force, on the other. Children are enrolled, they may drop-out from, or repeat a class, they may pass to the next class or graduate from a certain educational level, then they may join the labour force or go forward to the next higher educational level, etc.

All these changes in their status are simulated by means of the corresponding rates. For the purposes of the illustrations shown above, educated guesstimates were made, based on partial sources of information on the various rates as well as on statistical sources providing information on absolute numbers. The guesstimation procedure boiled down to reconciliate the one with the other, namely, making rates as reported deliver absolute values as indicated in statistics, and *vice versa*, that is, forcing absolute values to abide by rates. The resulting algorithm is a model description of reality, that is, it abstracts only the relevant features in order to simulate results under various assumptions such as policy changes, etc.

This modelling of Pakistan's educational system depicts, indeed, the situation prevailing in the whole nation. All parameters and values used are, thus, either national averages and/or national totals. The usefulness of this modelling exercise is two-fold: first it generates information providing the national context and, second, it provides the skeleton of an educational system, whichever it may be.

It must be well understood that national averages subsume wildly diverse situations at the disaggregated level. Indeed, average drop-out rates or average enrollment rates (or, in general, each of the rates built-in in the algorithm) do not reflect the circumstances and the differences existing between, say, the urban and the provincial sub-systems, or between boys and girls.

It is thus imperative to conduct research addressed towards disaggregating the national averages showing at least the above mentioned categories. In this way, instead of one single pipeline, one would be able to build several. Indeed, four pipelines would be the bare minimum, i.e., one for boys and one for girls, as well as urban and rural ones. Only thinking in terms of solving imbalances, these split pipelines will already manifest their usefulness because, e.g., excesses of male teachers in urban areas cannot be used to compensate shortages of female teachers in rural areas, etc.

THE LABOUR DEMAND EQUATION

Although, for the purposes of a manpower planning exercise, it is well recognized that requirements of any one factor (in this case, Labour) are to be

estimated by means of a simultaneous model solving for requirements of all factors, for their remunerations and for the level of production, the condition imposed to disaggregate made this orthodox venue to be impossible. Such an approach would have meant the solution of a huge general equilibrium model whose solution is consistent with the solution of nine sectoral equilibrium models each of which consisting of fifty production factors (i.e., forty-nine sorts of labour —seven times seven— plus capital) and fifty factor prices. Besides the theoretical difficulties, this venue was dismissed simply because of the scarcity of data.

Still, keeping in mind the structure of the above general equilibrium formulation, it is possible to think in terms of a reduced form equation for labour utilization where levels of production, of utilization of other factors, of remunerations to each factor as well as lagged levels of utilization of all factors are exogenously given. This reduced form equation for labour demand will come specified according to the specifications adopted for the various equations of the original general equilibrium model and will be expressed in terms of combinations of parameters such as the distribution coefficient, the substitution elasticity, the rate and class of technological growth, the (price)-income valuation of output, depreciation and other factor replenishment coefficients, etc.

A simplification of such a reduced form equation for labour utilization, is the conventional labour demand equation. This is a technical equation determined empirically. It is technical since it is based on the assumption that there is a technical necessity of labour to attain a certain income, and it is empirical since its parametric specification, subsuming all the above mentioned parameters, is chosen such as to fit the data.

It must be well understood, however, that the above described simplification is no more than that, a simplification. It, in fact, perverts the results by subsuming all the undercurrents that motivated a certain situation which was, afterwards, quantified in the statistics. The researcher actually observes the surface without entering in the mechanisms that delivered such a surface. These mechanisms are those of the labour market and are to be investigated.

A compromise might provide a way out. Thinking in terms of a general equilibrium model solved at macro and at micro level, the researcher might attempt to disentangle the working of the labour market mechanism. Results will anyway be macro, no information will be provided on occupations, the micro level will remain obscure, etc. But, nevertheless, taking into consideration that manpower planning is a macro exercise, such a compromise solution will relate manpower demands to levels of output, taking into consideration demands for other factors of production, their substitution possibilities, as well as the factor prices of all factors involved. The shortcomings of the conventional labour demand equation will be removed to a large extent.

EDUCATIONAL PROFILES

This is a typical statistical pitfall. It affects both sides of the problem, namely, the demand as well as the supply side. Indeed, once that labour requirements were obtained per sector of production according to expectations concerning sectoral output levels, these labour demands must be expressed in terms of demands per occupational classes in order to enter into the manpower planner's proper field of action. This conversion can be done since some information is available describing the occupational structure of employment per sector. But entering into his field of action is not enough: the manpower planner must dwell in it and derive conclusions. To do that he must disentangle the mechanisms which delivered workers endowed with the necessary skills as to discharge their tasks in their respective occupations they are holding. For that purpose, the educational profiles of the occupations are needed.

Statistical work aimed at mending this situation must begin by improving the currently used occupational classification. Indeed, a classification which permits large number of workers to be classified in one or another class just by drafting them into the bunch of "Related activities" is bound to deliver confusing results.

INVESTMENTS TRADE-OFF IN PRODUCTION
VERSUS EDUCATION

Labour demands determined by expected expansions in production which would result from planned investment allocations may not match labour supplies. These labour supplies, per segment of the labour market, are the results of decisions pertaining investment allocations embodied in the labour force. Given that the total available fund for investments is predetermined, a way towards clearing the segmented labour markets would require making the system to be reversible. That is, instead of asking what would the imbalances be which would result from investment decisions allocating funds to both production and education, one would rather need to ask which need the investment allocations be that would result in the smallest imbalances.

In Herman and Irfan (1989) a proposal was put forward which permits running the model back and forth, as many times as it is necessary to clear each of the segmented markets without tampering with the rate of growth of the national economy.

As already said, this might be a way out. Running manpower planning exercises omitting this approach may generate results falling far off the mark because labour markets do work, with or without the acquiesence of the manpower planner. The problem is that they clear themselves solving the imbalances in ways that are sub-optimal from the national point of view and which create unnecessary tensions in the labour force by engaging in production sub-optimally qualified labourers (either over-qualified or under-qualified).

Appendix Table 1

Workers Requirements for the Productive System, per Educational Attainments

Year	Stocks (Millions)			Flows (Thousands)		
	L	<M	M&up	L	<M	M&up
1988-89	29.9	26.6	3.31	910	809	101
1992-93	32.9	29.2	3.64	693	616	77
1997-98	36.4	32.4	4.03	727	647	81
2002-03	40.3	35.6	4.46	805	716	89

L   =   Total demand for productive workers, of which.
<M   =   Workers with less than Matric.
M&up   =   Idem with Matric and above.
Growth rates of value added planned for the Seventh Five-Years Plan, are supposed to remain valid beyond the plan period.

Appendix Table 2

Workers and Teachers Requirements per Educational Attainments; DEMO Version

Year	Stocks (Millions)			Flows (Thousands)		
	L	<M	M&up	L	<M	M&up
1988-89	30.2	26.6	3.63	920	809	111
1992-93	33.3	29.2	4.01	705	616	89
1997-98	36.8	32.4	4.46	742	647	95
2002-03	40.8	35.8	4.97	822	716	106

Appendix Table 3

Workers and Teachers Requriements per Educational Attainments; UPE Version

Year	Stocks (Millions)			Flows (Thousands)		
	L	<M	M&up	L	<M	M&up
1988-89	30.2	26.6	3.63	920	809	111
1992-93	33.3	29.2	4.10	738	616	122
1997-98	37.1	32.4	4.74	773	647	126
2002-03	41.2	35.8	5.39	849	716	134

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Comments on
"Manpower Planning in Pakistan: Statistical Pitfalls"

The paper under review is an interesting manpower planning exercise with three stated objectives, i.e., to present projections of employment and unemployment trends to cover the period of the perspective plan to the year 2003; to present policy simulations to demonstrate the usefulness of such exercises and finally to identify and highlight the areas of major deficiencies in data. The paper can be easily divided into two distinct parts; an excellent critical appraisal of the statistical pitfalls and the needed improvements, that forms the latter part of the paper and a rather general application of an extremely simplistic and highly aggregated manpower planning model and some simulations that form the first part. The first part raises a number of questions and issues in the readers mind as to the *raison d'etre* for the whole exercise and for the need to make specific assumptions. Some of these questions are answered in the second part. It might, therefore, have been worthwhile to restructure the paper so that the second part came first.

The topic is extremely important to Pakistan and the analysis could have serious policy implications. However, in their efforts to address a problem of extraordinary complexity with extremely inadequate data and in a few short pages, the authors have left themselves vulnerable to a number of noticeable pitfalls. I list below the more obvious ones with a view to provoking further discussion and perhaps, more detailed analysis in the future.

The model on the demand side sees the total requirements of manpower as the sum of the labour demanded for productive activities such as agriculture and manufacturing etc., and the labour demanded by the educational sector (teachers). This is an interesting breakdown because the education sector is generally considered part of the larger services sector which seems to be missing in the model. Labour requirements are obtained by aggregating over various sectors the numbers obtained by applying sectoral labour: value-added ratios. For purposes of simulation the study assumes that the various sectors are growing according to the sectoral growth rates indicated in the Seventh Five-Year Plan. An obvious question that comes to mind is whether these growth rates assumed in the Seventh Plan were actually met? Would it not have been more realistic to use actual growth rates rather than those assumed in

the five-year plan.

Labour requirements by educational attainments are obtained in the model by imposing educational profiles for various occupations. This again raises the problem that runs through the entire modelling and estimation presented in the paper. It is one of imposing static, highly aggregated and questionable parameters to predict a process that is dynamic and disaggregated.

The supply side of the model is supposed to be behaviouristically determined and consists of three sub-models i.e., the demographic, the educational and the labour market. Each one of these models is extremely sensitive to the different rates used to depict either societal behaviour of the demographic model, the parametric infrastructure of the education pipeline or the parametric descriptions of the labour market mechanism. Here again the validity of the entire exercise depends upon the starting values.

The questionable nature of most of the rates used in the simulations is highlighted by the authors own discussion of the "purely assumed" decreasing labour force participation rates of school-going youth namely 0.27 for younger and 0.47 for older boys.

The level of employment, and by default, that of unemployment would depend crucially on the values assumed for the income elasticity of employment. The authors having categorically established that the income elasticity of employment is "now around 0.35" (no source is cited for this information) go on to use an "eclectic approach" in the simulations wherein they allow the elasticities to decline "from 0.49 in 1988-89 through 0.4 in 1990 and 0.38 in 1991-92 to stabilize around 0.34 from the end of the Seventh Plan period onwards". While the authors are at liberty to assume any values they like, the implications for total employment (and unemployment) of an elasticity of 0.49 instead of 0.35 in the starting period are, gigantic. There are also several errors of "adding up" or discrepancies between the numbers in the tables and the descriptions in the text (rounding errors!) that can have implications that when translated mean either thousands more employed than the study is meaning to show or thousands more unemployed than the exercise has revealed.

However, it is to the authors credit that they are aware of all these shortcomings and have hinted at most of them either in the second half of the paper or in their presentation. It is also to the authors credit that while qualifying that all parameters are either national averages and/or national totals they state clearly that it must be well understood that national averages subsume wildly diverse situations at disaggregated level. The study makes an earnest call for research addressed towards disaggregating the national averages to reflect the differences between urban and rural, male and female and provincial sub-systems. Till such time as data are available that permit this to be effectively done, the study under review adds some

more evidence, most of it generated by the two authors of the present study, to the need for effective manpower planning in Pakistan.

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