

## **Return Migrants and International Transfer of Technology: A Case Study of Azad, Jammu and Kashmir**

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### **Abstract**

*The study aims at exploring contributions of return migrants, particularly, their role in international transfer of technology in Azad, Jammu and Kashmir (AJK). Besides, reasons for migration and impact on employment generation, as well as, characteristics of migrants (s) are identified who are most likely to promote the transfer of technology. For this purpose, a field survey was conducted in Azad, Jammu and Kashmir, an area with a high rate of international migration. Econometric models were estimated to draw empirical support for determining of the issues. The empirical evidences indicate that education level, demographic profile, career planning before migration, vocational training,, duration of stay abroad and specific type of employer are some of the important determinants of migrants who are likely to transfer technology. The return migrants who spend on luxuries are less likely to contribute in this respect. Such migrants possess specific set of characteristics (s). As per our knowledge, this source of international transfer of technology has not been identified so far. Besides, different technologies like improvement in infoware, humanware, technoware and organisational skills etc., which contribute to improve human capital are identified. The study also provides information on re-employment pattern of return migrants. It further highlights impacts of return migrants on the promotion of local businesses and employment generation. Based upon the evidences, the study provides policy guideline to fully benefit from migrants. A labour policy to provide information about the types of feasible businesses, incentives to bring new*

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*technology and facilitation of setting up business could enhance local development. The study contributes by identifying an important new source of international transfer of technology (s) through migrants. The policy direction are provided to explored this new channel to transfer new technologies and, therefore, accelerate economic development in developing areas. The study would also be equally beneficial for other areas, which experience return migrants.*

• **JEL Classifications:** O1, O15

• **Key Words:** migration international, technology transfer, return migrants, re-employment and business creation, development, characteristics of migrants and Azad Jammu and Kashmir

## I. Introduction

Economic efficiency, progress and sustainability depend on achieving international competitiveness, which is linked with technological advancement of a nation. Advancement of technology always led to an edge to the pioneering societies. Moreover, its improvement kept them competitive in the world. Advancement of technology has also accelerated the pace of development and improvement of human resources. Ample empirical evidences exist which indicate that new technologies are driving force for industrialisation and accelerated economic growth. [(ADB 1995), (Beg 1991), (Chaudhary 1989), (Oberai 1981), and (Hrich & Lin 1990)]. The limited resources of developing countries restrict their ability to invent new technologies. Therefore, they depend on transfer of technology from developed countries, until they become capable to develop the same by their own. Thus, their early development depends upon their ability to benefit through transfer of technology. For Pakistan, and Azad, Jammu and Kashmir (AJK), being in developing stage and having limited resources, the need for technology transfer is of significant importance. To achieve this objective, it is necessary, to identify sources and methods of technology transfer so that these avenues may be fully explored. In the literature, sources of technology transfer have been identified like government arrangements and through multinational corporations. However, one of these channels, for such transfer, could be migrant population. Hardly any study in AJK and Pakistan has either identified this source of technology transfer or placed due importance to exploit this channel.

Migration in general and return migration in particular, could be one possible

source of technology transfer. The inflow of return migrants equipped with financial resources, and know-how may also be a source of modernisation and mechanisation of the economy. The overseas migrants are usually capable of selecting appropriate technology for the local economy<sup>1</sup>. They are also capable of more quickly assessing the scope of appropriate foreign technology and, hence, promote efficient transfer of technology, given their self interest and better knowledge of their field.

Effects of return migration, on various aspects of family, business, and economy, have been widely discussed as a beneficial source for improvement of migrant's living standard and local development [Stahl 1986), Gmelch and Rickling 1986), ILO/ARTEP 1987), Authokorele 1990), and Amjad 1990)]. However, its contribution towards transfer of technology has been neglected. It is interesting to note that even comprehensive studies on the subject matter, including those pertaining to Pakistan and AJK, have ignored this aspect, for example, Haq (1979), Khan (1990) and Hsich and Lin (1990). These studies analysed conventional variables such as investment, consumption, causes of migration, effect on family, and fertility etc. Olin (1990) also pointed out the effect of migration on technological change. However, none of these studies indicated the process of technology transfer relating to return migrants.

Transfer of technology has always remained on the top of bilateral and multilateral economic negotiations between 'have and have not' countries. Beg (1991) mentioned that Japan, which was falling behind its own area of specialisation viz. textiles in 1870s, sent its experts to Britain and France to acquire necessary humanware and to learn about new technologies. Similarly, Egypt sent its teams of experts to France in 1830 to bridge the technological gap that existed, at that time, between the countries. As mentioned earlier, major source of the transfer of technology, as considered in literature, have always been government efforts and multinational companies [Kazi 1991, Beg 1991 and Khan 1992]. There are few studies, which pointed out that migration helps to promote business, joint ventures and co-production strategies. These sources enable developing countries to generate jobs, earn foreign exchange and promote industrial development.

Pertaining to Pakistan, Chaudhary (1989) conducted a comprehensive study on the role of migration in the development of agriculture. Although, the study was

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<sup>1</sup>Modernisation of Pakistani agriculture and construction sectors is partly attributed to migration. See: Economic Survey, of Pakistan (1982-83) and (M. Aslam Chaudhary 1989).

limited to the agriculture sector, still it brought important aspects of migrants who played an important role in the agricultural development. However, this study did not deal with the aspect of return migrants and their role in transferring technology.

There are different perceptions about technology. It is considered as transfer of huge plants and machines or transfer of production process only. In fact, it means transfer of any or all of the *following four components of technology*: Technoware (i.e. machines, tools, equipment), *humanware* (i.e. skills, knowledge, experience and abilities), *infoware* (i.e. processes, formulae, manuals, designs, specifications, software, and resource materials etc.) and *Orgaware* (i.e. organisational techniques and frameworks). Now a day, new technologies are getting even more importance, particularly, computers, modern machinery, networks and means of fast communications which have made the world a global village. As a result, transfer of technology has become one of the top agenda items of international institutions, particularly, for the developing countries. This keeps on increasing with the passage of time.

The present study is an attempt to analyse the contributions of return migrants (RMs), with a particular focus on transfer of technology and, therefore, fills in the gap in the literature in this respect. It is a case study of Azad, Jammu and Kashmir, where significant number of overseas workers returned with skills and capital<sup>2</sup>. Econometric models are developed to explain the technology transfer, through return migrants. These migrants are usually active, experienced, better skilled, motivated, healthier, well disciplined and financially resourceful<sup>3</sup>. A cross section analysis has been carried out, pertaining to AJK, regarding the role of personal characteristics, as well as, socio-economic factors which may have led the process of transferring *technoware and infoware*; from host to home country. Partially, it has also been focused to identify linkages among different variables, which could affect the attitude of RMs, regarding the magnitude of technology transfer. Moreover, re-employment pattern of RMs in the context of their practices about technology transfer is also focused. It is expected to improve upon the perceptions about the sources of technology transfer. Besides, policy guidelines pertaining to return migrants and transfer of technology will be provided.

To this end, the study is organised as under. Part II consists upon description of

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<sup>2</sup>Migration is phenomenally high in AJK, 24% of the population in some areas. Also return flow of workers with inevitable funds and technological know-how is high. Also see: (Hamdani 1996), section on empirical findings.

<sup>3</sup>See: "Overseas Migration' GOP, National Manpower Commission," 1989, P-62.

methodology, data and survey<sup>4</sup>. A model is presented in this section which is tested to draw empirical support for the issues. Section III provides discussion of results and their implications. Part IV is conclusion of the study, which also highlights policy implications of the findings of this study.

## **II. The Data and the Model**

### **A. Data Sources & Sampling**

A comprehensive questionnaire was prepared and a field survey was carried out in (AJK) to obtain first hand data. The survey covered different aspects of technology transfer and its related variables. Moreover, secondary data are also used to draw additional support for the evidences. The sample was drawn from all the seven districts of AJK. Table 7 (Appendix) provides information on migration in different districts of AJK.

There are large number of households, which consists upon overseas migrants i.e. 5.6% in Bagh, 12.5% in Poonch, 19% in Kotli and 24.5% in Mirpur. Fresh estimates regarding the same are much higher, About 50%, higher than this figure. It may be noted that every fourth household in the Mirpur district has overseas connections. The AJK population of return migrants has been classified in to two geographic zones viz.; Zone-I, consists upon northern districts of AJK (Muzaffarabad, Bagh, Poonch & Sudhnoti/Palandri)<sup>5</sup> and Zone-II covers the areas of the Districts of Mirpur, Kotli & Bhimber. The classification was based on intra-zonal similarities and differences (variability) in respect of migration and socio-economic set-up. Zone-II is a high migration area, as compared to the Zone-I.<sup>6</sup> Keeping in view the requirements of the study, the sample was selected into two stages, as follows. In stage-I, geographic zones and professional categories of Techno-Human-Resources (THRs) were identified<sup>7</sup>. In stage-II, sub-areas were selected and respondents were chosen for interviews.

### **Sample Size**

The sample size for the study was determined on the basis of a widely used

<sup>4</sup>For a detailed review of current literature on the subject matter see: (Hamdani 1996).

<sup>5</sup>Bagh & Poonch districts, which lie in the Northern Region of AJK, were included in the study. However, their representation in the sample was not proportionate due to time and resource constraints.

<sup>6</sup>For details of socio-economic characteristics of both the zones see: Hamdani (1996) and World Bank (1991).

<sup>7</sup>THRs are all types of skilled/unskilled persons, professionals and service workers who might have worked in technological environment. For classification of THRs, see appendix table 1

formula<sup>8</sup> (Cochran 1979). The total size of final sample is 94, which included 52 return migrants from Zone-I and 42 from Zone-II. A vision survey based upon long interviews was also conducted to obtain in-depth qualitative insight. The total numbers of such cases were 33.

## B. The Model

The impact of migrants' personal characteristics and socio-economic variables like savings, investment and fertility etc., have been identified by many studies [(Stahl (1986), Gmelch (1986), ILO/ARTEP (1987), Authokorele (1990)]. However, technology transfer depends on awareness of migrants, demographic characteristics (age, household size), human capital (education & training), pre-migration plans, overseas labour market experience (duration of stay and foreign earnings/cash reserves) and degree of personal motivation<sup>9</sup>. The motivation depends upon nature of employment and employer, labour force quality, and planning for post-migration period. The transfer of Technology (TT) may be specified as a function of these above-cited variables, as represented in the following model.

### Model-1

$$TT_{it} = \beta_0 + \beta_1 DUR + \beta_2 EDU + \beta_3 AGEND + \beta_4 CR + \beta_5 HHSIZE + \beta_6 VOCTPM + \beta_7 VOCTAB - \beta_8 LUXURIS + \epsilon \quad (1)$$

### Model-II

$$TT_{it} = \beta_0 + \beta_1 DUR + \beta_2 EDU + \beta_3 AGEND + \beta_4 CR + \beta_5 HHSIZE + \beta_6 VOCTPM + \beta_7 VOCTAB - \beta_8 LUXURIS + \beta_9 FPLANAB + \beta_{10} EMPLOYR + \beta_{11} LF-WEST + \epsilon \quad (2)$$

Where

$TT_{it}$  = Technology Transfer measured in terms of value, in rupees, of technware (t) and infoware (i).

<sup>8</sup> $n = K^2 V^2/D^2$

where:: n = Required sample size

K = Standard normal deviate for required confidence

V = Coefficient of variation of variable under study as proportion of mean

D = Required precision, as proportion of mean

(See Cochran, 1979; Casley and Kumar, 1988; Poate and Daplyn, 1993).

<sup>9</sup>This study does not discuss transfer of Hi-tech which, among others, includes; oceanography, Robotics, spaces, and defense technology etc.

<i>DUR</i>	=Duration of stay abroad.
<i>EDU<sub>pm/em</sub></i>	=Education of return migrants in completed years, at first migration/end of migration.
<i>AGE/AGEND<sub>v</sub></i>	=Age of RMs at migration/age at the end of migration.
<i>CR</i>	=Cash reserve or size of saving abroad/cash brought at time of final return.
<i>HHsize</i>	=Household size of return migrant.
<i>VOCTPM</i>	=Vocational training, pre-migration.
<i>VOCTAB</i>	=Vocational training abroad.
<i>LUXURIS</i>	=Luxury items purchased out of foreign earnings.
<i>FPLANAB</i>	=Dummy Variable for Future plan of self-business in post-migration period, while staying abroad (Clear plan=1; else=0).
<i>EMPLOYER</i>	=Dummy Variable for Employer abroad (Western=1; else=0)
<i>LF-WEST</i>	=Dummy Variable for labour force quality with whom return migrants worked abroad (Superior/western=1; else=0).
$\varepsilon$	=Error term, with standard assumptions

Model-I includes common explanatory demographic and human capital variables. Model-II includes all variables of the model-I and, in addition, it includes three dummy variables relating to personal motivation and behaviour of return migrants<sup>10</sup>. Two of them (EMPLOYR and LF-WEST) represent the notion, the opportunity to migrants to learn/acquire and practice new technological components during their stay abroad. The third variable represents one's motivation, desire and plans for re-employment after returning home, i.e.. Post-migration plan<sup>11</sup>. OLS technique has been used for estimation of the models. Both the models have been tried using alternative specifications. Moreover, some evidences were directly obtained from the survey data, which is presented in table forms in the next section.

<sup>10</sup>The above model explains transfer of two technological components i.e. Technoware and Infoware. The other two variables i.e. Humanware, and Orgaware are qualitative and also slightly different in nature, so the above model could be reviewed for estimation in these cases, which is not in the scope of this study.

<sup>11</sup>A clear plan to establish own business in the post-migration period is likely to affect one's purchase of productive technological components or non-productive consumer/durable items out of one's foreign earnings.

### III. EMPIRICAL FINDINGS & IMPLICATIONS

#### A. General Findings

The majority of migrants are craftsmen, academician, developers (engineers & managers) and promoters (Appendix Table 1). The details of the types of technology transfer induced by these categories are produced in appendix Table 2. The survey indicated that the mean age of RMs is 27 and 39 years, at first migration and end of migration, respectively. Majority of migrants (74%) belong to age group 31-50 years. This finding is consistent with that of National Manpower Commission, Government of Pakistan (1989) i.e. most of the RMs are in prime working age, hence, they are productive and motivated. One of the major reasons for migration is search for higher income (61%). About 11% migrants migrated for learning better skills, 10% for unfavourable local conditions at home and 8% migrated for higher education. Majority of the RMs belongs to the group whose cash savings is less than Rs 50,000. [Appendix Table 3]. However, the percentage of those who saved enough (Rs 200, 000 and above) is also as high as 28%. These savings or cash reserves are in addition to the remittances, which they had already sent prior to their final return from abroad. On average, such remittances were over Rs. 1.146 million. Average income of the RMs shows a sharp increase due to migration, i.e. 3-times higher than that in pre-migration; 7-times higher towards the end of migration; and almost 4-times higher after migration. The average earnings of the migrants substantially increased over time. The mean earnings of the migrants at the time of migration (at home) were Rs 3,015. However, the maximum earnings were about Rs 13, 000. On migration, the same increased to Rs. 9,798 and Rs.30, 000, respectively. It further enhanced to Rs 20, 361 and Rs 80, 000, respectively. It is interesting to note that although the average income of the return migrants decreased, on return, as compared to their early time abroad. But it was still three times higher than that which they were earning before migration.

#### B. Pattern of Technology Transfer in AJK

Three alternative specifications of the model were tested. Based upon the model, we estimated the effect of a combination of demographic, human capital and other related variables, on the transfer of technoware & infoware (dependent variables). Three alternative specifications of the model were tested; equation 1.1,

**Table 1.** (Results of Model I)

Dependent Variable=TTt (Value of Technoware and Infoware in rupees)

VARIABLES	Models/Equations		
	1.1	1.2	1.3
Constant	-53.0 (-0.92)	45.09 (0.7)	-149.08 (-2.4)*
DUR	0.31 (2.6)*	0.23 (1.75)***	0.17 (1.4)
EDUem	0.25 (2.7)*	0.28 (3.0)*	0.31 (3.4)*
AGE a		-0.14 (-1.4)	
AGEND	0.09 (0.8)		0.16 (1.5)
CRb	0.21 (2.0)**	0.20 (1.9)**	0.23 (2.4)**
HHsize			-0.10 (1.04)
VOCTPM			0.20 (2.15)**
VOCTAB			0.45 (4.7)*
LUXURIS	-0.23 (-2.3)**	-0.24 (-2.3)**	-0.26 (-2.7)*
EMPLOYER	0.22	0.18 (1.5)	0.41
LF-WEST	1.68	0.23 (1.7)	1.93
EXPRNCC		0.18 (1.5)	7.4
Adj R <sup>2</sup>	0.22	0.23	0.41
D.W	1.68	1.70	1.93
F Statistic	6.10*	5.6*	7.4

a ,b ,c = Alternately AGESQR(Age Squared), AVG-YEND(Average month income towards the end of migration period) , and EXPSQR (experience square) was also tested and found insignificant.

TTt = Technology Transfer measured in terms of Value, in rupees, of technoware ( t ) and infoware ( i ) .

Dur = Duration of stay abroad

Eduem = Education of return migrant

Age/Age at end = Age of RMs at migration/age at the end of migration

CR = Cash reserve or size of saving abroad/cash brought at time of final return

Hhsize = Household size of return migrant

Voctpm = Vocational training pre-migration

Voctab = Vocational training abroad

Luxuris = Luxury items purchased out of foreign earnings.

Fplanab = Dummy Variable for Future plan about post-migration period while staying abroad (Clear plan = 1; else = 0)

Employer = Dummy Variable for Employer abroad (Western = 1; else = 0)

Lf-west = Dummy Variable for labour force quality with whom RMs worked abroad (Superior = 1; else = 0)

Figures in parentheses are t-values.

\*=significant at 1%, \*\*=significant at 5%, \*\*\*=significant at 10%

**Table 2.** (Results of Model II)

Dependent Variable = TTi (Value of Technoware and Infoware in rupees)

VARIABLES	Models \Equations		
	2.1	2.2	2.3
Constant	-172.86 (-2.9)*	-146.5 (-2.4)*	-149.5 (-2.5)*
DUR		0.19 (1.6)	0.19 (1.7)***
EDUem	0.22 (2.2)**	0.22 (1.2)	0.22 (2.3)**
AGEND <sup>a</sup>	0.26 (2.7)*	0.11 (1.03)	0.16 (1.6)
CR <sup>b</sup>		0.16 (1.6)	0.16 (1.6)***
HHsize		0.13 (1.3)	0.12 (1.3)
VOCTPM		0.16 (1.8)***	0.15 (1.8)***
VOCTAB	0.34 (3.5)*	0.33 (3.1)*	0.34 (3.6)*
EDU <sub>pm</sub>		-0.006 (-.03)	
LUXURIS		-0.25 (-2.8)***	-0.25 (-2.8)*
FPLANAB	0.31 (3.3)*	0.21 (2.2)**	0.21 (2.2)**
EMPLOYER	0.18 (1.7)***	0.26 (2.3)**	0.26 (2.4)*
LF-WEST		0.14 (1.7)***	0.14 (1.7)***
Adj R <sup>2</sup>	0.43	0.50	0.52
D.W	2.01	1.93	1.94
F.	11.97*	6.5*	8.03*

a, b = Alternately AVG-YEND(Average month income towards the end of migration period) and age (at first migration) was also tested and found insignificant.

Dur = Duration of stay abroad.

Edu<sub>pm</sub>/EDUem = Education of return migrant pre-migration/at the end of migration.

Age/Agend = Age of RM. at migration/age at the end of migration.

CR = Cash reserve or size of saving abroad/cash brought at time of final return.

Hhsize = Household size of return migrant.

Voctpm = Vocational training pre-migration.

Voctab = Vocational training abroad.

Luxuris = Luxury items purchased out of foreign earnings.

Fplanab = Dummy Variable for Future plan about post-migration period while staying abroad (Clear plan=1; else=0).

Employer = Dummy Variable for Employer abroad (Western=1; else=0)

Lf-west = Dummy Variable for labour force quality with whom RMs worked abroad (Superior =1; else=0)

Figures in parentheses are t-values.

\*=Significant at 1%, \*\*=significant at 5%, \*\*\*=significant at 10%

1.2 & 1.3 (Table 1). Keeping in view theoretical rationale, some dichotomous variables of paramount importance were introduced in the model-II.

Table 1, presents regression results of model-I. The results show that variables representing duration of stay abroad, education, cash reserves and purchase of luxury items out of foreign earnings, (negative sign, as expected) were significant at 1% to 10% levels, with expected signs. The age of migrant work experience were also tested, as explanatory variable. Both the above-cited variables were insignificant. It may be the case that at the time of migration, workers may not have enough experience. The variables like vocational training before and after migration was introduced in the model. It led to improve the results. Equation 1.3 (Table 1) includes household size, and variables related to training (voctpm and vocatab). The significant determinants of technology transfer were education, cash reserves (savings), vocational training, pre-migration and spending abroad on buying luxury items. It also indicated that the migrants who buy luxuries lose their chance to buy investment equipment. They appear regretting on this aspect. The vision survey indicated these findings too.

Model-II, Table 2, equation 2.1 was estimated, first using significant demographic and human capital variables of the model-I. Besides, two dummy variables were also introduced, as given below.

i) The effect of future plans of return migrants and migrants' employer abroad (Western, Middle Eastern & Asian), under whom the RMs worked, were tested. Thus, equation 2.2 (Table 2) included six additional variables, as compared to equation 2.1. These variables were duration of stay abroad, cash reserve with migrants at the time of return, pre-migration education, and dummy variable, i.e. impact of working with specific employer and in country (Western, Middle Eastern & Asian). This specification neither improved the results nor the explanatory power of the model.

The finally estimated model is reported in Table 2, model 2.3, which include all possible explanatory variables. The results indicate that the return migrants of given characteristics (s) are good agents of technology transfer. Most of the variables included in the model turned out with expected sign and significant. The two insignificant variables i.e., age at end of migration and household size which do have positive sign hence do not contradict the above view. The only negative variable is spending on luxury items.

The migrants who buy luxuries are less likely to spend on technowares, as expected. Therefore, they are less likely to be helpful in the transfer of technology.

The significant variables are duration of stay abroad, cash reserves (savings), vocational training, notional planning for business set up, education of the migrants, and specific (s) employer abroad. Thus, the empirical results support the notion that specific return migrants (s) are important sources for the transfer of technology. The findings add to the literature an additional source of technology transfer, in addition to governments and multinational companies, as indicated in the conventional literature. This contribution of RMs is very important. The policy makers may utilize this source of technology transfer for any specific sector of the economy i.e. agriculture, industries, business, education etc. and, therefore, accelerate growth. It is also interesting to note that not all the migrants are helpful in the transfer of technology.

### **C. Spending On Technology Transfer**

The survey data revealed that mean spending on technological items or tools-equipment etc, among RMs was Rs 1.31 million, on average, with a maximum of Rs 8 million<sup>12</sup>. The highest spending on technoware was found among RMs with mean education of 10 years. The mean spending on technoware in Zone-I is significantly lower (Rs 92,092) than in Zone-II, (Rs 2, 60,390). The technoware and infoware transfer from Western countries was on average much higher (Rs 3,09,000) than the Middle Eastern countries (average, Rs 15, 500). About 14% RMs spent Rs 50, 000 to Rs 200,000 on tools & equipment (excluding infoware), 4.3% spent larger amount and the rest spent lesser than Rs 50,000. Regarding Infoware, a maximum of Rs.3, 50,000 and Rs 50,000 was spent by a few RMs. Majority (90%) of migrants spent less than Rs.50, 000 on it. Appendix Table 4 provides a picture of technology transfer by various types of THRs/return migrants. The above findings also indicate that RMs, can play an important role in bringing productive technologies, tools, equipment and other accessories which meet their professional requirements at home. Their orientation, motivation and education, therefore, may be of a great help. Popularising the need of technology transfer among them could help to better utilisation of foreign exchange earned by the migrants.

Spending on luxury items (LUXURIS) was observed to be negative and highly significant (at 1%). The return migrants choosing to buy luxuries from their foreign earnings have to forego purchase of technoware i.e. machines, equipment

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<sup>12</sup>Medical doctors for bringing medical technology in Mirpur spent the amount up to Rs. 8 million).

and productive tools. It was noted that RMs spent from Rs 300, 000 to Rs 500, 000 on luxury and comforts items. The RMs, unable to bring technoware relevant to their profession were found regretting on two grounds: they lost the price and quality attraction available to purchase technoware, from abroad, and their initiative to re-start economic/professional activity at home.

The longer stay abroad and age at the end of stay abroad are positively associated with the technoware and infoware transfers. The education of return migrants and clear notional plan for setting up business, on return, turned out to be positively related with the dependent variable and also highly significant (table 2, model 2.3). The pattern of technology transfer shows that the highest rate of infoware transfer from abroad is among those with education, more than 18 years (Ph.D.), who spend Rs 2, 55,000, on average, for this purpose. It is followed by those with over 16 years education (MS/M.Phil./Professional Degree), who spent Rs 1,22,500, on average. This infoware include, computer software, engineering documents, designs, electronic equipment, books, journals, display material and professional resource material etc. (see appendix, Table 5). Researchers and academicians mostly bring computers and latest professional equipment. Technicians/crafters/carpenters etc., bring toolkits, electronics, automatic and semi-automatic equipment. Since education may enhance the capability of learning about new methods of production and technologies, and they may also develop skill to evaluate efficiency and cost effectiveness of different technoware/infoware, therefore, migrants with better education are more likely to bring relevant technoware and infoware to their home country. This result, however, has to be taken cautiously as this is not always necessary to hold. A less educated technician may bring more technoware than a highly educated office-worker. Furthermore, purchase of technoware is also dependent on the foreign earnings of migrants. It implies that if technology transfer is desirable, then, there is a need to promote educated and skilled workers to go abroad for appropriate duration, giving them incentives for bringing technology with them upon return.

Cash reserves (savings) are one of the most important variables, which encourages migration. On average, the RMs brought Rs 4,16,000 with them. The maximum amount was Rs 10.00 million. Although, majority (44.4%) brought less than Rs 50, 000. The RMs were able to bring more than Rs 200,000 with them, at the end of their migration. (Appendix Table 3). It is useful information for policy guideline. The RMs with better jobs and higher earnings abroad may be identified through various (practicable) means and motivated them to promote technology transfer.

**Table 3.** Transfer of Technology by country and Employer (Independent Sample T-Test)

<u>BY POST MIGRATION PLANS</u>			
	Clear	Unclear	Mean Difference(Rs)
Mean Value of $TT_{ii}$ (Rs)	3,96,349	35,770	
Mean Difference (Rs)	–	–	3,60,579
t-value	–	–	1.35
Sig. of t-value	–	–	20%
<u>BY PRESENT EMPLOYMENT</u>			
	Self Employed	Non-self Employed	
Mean value of $TT_{ii}$ (Rs)			
Mean Difference (Rs)	2,42,392	42,472	
t-value	–	–	2,00117
Sig. of t-value	–	–	1.2
	–	–	20%
<u>BY COUNTRY OF MIGRATION</u>			
	Western	Middle Eastern	
Mean value of $TT_{ii}$ (Rs)	3,09,263	15,451	
Mean Difference	–	–	2,93,812
t-value	–	–	1.5
Sig. of t-value	–	–	15%

The size of household members could play a positive role in determining the transfer of technology. A migrant with more liabilities (married/large family size, etc.) may be more motivated to learn new technologies/methods during his stay abroad and bring with him new technology upon return, in order to start income generating activity at home. Households of a large size were also found to have more number of literate persons, as well as, those in working age. This usually serves as a motivation to the RMs for starting own business.<sup>13</sup> Since in the present sample, mean household size was observed to be 4.8 persons, with 3.8 people in working age and 3.7 literate, therefore, they may be more inclined to buy technoware/software etc, from their foreign earnings. The effect of household size was not found very significant (significant only at 20%).

The labour force quality with whom an RMs worked abroad, and specific employer (Western/non-Western) are found to have significant effect on shaping the behaviour of RM, regarding professional and economic activities, as well as,

<sup>13</sup>This view is strengthen if we consider the post-migration income from any employment which is usually lesser than the income abroad, hence, discourage RMs get some employment and motivate them to setup their own business.

decision making. As expected, the migrants having worked with better quality of labour force or employer abroad is likely to acquire more technological information, higher income generation techniques and to know more about modern business mechanism. On the basis of information provided by the return migrants, the labour force employed with Western employers was rated high regarding quality of work, working habits, abiding principles, and willingness to work hard. The Western employers are also rated high regarding human capital. The same was also rated high regarding orgaware and organisational frameworks. This was also tested in our model and found significant at 10% level. Both the variables mentioned above were confirmed being effective in transfer of technoware & infoware. The migrants employed with Western employers and in the Western countries were inclined to bring more technology to home.

The desire to establish one's own business, upon final return to home, was considered, a priori, determinant of what the RMs could bring with them. The variable was expected to have a positive effect on migrants' spending on transfer

**Table 4.** Impact on RMs business Enterprises

<u>FOREIGN COLLOBRATION</u>		
	Before Migration	After Migration
Foreign MOUs <sup>a</sup>	15.8%	42.0%(b)
Foreign Partnership	13.3%	33.3%(c)
<u>SCOPE OF BUSINESS</u>		
Local	17.3%	37.3%
Domestic	2.7%	12.0%
International	1.3%	2.7%
Not Applicable/Others	78.7%	48.0%
<u>WHO REPAIRS MACHINERY ETC.</u>		
Self	30%	72%
Hired	70%	28%
<u>TYPE OF BUSINESS</u>		
Service	7.9%	19.7%
Trading	5.3%	29.0%
Manufacturing	5.3%	5.3%(d)
Not Applicable/Others	81.6%	46.1%

a = Memorandum of understanding to set-up/join some enterprise.

b& c = Include MOUs & Partnerships with Non-foreign individuals/companies etc.

d = Some underestimation or data error may be suspected since increase in manufacturing was also observed during the field survey.

of technology. The RMs with a clear notional plan, or high desire for self-business activity was observed to have spent larger amounts on productive durable (tool, equipment & infoware etc.). However, others, having none or unclear plan/desire to establish their own business were found bringing non-productive durable and luxury items. This effect was captured through the Dummy variable FPLANAB (plan for self-employment/business in post-migration period while staying abroad, Table 3). This variable was also positive and significant at 5% level. The results of the vision survey also confirm the findings of the model. It implies that the migrants' practices of planning for post-migration period is significant determinant of effective technology transfer. Besides, it is important because it can ensure channelisation of one's foreign earnings for productive re-integration upon return. For home country, it is important since it may lead to employment promotion through self-owned enterprises of return migrants and it also generate jobs for others too. There is a clear implication of this finding. Since the return migrants' practice of planning about post-migration period is a source of technology transfer. It re-enforces self-employment decision making. As a policy, popularising career planning among migrants could have dual effects, which must be taken into account by the policy makers.

### **C. Transfer of Technological Components**

Whether technology or any of its components (technoware, human skills, infoware, organisation's styles, etc.) has been transferred, from abroad to home country, through return migrants can also be noticed from the business activities, which they may start upon their return. There are four major areas where return migrants could affect their businesses upon their return. These are: a) scale of operation, b) degree of sophistication in technological setting of the enterprise, c) scope of their business and d) type of business (Table 4). The important findings in this respect are given below:

(i) Those return migrants who established their own business, before migration, were able to successfully re-establish businesses again, because of the following factors; family business being the same or similar (35%), acquired skills/humanware (33%), other institutional or non-institutional reasons (31%). After migration, there was substantial increase in those businesses, which had foreign collaboration. Such businesses increased from 13.3% to 33.3%. Besides, there was a significant increase in the local businesses (Table 4). Apart from employment generating effect, it created additional and improved technological capacity, which

**Table 5.** Effect of Staying Abroad on Degree of Sophistication of Business (TECHNOWARE, HUMANWARE, ORGAWARE & INFOWARE)

EFFECT ON:	ZONE-I		ZONE-II		OVERALL AJK	
	Improved	Unchanged	Improved	Unchanged	Improved	Unchanged
Tool/Equipment	67%	33%	67%	33%	64%	32%
Staff Skills	72%	28%	70%	30%	71.1%	9%
Organisational Infrastructure						
- Phone/Fax	74%	26%	30%	70%	57%	38%
- e-mail	56%	42%	33%	67%	48%	52%
- Computer	44%	56%	45%	55%	44%	55%
- Software	47%	53%	44%	56%	46%	54%
Management Styles	90%	10%	100%	0%	93%	7%
Marketing Styles	100%	0%	67%	33%	88%	12%

enhanced their businesses.

(ii) The return migrants who were operating some business/manufacturing enterprise prior to their overseas migration were found to have substantially improved in technoware, humanware, infoware and orgaware. The improvement was in such a way that their scale of operation was considerably increased after migration. The survey indicated that 73.5% of return migrants, having some enterprise in pre-migration period increased the scale of operation of their enterprises. However, 26.5% migrants were unable to improve their businesses on return from abroad. Decrease in scale was observed in none. It is interesting to note that in both the Zones, there is an increase in the scale of operation. But in

Zone-II, percentage of those who increased scale of operation was much higher (86%), than in Zone-I (62%). This may be due to the wider technological base already existing in this zone.

It was enquired from the relevant respondents (vision survey) whether their enterprise/office has been improved after their return from abroad. The responses were gathered against each important component of the office/enterprise i.e. tools and equipment, status of the enterprise before and after migration, staff skills level, management styles, marketing styles and organisational infrastructure which includes phone/fax, computer/hard ware and software, e-mail facility etc. Table 5 provides two important outcomes. a) A high percentage (between 44% to 93%) of the RMs brought improvement in degree of sophistication in technology for their enterprises, b) Improvement rate was higher in the backward zone<sup>14</sup>,(Zone-I),

<sup>14</sup>A more advance analysis using test of significance and also control-group approach would be suggested to rely upon these findings

where it was more needed than Zone II [also see Appendix Table 5].

The most improvement was observed for tools, skills, management and marketing techniques. In Zone I, the improvement in business was observed for 44% to 90% businesses. However, the same for Zone II was from 30% to 80% businesses. The RMs significantly improved technology pertaining to technoware, humanware, orgaware and infoware. The empirical evidences indicated strong linkages between RMs and transfer of variety of technology, which significantly improved the local environment. Therefore, this source of technology transfer, which was hidden, can be further exploited for modernisation of business activities and acceleration of economic growth in developing areas.

#### **IV. Conclusions & Policy Implications**

The purpose of this study was to analyse the role of return migrants in the transfer of technology and their re-employment pattern, after they return from abroad. Moreover, specific characteristics of the migrants were to be highlighted which could help to promote transfer of technology. Besides, preference for purchase of luxury goods vs. technoware was also focused. In this respect, major categories of technologies were analysed i.e. technoware, humanware and infoware. In addition, motives behind migration were also to be highlighted. Based upon empirical findings, policy guideline was to be proposed for better utilisation of human resources and foreign exchange earned by the migrants.

To study the above-cited aspects of migrants, a field survey was carried out. It was further supplemented by the vision survey. Econometric models were tested to find out the significant variables, which could play any role in the transfer of technology. The empirical evidences indicated that major motives for migration were high income earning opportunities, acquiring education and business/skills etc. By migration, these objectives were successfully achieved. The income of RMs increased many folds, not only during migration, but also they improved their earning abilities after returning home. They successfully re-employed themselves self-established businesses, after returning home, and also increased higher income earning activities.

The empirical findings of the study indicated that RMs are a source of technology transfer. In this respect, duration of stay abroad, education of RMs, age, household size, vocational training abroad, future notional business plans at the time of migration, nature of employer abroad (Western, Middle Eastern & Asian) and country of migration are important variables which help to promote the

transfer of technology. The RMs returning from Western countries were more inclined to bring with them technology and new technological equipment than those returning from Middle East countries. Thus, it is interesting to note that not all the RMs were helpful to promote the transfer of technology.

The empirical evidence also indicated that majority of RMs, along with transfer of technology, also preferred to establish their own businesses, after returning home. However, the RMs who had some business before migration, were more successful in expanding or establishing business again. Technology guided effects on enterprises were observed for RMs businesses. Majority of RMs improved their production technology like tools, equipment, skill and organisational efficiency. Such an improvement was higher in zone I, which was backward as compared to zone II. Thus, it helped not only to fill in the economic gap between the two zones, but it also brought new technology to the area where it was needed more than other areas. Thus the study has contributed by highlighting a major source of technology transfer, in addition to the conventional means, like, government and multinational companies. Training and education of migrants were adding factors in transferring of technology, from abroad. Besides, the migrants (s) are identified who are helpful in the transfer of technology and promotion of businesses, on the return migrants from abroad.

There are important policy implications of the study. The government may encourage and facilitate migrant (s) who are helpful to promote the transfer of technology i.e. skilled and educated and business related manpower. Therefore, facilities and incentives for them to bring productive technology from abroad need to be enhanced. Moreover, information may be provided through systematic ways pertaining to feasible businesses and enterprises. Return migrants who have savings, skill and ability to establish business could also take up such activities. Such a policy will help to promote employment and accelerate economic growth in the home country, particularly, to bring the backward areas in to the mainstream.

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## References

- Aslam M. Chaudhary, (1989), *Agricultural Development and Public Policies*, with special reference to Baluchistan, Izhar Sons, Lahore, Pakistan.
- Asian Development Bank (ADB,1995), *Technology Development & Technology Transfer*, Manila.
- Athukorele, P, (1990), "International Contract Migration & the Re-integration of Return Migrants: the experience of Sri Lanka" *International Migration review*, Vol. 24, No.2.
- Azam. F, (1987), "Re-integration of Return Migrants in Asia" Working Paper # 2 ILO/ARTEP.
- Baloch, Shaukat H. & Gilani, S. Zaheer A, (1986), "Technology Assessment and Acquisition" Paper presented at ECO workshop on Science Policy, Planning & Development Division, Govt. of Pakistan, Islamabad, Sept 21-28.
- Beg, M.A.A, (1991), "Tech Transfer in Ummah through Baitul Fanoon". *Islamic Thought & Scientific Creativity*". Vol. 2 No. 4 COMSTECH.
- Cochran, W.G. (1979), "Sampling Techniques" 3rd ed., John Wiley, London.
- Daplyn, M.G. (1994), "Sampling Size Determination for Formal Surveys" Report No. ARP-II (Federal)-1994-1, Pakistan Agricultural Research Council (PARC).
- Govt. of Azad, Jammu and Kashmir, (GOAJK), Planning & Development Department, (1995). Muzaffarabad, "Azad Kashmir at a Glance"
- Ebola, E. "A Household Survey of Farm Women's Access to Agro-Information and Technologies" *Journal of Rural Development and Administration* Vol. 25 No. 4.
- Gilani, Ijaz, Fahim Khan and Munawar Iqbal, (1981), "Labour Migration from Pakistan and its Impact on Domestic Economy" PIDE Research Report 126, 127 and 128, Islamabad, Pakistan.
- Gmelch G. & B Richling, (1986), "The Impact of Return Migration on Rural Farmland," in *Return Migration & Regional Problems*, Ed. by R. King, London, Croom Helm.
- GOAJK, Planning & Development Department, (1994), "Azad Kashmir Statistical Year Book," Various Issues.
- Government of Pakistan (GOP, 1990), "National Science & Technology Policy," Ministry of S & T, Islamabad, Pakistan.
- Government of Pakistan, (1982-83), (1995-98), "Economic Survey" Ministry of Finance, Islamabad.
- Hamdani, N. Hussein S., (1996), *Technology Transfer & Re-employment Pattern of Return Migrants: A case study of Azad, Jammu & Kashmir*, M. Phil. Dissertation,

Quaid-I-Azam University, Islamabad.

- Haq, Anwarul., (1979), "Perspective on Migration Research" A Review of Theory, Evidence, Methodology and Research Priorities. *Pakistan Economic & Social Review*, Spring- Summer.
- Hsieh, Sang Ching and Ye Jin Lin, (1990), Survey of Technology Transfer in Agriculture in Taiwan, R.O.C, Chapter 10, A survey of Technology Transfer in Agriculture. The Asia & Pacific, Asian Productivity Org. Tokyo.
- ILO/ARTEP, (1984), Impact of Return Migration on Domestic Employment in Pakistan, A Preliminary Analysis.
- Iqbal, Munawar and M. Fahim Khan; (1981), "Economic Implications of Return Flow of Immigrants from the Middle East: A Preliminary Study", Research Report Series No.123, Pakistan Institute of Development Economics, Islamabad.
- Kazi M.A (1991), "Scientific and Technological Co-operation among the Muslim Countries." *Islamic Thought & Scientific Creativity*. Vol. 2 No 1 COMSTECH.
- Kazi, S. (1989), "Domestic Impact of Overseas Migration" Pakistan into the Gulf and Back" Studies on the Economic Impact of Asian Labour, ILO.
- Khan, Ahmad Saeed, (1990), "Technology Transfer in Agriculture in Pakistan" Asian Productivity Org.
- Monson, Ferry.D. (1975), Industrial Learning Patterns of Turkish Workers at Home and Abroad, the *Journal of Developing Areas*, 9, Jan.
- Mir, Anjum Altaf and Obaidullah, (summer 1992), "The Spatial Pattern of International Migration, Flows from and to Pakistan: A Preliminary Analysis": *The Pakistan Development Review* 31:2.
- National Manpower Commission (NMC), Govt. of Pakistan (1989), *Overseas Migration, Islamabad*.
- Oberai, A.S. (1981), Migration, Productivity & Technological Change: Analytical Issue and Guidelines for Data Collection and Analysis, World Bank Employment Program Research, Working Paper No. 107.
- \_\_\_\_\_ and H.K.M Singh (1980), "Migration, Remittances & Rural Development *Int. Labour Review*, vol. 119, No.2
- Govt of AJK, P&D Department (1995), Azad Kashmir Statistical Year Book, Muzaffarabad, AJK.
- PERI (1992), Socio-economic Study of Azad Jammu & Kashmir, Punjab Economic Research Institute (PERI), Lahore.
- Smart JE, VA Jeodosio & CJ Jimenez (1986), Skills and Earnings Issues in Development, Impact on the Philippines Labour Export to the Middle East. Asian, Labour Migration Pipeline to the Middle East. Edited by F. Arnold, NN Shah, London West view.
- Stahl, C.W, (1986), "Southeast Asian Labour in Middle East," Asian, Lahore, Migration Pipeline to the Middle East. Edited by F. Arnold, NN Shah, London, West view press.
- UN, (1982), National Migration Surveys, Guidelines for Analysis, ESCAP
- \_\_\_ (2000-01) Human Developments Reports, Oxford.
- World Bank, (1991) Shelter for Low Income Communities in Azad, Jammu and Kashmir.

## Appendix

**Table 1.** Composition of Return Migrants (Sample)

THRs	Before Migration		After Migration	
	Count	%	Count	%
Researchers	4	4.3%	3	3.2%
Academician	15	16.0%	12	12.6%
Developers	2	2.1%	17	18.1%
Crafters	22	23.4%	26	27.7%
Promoters	9	9.6%	15	16.0%
Facilitators	9	9.6%	6	6.4%
Server/Workers	5	5.3%	4	4.3%
Learners	10	10.6%	–	–
Others	18	19.1%	11	11.7%
	94	100.0%	94	100.0%

**Table 2.** Type of Technology Transfer through RMs in AJK

Type of RM	Type of Technology Transferred*
Researcher & Academicians	Literature, Computers, Software, Lab Equipment, Formulae.
Developers & Promoters	Plants, Machinery, Manuals, Computer, Software, Equipment, Processes, Specifications, Quality Management.
Crafters	Professional Equipment, Toolkits, Hi-tech devices, Processes, techniques
Facilitators	Literature, Professional Equipment, Toolkits, Hi-tech. devices, } Medical Equipment, Calculators, Intercoms, Electronic Equipment, Automobile
Workers	Toolkits, Traffic habits, Environmental Consciousness Miscellaneous Equipment & Techniques, Quality Operations
Learners	Education, On-job-experience, Specialised Training, Educational & Audio-visual Equipment, Research and Lab Equipment, Literature, Specifications, Designs, Formulae, Quality Management, and Information Technology.

\*This list is, however, is not exhaustive to cover all the components transferred by various categories of RMs.

**Table 3.** Cash Reserve at the end of Migration

CASH (Rs)	Percent
< 50,000	52.2%
50,001 - 200,000	20.0%
>200,000	28.0%
Mean Cash	Rs. 4,46,444
Mean Total Remittances	Rs. 11,46,956

**Table 4.** Average Income of RMs by Period of Migration

	Average Earning Before Mig.	Average Earning Abroad (in start)	Average Earning Abroad (at end)	Average Earning Now
Mean (Rs).	3015.00	9748.00	20,361.00	11357.00
Maximum (Rs).	13000.00	30,000.00	80,000.00	85,000.00
< 5000	75%	13%	11%	37%
>5001 to 15000	18%	70%	39%	38%
> 15000	0%	12%	49%	20%

**Table 5.** Transfer of Technoware, Infoware & Luxury Items By RMs.

	Technoware or Tools, Equipment Machinery, etc.	Infoware or Documents/Software Resource Material etc.	Luxury Items Gifts, Ornaments, Miscellaneous
Mean (Rs)	1,31,062	21.408	13,127
Maximum (Rs)	80,00,000	3,50,000	
< 50,000	78.5%	90.3%	90.3%
> 50,000-200,000	18.0%	6.5%	8.6%
> 200,000	4.3%	3.2%	1.1%

**Table 6.** Value of Tti & Average Income Now by Post Migration Plan

<u>Post Migration plan.</u>	<b>Clear</b>	<b>Unclear</b>
<b>Value of <math>TT_{ti}</math> (Rs0)</b>		
<20,000	20.8%	38.5%
20,001-100,000	42.0%	49.0%
1,00,001-500,000	13%	5.0%
>500,000	25.0%	7%
<u>Average Income Now</u>		
≤10000	69.0%	55.7%
10001-30,000	16%	43.0%
30,001-50,000	14%	1.6%

$TT_{ti}$ =Transfer of Technological components i.e. technoware (t) and infoware (I) in rupees.

**Table 7.** Distribution of Households by Place of Living (%)

Place of Living	Zone <sup>#</sup>					Overall
	North AJK			South AJK		
	Muzaffarabad	Bagh	Poonch	Kotli	Mirpur	
Inside AJK	88.1	73.0	73.0	76.0	72.0	76.5
Pakistan	10.4	21.0	14.4	5.2	3.5	11.0
Overseas	1.5	5.6	12.4	19.0	24.2	12.5
	100	100	100	100	100	100

Source: Calculated from World Bank Shelter Study 1991.