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U. P. AGRICULTURAL UNIVERSITY AND
AGRICULTURAL GRADUATES IN INDIA

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DEPARTMENT OF
AGRICULTURAL ECONOMICS
WARREN HALL

May 26, 1972

TO: John W. Mellor
FROM: Richard L. Shortlidge, Jr.
RE: U.P. Agricultural University and
Agricultural Graduates in India

Introduction: This memorandum summarizes the results to date of the "Employment Survey of Graduates from U.P. Agricultural University 1963-1971." The cost-benefit analysis is based on the assumption that the earnings at age 40 for village level workers, age 29 for all bachelor degrees, and age 31 for all master degrees are constant over the remainder of the graduates working life or until age sixty. By employing this assumption, the analysis does not extrapolate beyond the employment data actually collected. It represents the experience of graduates in the labor market between 1963 and 1971. This assumption underestimates the present value of the graduates life time earnings, since it assumes the maximum earnings are reached by age 29 or 31. Empirical evidence from Mark Blaug's study of graduates in India indicates that the maximum for degree graduates occurs when the graduate is in his 50's. The next stage in the analysis will be to estimate wage functions using multiple regression analyses for each degree group. Extrapolating beyond the range of the data, it will be possible to generate a hypothetical earnings profile for each degree category. This procedure should result in rates of return higher than those presented in this memorandum.

1. The stock of agricultural graduates in India (B. Sc. Ag.) in 1960-61 equalled 14,000, or approximately 1 percent of all college

graduates in the adult population. Using the guidelines of the Fourth Plan Working Group and the Planning Commission, Tyrell Burgess, Richard Layard, and Pitambar Pant have estimated that the Indian economy required by 1965-66 a total stock of 34,000 B. Sc's. in agriculture, by 1970-71 64,000, by 1975-76 94,000 and 1985-86 305,000. For the period between 1960-61 and 1965-66, this necessitated an average output of at least 4,000 graduates per year without regarding retirements, deaths, and other factors tending to reduce the initial stock of 14,000 over the period. In 1960-61, the output of B. Sc. in agriculture was 2,649 from 36 Colleges of Agriculture in India. This was up from 882 in 1955-56. By 1964-65, the output was up to 4,614 per year. During this period, the annual output of agricultural graduates closely corresponded to manpower requirements. Unfortunately, published data is unavailable on the output of agricultural graduates between 1965-66 and 1970-71. To meet the estimated requirements for this period, roughly 6,000 graduates would be needed each year. If the goal of 305,000 trained agriculturalists is to be achieved by 1985-86, it will be necessary to more than triple the current output. This is based upon reaching a goal of ten agricultural graduates per block by 1986 and one graduate VLW per five villages.

In 1960, there were approximately 50,000 village level workers in India. The average VLW served ten villages. The Fourth Plan Working Group and the Planning Commission recommended that the number of villages per VLW be decreased to five. Meeting this requirement would double the number of VLW's to 100,000. The task of up-grading VLW's, the majority of whom are matriculates, falls on the agricultural universities and colleges and is included in the goal of 305,000 agricultural graduates by 1986.

The quantitative achievement of this goal lies well within the capabilities of India's higher educational system and its expected expansion. Yet careful consideration should be given to the qualitative nature of the education being provided. Examples of quality agricultural education in India are Punjab Agricultural University and U.P. Agricultural University. Both institutions extend to their students the opportunity to combine classroom instruction and practical field experience. Granted quality is intangible and eludes direct quantification.

A crude proxy allowing a glimpse at the effects of quality agricultural education may be the returns on the education based upon the labor market experience of graduates. For example, if the economy required 4,000 agricultural graduates per year and the actual output exceeded this requirement by 1,000 graduates, one would expect that the labor market would function to allocate the 4,000 positions in manner that maximized productivity. If these 4,000 positions were ranked according to salaries, one would hypothesize that the top jobs would go to the best qualified graduates and so forth down the rank of jobs until all were filled. The effects therefore of quality agricultural education should be reflected in shorter "waiting periods", or initial periods of unemployment, between graduation and the first job, and higher private and social returns on the investment than for poorer quality education. Since the analysis is not based on a comparison between U.P. Agricultural University and a more traditional agricultural university or college, it will be extremely difficult to justify or confirm the above hypothesis. But some indication of the existence of evidence may come from comparing the results of this analysis with those of Blaug's earlier work in India.

2. Annual Output and Enrollments from U.P. Agricultural University

(see Table 1)

Table 1. Students admitted, enrolled, and graduating between 1960-61 and 1970-71 by degree category at U.P. Agricultural University.

Degree program	Numbers of students in each year										
	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71
<u>1. B.Sc.Ag.</u>											
a. Admitted	152	120	151	126	155	140	134	145	153	184	202
b. Enrolled	152	248	382	380	372	395	307	337	397	457	515
c. Graduated ^{1/}	---	---	81	85	105	114	71	100	108	98	48 ^{2/}
<u>2. B.Vet. Sc.</u>											
a. Admitted	103	91	93	66	102	117	95	79	81	68	79
b. Enrolled ^{1/}	103	167	230	250	332	390	332	341	343	318	267 ^{2/}
c. Graduated ^{1/}				45	63	61	67	69	65	99	31 ^{2/}
<u>3. B. Technology</u>											
a. Admitted			84	91 ^{1/}	91 ^{1/}	78	189 ^{3/}	158	115	145	127
b. Enrolled			84 ^{4/}	140 ^{4/}	232 ^{4/}	308 ^{4/}	379 ^{3/}	445	472	516	578
c. Graduated ^{1/}					56	47	65	68	30	30	0 ^{2/}
<u>4. M.Sc.Ag.</u>											
a. Admitted				64	22	19	46	49	74	116	128
b. Enrolled				64	86	57	63	88	133	176	254
c. Graduated ^{1/}					3	44	22	16	31	39	52 ^{2/}
<u>5. M.Vet.Sc.</u>											
a. Admitted					17	19	24	22	29	35	24
b. Enrolled					17	34	38	41	57	57	48
c. Graduated							16	16	18	12	19 ^{2/}
<u>6. M. Technology</u>											
a. Admitted									15	28	8
b. Enrolled									14 ^{2/}	36	34
c. Graduated											5 ^{2/}
<u>7. M.D.</u>											
a. Admitted							7	18	27	28	19
b. Enrolled							7	10	41	52	76
c. Graduated											7 ^{2/}

^{1/}As of the 3rd trimester in the year.

^{2/}Includes degrees awarded for the 1st and 2nd trimester of 1970-71.

^{3/}Programs in Civil Eng., Mech. Eng., and Elect. Eng. were added to the existing program of Agric. Eng. in the year 1966-67.

^{4/}College of Agricultural Engineering only.

^{5/}Reason for difference between those admitted and enrolled in 1968-69 to M. Tech. is unexplained. Admission and enrollment data were collected from two different sources.

In 1960-61, the university admitted its first students in the Colleges of Agriculture and Veterinary Medicine. The first class in agriculture contained 152 students and in veterinary science 103. Admission to the College of Agriculture remained fairly stable between 1960-61 and 1968-69 fluctuating from a low of 120 in 1961-62 to a high of 155 in 1964-65. However, admission has risen sharply since 1968-69 to 202 freshman in 1970-71. The admission in Veterinary Medicine has declined from a peak of 117 in 1965-66 to 79 in 1970-71. This represents a policy decision of not expanding freshman admissions to the Veterinary program and an attempt to control output. The decision is grounded on the current structure of employment opportunities for Veterinary graduates in India and particularly U.P. state.

The College of Agricultural Engineering was started in 1962-63 with 84 students. The College of Agricultural Engineering later was consolidated into the Pant College of Technology. However, it was not until the academic year 1966-67 that programs of civil, mechanical and electrical engineering were added to the existing program in agricultural engineering. Peak freshman enrollment was reached in 1966-67 with 189 incoming students.

3. The Survey

A mailed questionnaire was sent to 1,536 graduates from U.P.A.U. as of March 16, 1971. From Table 2, the total number of degrees awarded by the university as of this date was 1,868. The 1,868 degrees contain a large number of students who received more than one degree from the university. Thus, the mailed questionnaire to 1,536 graduates represented all individuals who had obtained one or more degrees from U.P.A.U. less graduates for whom no mailing address was available or who were known to be living outside of India or Nepal. By July 1, 1971, 605 questionnaires had been returned for a response rate of 39.39 percent. These 605 individuals represented 666 awarded degrees or 35.65 percent of all degrees awarded. The response rate fluctuated from a low of

Table 2

Actual Number of Degrees Awarded by U.P. Agricultural
University and Number of Degrees Included in Sample

Degree Category	Number of Degrees Awarded	Number in Sample	Proportion in Sample
B. Sc. Ag.	802	279	34.79
B. Vet. Sc.	500	184	36.80
B. Tech.	266	93	34.96
M. Sc. Ag.	207	77	37.20
M. Vet. Sc.	81	28	34.57
M. Tech.	5	2	40.00
Ph.D.	7	3	42.86
	<hr/>	<hr/>	<hr/>
TOTALS	1868	666	35.65

34.57 percent for Masters of Veterinary Medicine to a high of 42.86 percent of the Ph.D.'s awarded. Since only seven Ph.D.'s had been awarded and all of these in 1969-70 or 1970-71, this group was excluded from consideration in the analysis. With only three individuals in the sample and approximately twenty-four months working experience at the maximum, it was felt any analysis attempting to draw conclusions from this meagre evidence would be misleading. For similar reasons the Masters in Technology was removed from the analysis.

4. Educational Cost

A. Tuition and Scholarships

This information is included in Table 3. The average annual tuition charged for undergraduates varied from Rs. 311 for Bachelors in Technology to Rs. 349 for B. Sc. in Agriculture. The tuition charges were roughly double for graduate students. The average tuition charged annually for M. Sc. in agriculture was Rs. 660 and Rs. 651 for M. Vet. Sc. These figures represent the average tuition charged for the 1960's in 1970-71 rupees. The tuition charges on a yearly basis have fluctuated. For example, in the College of Agriculture the average tuition charged at current prices was Rs. 252 during 1960-61. This had increased to Rs. 348 in 1969-70. However, using the Reserve Bank of India's "Consumer Price Index Numbers for Urban Non-Manual Employees", the adjusted tuition charge in terms of 1970-71 Rupees was Rs. 438 in 1960-61 and Rs. 362 in 1969-70. This would indicate that in real terms the tuition payments have declined. However, the nature of the price index cautions against coming to this conclusion. The most reasonable conclusion seems that tuition charges have kept up with changes in the price level. Since real incomes of class I and II civil servants have fallen during this period, the tuition charges would represent an increase in the "sacrifice" to the students families, if scholarships failed to grow during this period. However, the

Table 3

Average Annual Tuition Charged; Scholarship Payments
Received; and Food Plus Hostel Payments by Degree
Category for U.P. Agricultural University Graduates
(Amounts in 1970-71 Rupees)

Degree Received	Tuition Charged Per Student	Amounts for Scholarships Per Student	Per Student Food and Hostel
Bachelor of Science Agriculture (VLW)	326	1,665	699
Bachelor of Science Agriculture	349	194	749
Bachelor of Vet. Medicine	330	199	740
Bachelor of Technology	311	476	779
Master of Science Agriculture	660	1,590	1,239
Master of Vet. Medicine	651	1,697	1,138

(1) The relevant cost in computing the rate of return is the amount paid for food and lodging over and above the cost of living at home.

actual tuition payments by students in the College of Agriculture have decreased during this same period in current and constant prices. In 1970-71 Rupees, the average scholarship payment per student enrolled in the College of Agriculture was Rs. 52 in 1960-61. This had increased to Rs. 281 in 1969-70 (again in 1970-71 Rupees). In current prices the average scholarship per student in 1960-61 was Rs. 30 and Rs. 270 by 1969-70. A similar pattern holds for all degree programs at the university.

The three most heavily subsidized degree programs in this analysis are (1) the special two-year bachelors degree for VLW's, (2) the M. Sc. in Agriculture, and (3) M. Sc. in Veterinary Medicine. The average scholarships received over the 1960's were Rs. 1,665 for VLW's, Rs. 1,590 for M. Sc. Ag., and Rs. 1,697 for M. Vet. Medicine (all in 1970-71 rupees). The annual growth in scholarships per student enrolled for these categories has kept pace with changes in the price level. For example, the average scholarship per student enrolled in 1963-64 in the M. Sc. Ag. program were Rs. 900 in current prices or Rs. 1,386 in 1970-71 prices. By 1969-70, the average scholarship had increased to Rs. 1,821 in current prices or Rs. 1,894 in 1970-71 prices.

In summary, the average annual scholarship per student at U.P.A.U. has increased for all degree programs. The most dramatic increases have occurred in the undergraduate programs. However, in terms of the relative relationships among scholarships at the undergraduate and graduate levels in the Colleges of Agriculture and Veterinary Medicine, the average scholarships received over the decade at the graduate level were about eight times the amount available per student at the undergraduate level.

B. Food and Hostel

The most dramatic cost increase to students has occurred in the area of food and lodging. The average undergraduate in the College of Agriculture

paid Rs. 389 in 1960-61 for hostel room and food, or Rs. 477 in 1970-71 rupees. By 1969-70, the cost increased to Rs. 1262 in current prices or Rs. 1312 in 1970-71 rupees. This involved a doubling in the cost of living at U.P.A.U. This increase was due mainly to two factors: (1) rising prices and (2) changes in the university's food service. Before 1967-68, the food service operated on a cooperative basis with a common menu served to all students residing in a hostel (the mess provided 2 meals per day).

In 1967-68, the three meal cafeteria system was introduced to provide a variety in the hostel's menu and to give the individual student the opportunity of selecting his diet. The increase in variety resulted in a significant increase in food cost, since the advantage of cooking a few dishes in bulk was lost.

From calculations regarding the cost of eating at home during this same period, it appears that before 1967-68 there was a close correspondence with the cost of eating at the university. At home food charges were computed for a ten month period under the assumption that students spent the one month between the 1st and 2nd and the 2nd and 3rd trimester at home. The data for home food consumption was derived from National Sample Survey's consumption expenditure information for different income groups. The additional living cost at the university was largely confined to room charges. With the introduction of a cafeteria program in 1967-68, the cost nearly doubled.

5. Fixed and Variable Cost to the University

The fixed cost of education at U.P.A.U. comprises the investment in buildings, labs, and other equipment not requiring annual outlays. The construction cost for the existing university structures as of 1970-71 are based on information provided by the university comptroller's office. The annual cost to the university for its fixed investment is the annual depreciation plus annual maintenance expenditures. The depreciation of the fixed plant was

calculated by using a straight-line depreciation rate over a period of 60 years. The straight line method of depreciation allocates the cost equally over the expected life of the fixed investment. This does not place the burden of depreciation on students at the university in its early years as a more rapid means of depreciation would. It results in a more equitable distribution of cost. A life expectancy of 60 years was arrived at after discussions with the university's engineering staff. Maintenance was determined by estimating its cost at 1 percent per year of the construction cost.

The university is engaged in a multiplicity of functions, only one of which is teaching. It would overestimate the cost per student to allocate the full depreciation per year to teaching. Using the third Trimester Programme Directory for 1970-71, it was determined that 29.0 percent of the staff's time in the College of Agriculture was devoted to classroom instruction, preparation, and student counseling. The comparable figures for the Colleges of Veterinary Medicine and the College of Technology were 36.7 percent and 43.3 percent. Without information on the distribution of the staff's time throughout the 1960's, two assumptions were made. The first assumption assumed that when the university admitted its first students in 1960-61, 80 percent of the staff's time was related to teaching activities. This is justified on the following grounds. The staff in 1960-61 was composed of 28 members with a total enrollment of 255 students. By 1969-70, there were 450 staff members and 1925 students enrolled. This gives a student-staff ratio of 9.1 in 1960-61 and 3.6 in 1969-70. During this period, the financial resources for research and extension have dramatically increased. Therefore, it was decided to use a higher percentage of the staff's time for teaching in 1960-61. Admittedly the 80 percent is arbitrary, but it seemed more reasonable than allocating 100 percent to teaching. Without any reasonable means of varying the proportion of time to teaching during the period between 1960-61 and

1970-71, it was assumed that the proportion of time in teaching functions declined at a constant rate to the levels estimated for each college in 1970-71. The second assumption assumed that the proportion of time devoted to teaching activities remained constant at the 1970-71 levels for each year between 1960-61 and 1970-71.

Both assumptions were used to allocate the annual depreciation and maintenance cost as well as the annual recurring cost. The corresponding per student costs are given in Table 4. The per student enrolled fixed cost varied from Rs. 370 under assumption one to Rs. 304 under assumption two for the College of Agriculture. The lowest fixed cost per student is in the College of Technology where it was Rs. 237 under assumption one and Rs. 207 under assumption two.

The annual recurring expenditures for each college between 1960-61 and 1970-71 were utilized to estimate the annual variable per student cost. Under assumption one it was estimated as Rs. 1,135 per student in agriculture, Rs. 1,212 per student in veterinary medicine, and Rs. 1,691 in technology. The figures were slightly lower using assumption two, Rs. 935, Rs. 1,013, and Rs. 1,527 respectively.

Adding the depreciation plus maintenance and the recurring expenditures per student, it cost under assumption one Rs. 1,513 in agriculture, Rs. 1,545 in veterinary medicine, and Rs. 1,928 in technology. Under assumption two, the corresponding amounts were Rs. 1,239, Rs. 1,299, and Rs. 1,734.

In 1961-62, the Education Commission 1964-66 estimated that the average per student expenditure for agricultural colleges at Rs. 1,136 and for technological colleges Rs. 1,163. These per student expenditures were determined by dividing the annual expenditures by all agricultural and technological colleges in 1961-62 by their corresponding enrollment. No adjustment was made for the proportion of time devoted to teaching as in the case of the U.P.A.U. cost figures. If no allowance for teaching time is made in the

Table 4. Average Per Student Rent on Fixed Capital Investment and Per Student Recurring Expenditures on Staff and Equipment Used in Teaching at U.P. Agricultural University by College of Enrollment. (Amounts in 1970 Rupees)

College	Fixed Capital Investment (Depreciation Plus Maintenance)		Recurring Expenditures		Total A + C	Total B + D
	Assumption 1 ¹	Assumption 2 ²	Assumption 1 ¹	Assumption 2 ²	Rs.	Rs.
	A	B	C	D		
Agriculture	378	304	1,135	935	1,513	1,239
Veterinary Medicine	333	286	1,212	1,013	1,545	1,299
Technology	237	207	1,691	1,527	1,928	1,734

1. This assumes that the fixed plant is allocated to teaching according to the amount of staff time devoted to teaching. It is known that for the College of Agriculture in 1970-71, 29.0% of the staff's time was devoted to teaching functions, for the College of Veterinary Medicine it was 36.7%, and for the College of Technology it was 43.3%. However, it is assumed that when the university opened its doors in 1960-61, 80% of the staff time was spent on teaching functions since the university had not fully developed its present research and extension activities. The proportion of staff time devoted to teaching declined steadily over the decade to the current distribution.
2. The allocation of staff time to teaching has remained constant at the current levels over the decade: College of Agriculture 29.0%, College of Veterinary Medicine 36.7%, College of Technology 43.3%.

recurring expenditure at U.P.A.U., the average cost per student between 1960-61 and 1969-70 would be Rs. 3,224 in agriculture and Rs. 3,527 in technology. This corresponds to a 1961-62 price adjusted (to 1970-71 prices) per student cost of Rs. 1,893 in Agriculture and Rs. 1,933 in technology for the Education Commission's estimates of Rs. 1,136 and Rs. 1,163 respectively in 1961-62 prices. Without comparable statistics it is difficult to draw a definitive conclusion from this comparison. However, it appears that the cost per student at U.P.A.U. is higher than the average for all agricultural colleges.

6. Unemployment of Graduates

The average period of unemployment after graduating for all degree groups was 2.58 months. This compares with Blaug's estimate of 6.5 months for an average graduate in India (Mark Blaug, et. al., The Causes of Graduate Unemployment in India, London: Allen Lane, 1969, p. 80). The distribution according to degree received was as follows: zero for VLW's with a B.Sc.Ag, 3.59 months for B.Sc.Ag. (non-VLW), 3.99 months for B.Vet.Sc., 2.15 months for B.Tech. (Ag. Eng.), 1.42 months for M.Sc.Ag., and 1.30 months for M.Vet. Med. This represents only the initial period after graduation which is the period of significant unemployment in the employment experience of graduates between 1963 and 1971. Between 1963 and 1969, the initial period of unemployment fluctuated between two months and two and a half months for B.Sc.Ag. (non-VLW). For B.Vet.Med., the initial period of unemployment was shown a steady increase from a low of 1.0 months in 1965 to 5.8 months in 1969. The initial period of unemployment has remained less than 1.0 month for M.Vet.Med. since 1967. For M.Sc.Ag., it has remained between one and two months. For B. Tech (Ag.Eng.), it has remained between two and three months. The only recognizable trend in the annual unemployment rates has been a rather steady rise in the length of initial unemployment for B.Vet.Med.

7. Job History of Graduates (see Tables 5 and 6)A. B.Sc.A. (VLM):

The vast majority of VLM's return to their post as VLW's after receiving their degree. In the sample of VLM's, 96.67% of all jobs held were in state government post. The pattern of employment is for the VLW to return to the position held before coming to U.P.A.U. immediately after graduation. This is generally followed within the year by promotion to District Agricultural Officer. The vast majority of the VLM's have come to the university from states other than U.P. Only 25.83% of the jobs held by VLW graduates were in U.P.

A profile of the average VLW graduating from U.P.A.U. and comparing him with nongraduate VLW's would be as follows. He is 33 years old at the time he graduates having entered the university at age 31. For his fellow VLW's who have only matriculation, the average earnings at age 33 was Rs. 3,096 (see Table 7). This compares with the graduate VLW's first year salary after graduation of Rs. 3,132 (see Table 6). The amounts are roughly comparable indicating the return of graduate VLW's to their pre-degree positions. However, three years after graduation, the degree holding VLW was earning Rs. 3,852 per year compared to the non-degree VLW's Rs. 3,494 per year. By the 34th month after graduation, the degree holding VLW had annual earnings of Rs. 5,124 per year.

Table 5

Distribution of Jobs Held by Graduates from U. P. Agricultural
University by Occupational Group and Degree Received from the University

(in Percentages)

Occupational Group	B.Sc.Ag. (VLW)	B.Sc.Ag. (non-VLW)	B.Vet.Med.	B.Tech.	M.Sc.Ag.	M.Vet.Med.	All
Non-University Teaching	.83 (1)	4.87 (11)	0.00 (0)	.59 (1)	0.00 (0)	0.00 (0)	1.52 (13)
University (Research)	1.67 (2)	37.61 (85)	5.20 (9)	20.12 (34)	45.38 (54)	12.50 (6)	22.22 (190)
University (Teaching)		1.33 (3)	2.31 (4)	13.02 (22)	12.61 (15)	27.08 (13)	6.67 (57)
G.O.I. Corporation	.83 (1)	13.72 (31)	1.16 (2)	4.14 (7)	13.45 (16)	0.00 (0)	6.67 (57)
G.O.I. Research Institution		6.64 (15)	2.89 (5)	7.69 (13)	2.52 (3)	33.33 (16)	6.08 (52)
Military		1.77 (4)	2.89 (5)	0.00 (0)	0.00 (0)	8.33 (4)	1.52 (13)
State Government Employment	96.67 (116)	11.95 (27)	79.77 (138)	35.50 (60)	9.24 (11)	10.42 (5)	41.75 (357)
Farming		3.98 (9)	2.31 (4)	.59 (1)	2.52 (3)	4.17 (2)	2.22 (19)
Private Business		18.14 (41)	3.47 (6)	18.34 (31)	14.29 (17)	4.17 (2)	11.34 (97)
	----- 100.00 (120)	----- 100.00 (226)	----- 100.00 (173)	----- 100.00 (169)	----- 100.00 (119)	----- 100.00 (48)	----- 100.00 (855)

Note: The figures in brackets below each percentage for the job category represents the number of jobs held by graduates in this category over the period 1963 - 1971.

Table 6

Average Annual Earnings of Graduates from
U. P. Agricultural University in Months After Graduation

(in 1970/71 Rupees)

	B.Sc.Ag. (VLM)	B.Sc.Ag. (non-VLM)	B.Vet.Sc.	B.Tech.	M.Sc.Ag.	M.Vet.Sc.
Age at Graduation	33	22	23	23	24	24
Months After Graduation						
12	3132	3786	4421	4740	5086	5402
24	3648	5110	4514	4897	5874	6490
36	3852	4894	5249	5552	8317	6490
48	4548	5667	4727	6427	8317	6490
60	5004	6566	4962	7665	8317	7332
72	4884	6566	5765		9780	
84	5124	8287				

Note: The earnings data presented in this table are computed from the questionnaires returned by the students. As of July 1971, 96 months had elapsed since U. P. A. U. graduated its first students in 1963. The data above are based on the experience of the sampled graduates during this period. (The first B.Sc.'s in Agriculture were awarded in 1963, B.Vet.Sc. in 1964, B.Tech. in 1966, M.Sc.Ag. 1965, M.Vet.Sc. in 1966.)

Table 7

Earnings of Matriculates from Urban Income Survey,
1960/61 and Village Level Workers with Only Matriculation

Age	Earnings of Matriculates		Age	Earnings of VLW's
	Annual Earnings (in 1960/61 ² Rupees)	Annual Earnings (in 1970/71 ¹ Rupees)		Annual Earnings (in 1970/71 ³ Rupees)
18	492	856	33	3096
19	984	1733	34	3264
20	1176	2046	35	3494
21	1404	2443		
22	1452	2526		
23	1452	2526		
24	1476	2568		
25-29	1956	3403		

¹In order to make the earnings of matriculates in 1960/61 comparable to the earnings of graduates from U. P. A. U., it was assumed that over the decade the real value of earnings remained the same in 1970/71 as 1960/61. This adjustment was made by using Table 38: "Consumer Price Index Numbers for Urban Non-Manual Employees," p. 941, Vol. XXV, No. 6, June 1971, Reserve Bank of India Bulletin.

2. Mark Blaug, et al., The Causes of Graduate Unemployment in India, London: Allen Lane the Penguin Press, 1969, p. 171, table 7.1.

3. Earnings for VLW's estimated from the data collected at U. P. A.U.

B. B. Sc. Ag. (Non-VLW's)

The largest proportion (37.61%) of the jobs held by B. Sc.'s in agriculture was in the area of university research (see table 5). For the most part, these were research jobs at U. P. Agricultural University. This was followed by jobs in private business (18.41%). The type of concerns employing agricultural graduates were Escorts Ltd., Indian Explosives, Hindustan Lever, Union Carbide (India) Ltd., Warner Hindustan, Tractors and Farm Equipment Ltd., Massey Ferguson, and Duncan Tea Estates to name only a few. Another 13.72 % of the jobs held by agricultural graduates was with Government of India (G.O.I.) sponsored corporations such as the National Seed Corporation and the Food Corporation of India. Of all the jobs held by agricultural graduates, 62.39% were in U. P. state.

During the first twelve months after graduation, the average bachelor of science in agriculture was earning Rs. 3,786 per year. After 84 months, his earnings had increased to Rs. 8,087 per year. His average age after 84 months of work was 29 years.

C. B. Vet. Med.

The largest single employer of veterinary graduates from U. P. Agricultural University has been the U. P. state government. From table 5, it can be seen that 79.77% of all jobs held by veterinary graduates were with state governments of which 82.08% were in U.P. state government service. The average veterinary graduate was employed by the state as a veterinary assistant surgeon working in one of the districts of Uttar Pradesh. In the first year after graduation, the graduate was earning Rs. 4,421 per year. Although this represented a higher initial salary than the agricultural graduate, the B. Vet. Med.'s annual earnings failed to grow as rapidly as the agricultural graduate.

After six years, the veterinary graduate's annual earnings had increased to Rs. 5,765 (see table 6), compared to Rs. 6,566 for the agricultural graduate. These figures may actually understate the earnings of the B. Vet. Med., since the veterinary assistant surgeon may carry on private practice in addition to his governmental functions. Several graduates mentioned on their questionnaires that they had private veterinary practices but they failed to list their earnings from it. If this proved to be extensive among graduated B. Vet. Med., the rates of return may grossly understate the "true" returns.

D. B. Tech. (Agricultural Engineering)

35.50% of the jobs held by B. Tech's are with state governments. Another 18.34% of the jobs have been in the areas of private business and 20.12% in university research. These three areas combined accounted for 73.96% of the jobs held by technology graduates between 1966 and 1971. The majority of these jobs or 64.50% were in U. P. state.

The average graduate was earning Rs. 4,740 per year, the highest of all undergraduate degrees, after 12 months of graduation. Five years later, the graduate's earnings had increased to Rs. 7,665 per year. This compares to Rs. 6,566 for the agricultural graduate. This suggests that the rate of return for the B. Tech. degree may be higher than the B.Sc. in agriculture if data for 84 months of work experience were available.

E. M. Sc. Ag.

University research jobs accounted for 45.38% of the positions held by M.Sc. in agriculture between 1965 and 1971. The proportion of jobs in university teaching was 12.61%, Government of India (G.O.I.) sponsored

corporations 13.45%, and private business 14.29%. These four employer groups represented 85.73% of the jobs held. Again most of the graduates were employed in U. P. state (68.07%). The largest single employer has been U. P. Agricultural University. Graduates have remained at the university to staff the growing areas of research and extension.

The average M. Sc. in agriculture was earning Rs. 5,086 twelve months after graduation. This had increased to an annual earnings of Rs. 9,780 six years after graduation. This makes M.Sc. in agriculture the highest earning group among U.P.A.U. graduates.

F. M. Vet. Med.

The M. Vet. Med. graduates have held jobs primarily in four employer categories: 33.33% in G.O.I. sponsored research institutions, 27.08% in university teaching, 12.50% in university research, and 10.42% in state government service. The G. O. I. research institution employing the largest number of graduates has been the Indian Veterinary Research Institute located in Uttar Pradesh state. Similar to other degree categories 60.42% of the jobs were in U. P. state.

The average M. Vet. Med. was earning Rs. 5,402 per year after 12 months. This had increased to Rs. 7,332 per year after 60 months of employment.

8. Average Rates of Return to the Individual Graduate and the Present Value of Earnings

The average private rate of return is that rate of return which will discount the absolute value of the net gain in earnings from receiving the degree over the earnings of individuals with a lower level of education back

to equal the cost of schooling. For most degrees in this analysis, the benefit is measured by the net gain in earnings over the earnings of matriculates (see table 7). The differential at age 29 for bachelor degrees, age 31 for master degrees, and age 40 for VLW's is assumed to hold over the remainder of the individual's working life or until retirement at age 60. The earnings profiles are net of taxes for the estimation of the returns to the individuals. The cost of schooling include (1) tuition paid net of scholarships received, (2) cost of food and lodging net of the alternative cost of remaining at home, and (3) foregone earnings while in school. Excluded from this analysis is the cost of books. From the Report of the Education Commission 1964-66, the cost of books at the college level ranged from Rs. 150 annually in Arts and Science Colleges to Rs. 250 in professional colleges (engineering, medicine, agriculture, and teacher training).

The earnings are generally adjusted for initial periods of unemployment, life expectancy probabilities, and any future unemployment risk beyond the initial post-graduation period. Since the average initial unemployment periods were extremely short for U. P. Agricultural University graduates and it was not clear how much of this might be voluntary unemployment, no adjustment for initial unemployment was made. The risk of future unemployment after obtaining the first job was negligible for all graduate categories. Without information on life expectancies by income level in India, it was decided not to use all-India mortality tables which are available since these would give undue weight to lower income levels who may have higher mortality rates. This exclusion of mortality adjustments biases the results upward. However, the bias is probably small since mortality would be most significant in the late working years, say age 50 to 60. The last decade of work, and the earnings, carries less weight than the early

Table 8

Average Private Rates of Return by Degree Categories with 100% of Differential Due to Education and 60% of Differential Due to Education. Also included is the return estimated assuming no scholarships available.

Degree Category	Rates of Return in Percentages			
	With Scholarship		Without Scholarship	
	100% ¹	60% ²	100% ¹	60% ²
<u>Over Matriculation</u>				
B.Sc.Ag. (VLW)	15.8	10.9	11.0	6.7
B.Sc.Ag. (non-VLW)	36.9	26.2	33.1	23.5
B.Vet.Med.	19.7	13.0	18.0	11.8
B.Tech. (Ag.Eng.)	27.4	19.1	25.7	17.8
M.Sc.Ag.	24.4	17.4	21.3	14.9
M.Vet. Med.	16.8	11.5	14.7	9.8
<u>Over Bachelor's Degree</u>				
M.Sc.Ag. (over B.Sc.Ag.)	8.6	3.2	7.2	2.1
M.Vet.Sc. (over B.Vet.Med.)	12.6	7.6	10.4	6.0

1. Assumes 100% of the differential in earnings due to education.
2. Assumes 60% of the differential in earnings due to education.

years in the computation of the rate of return.

The average private rates of return for the various degrees in this study are presented in table 8. The returns to the individual over matriculation ranged from a low of 18.8% for the Village Level Workers to a high of 36.9% for the B.Sc.'s in agriculture assuming 100% of the differential in earnings was due to education. The corresponding returns attributing only 60% of the differential to education were 10.9% and 26.2% respectively.

If the student received no scholarship and paid the full amount of the tuition charged, the returns declined as expected. However, the decline was on the order of two or three percentage points depending on the size of the scholarship and its effect on reducing the amount of tuition paid. For example, at 100% of the differential due to education the B. Sc. in agriculture earned a return of 33.1% instead of the 36.9% when he received a scholarship. A shift to charging full tuition for the education received at U. P. Agricultural University would continue to make the undergraduate programs of technology and agriculture attractive. But it may lead to restricting enrollment to students from families with higher incomes than those currently enrolled. In addition, it would make it unlikely that the average VLW would opt to obtain a degree in agriculture if they paid full tuition and received no scholarship.

The graduate degrees in agriculture and veterinary medicine when compared to the earnings of matriculates remain profitable investments. However, the incremental gain in going from the bachelor's level to the master's is quite low. Only students with low alternative cost for funds invested in education could afford to make the investment. This would suggest that only students from the upper income groups could afford the investment in graduate degrees. The average earnings of the immediate families of students enrolled at U. P. Agricultural University during 1970-71 was

Rs. 823 per month or Rs. 9,876 per year.

Tables 9 and 10 indicate the present value of earnings net of taxes and the present value of the net increment in earnings after taxes of obtaining the degree. For all degrees the increment is based on allocating 100% of the difference to education. The bachelor degrees are based on the gain above matriculation and the masters the gain above the respective bachelor degrees. Discounting at 15%, the present value of the earnings of graduates from U. P. Agricultural University varied from Rs. 39,421 for M.Sc.Ag. to Rs. 19,317 for B. Vet. Med. (see table 9). The lower the rate of discount the higher the present value of future earnings for each degree category. The relevant comparison would be the net gain which is represented in table 10. For M.Sc. in agriculture the expected gain in income over cost becomes positive only below discount rates of 8.6% (see table 8). This suggests two reasons for students to invest in the M.Sc.Ag. First, students are attempting to maximize future earnings. Second, the opportunity cost of funds invested in the masters has a rate of interest of less than 8.6%. If the opportunity cost were higher than 8.6% the student would not be maximizing his life time earnings by making the investment.

9. Social Rates of Return on Various Degrees from U. P. A. U.

The social return is based on the total or gross earnings as a measure of the benefits and on the total cost to society and the individual from the investment in education. The social return's benefit stream is the absolute value of the differential between the earnings of individuals who have invested in an increment of schooling and the earnings of individuals

Table 9

Present Value of Earnings Net of Taxes for Each Degree
 Category Assuming Discount Rates of 15%, 10%, 8%, 4% and 0%

Degree	Present Value of Discounted Net Earnings at:				
	15%	10%	8%	4%	0%
B.Sc.Ag. (VLW)	21,470	34,334	42,696	70,467	128,786
B.Sc.Ag. (non-VLW)	27,550	49,055	64,629	124,678	287,472
B.Vet.Med.	19,317	34,567	45,572	87,879	202,184
B.Tech. (Ag.Eng.)	24,215	43,918	58,214	113,346	262,754
M.Sc.Ag.	39,421	65,808	84,313	153,083	329,836
M.Vet.Med.	32,850	53,500	67,826	120,639	255,325

Table 10:

Present Value of Earnings Net of Taxes for Each Degree Category after Taking into Account Cost and the Alternative Earnings Assuming Discount Rates of 15%, 10%, 8%, 4%, and 0%

<u>Degree Received</u>	<u>Present Value of Earnings Discounted at</u>				
	15 %	10 %	8 %	4 %	0 %
<u>1. Alternative Earnings</u>					
<u>Matriculation</u>					
B. Sc. Ag. (VLW'S)	Rs. 349	Rs. 3,650	Rs. 5,924	Rs. 13,861	Rs. 31,203
B. Sc. Ag. (Non-VLW)	Rs. 10,509	Rs. 22,117	Rs. 30,754	Rs. 64,730	Rs. 158,385
B. Vet. Med.	Rs. 2,165	Rs. 7,475	Rs. 11,522	Rs. 27,705	Rs. 72,805
B. Tech. (Ag. Eng.)	Rs. 6,999	Rs. 16,745	Rs. 24,073	Rs. 53,068	Rs. 133,287
<u>2. Alternative Earnings</u>					
<u>Respective Bachelor</u>					
<u>Degree</u>					
M. Sc. Ag.	Rs. -4,061	Rs. -1,340	Rs. 791	Rs. 9,288	Rs. 32,463
M. Vet. Med.	Rs. -1,360	Rs. 2,203	Rs. 4,834	Rs. 14,921	Rs. 41,485

who have not invested in the increment of schooling. Unlike the private return, the absolute earnings differential is not adjusted for taxation. Ideally the earnings comparison relies on a controlled sample of individuals who are similar in all respects except that one group in the sample has an additional unit of education. Basing the benefit on earnings ignores the non-quantifiable benefits to society and externalities from educational investments. If the non-quantifiable aspects of the educational investment are positive, the use of earnings as the sole benefit criterion understates the returns all else being equal.

The social cost include (1) the expenditures on the fixed educational investment such as buildings and durable equipment; (2) the recurring expenditures on teacher salaries, non-durable equipment, and scholarships; (3) the productivity loss while the individual is in school measured by the foregone earnings; and (4) the cost to the individual. Ideally, these would be based on the true cost to society as measured by a set of shadow prices. For a more detailed explanation of the methodology refer to Mark Blaug's A Cost-Benefit Approach to Educational Planning in Developing Countries (EC-157, December 20, 1967) which was prepared by Mr. Blaug for the International Bank for Reconstruction and Development.

The results of calculating the social rates of return are given in table 11. The most significant result is the return for the B.Sc. in agriculture. It varies from a low of 15.8% under assumption one regarding cost allocation to teaching and 60% of the differential due to education to 24.4% under assumption two and at 100% of the differential due to education.

Comparing the results under the two assumptions regarding the allocation of the fixed and variable cost to teaching indicates that the returns are not significantly altered. Assuming a constant proportion of the time devoted to teaching between 1960 and 1971 increases the return but only marginally.

Table 11:

Total Cost Returns or Social Returns with Earnings Gross of Taxes

Degree Category	Rates of Return in Percentages			
	¹ Cost Assumption One		² Cost Assumption Two	
	100 %	60 %	100 %	60 %
<u>1. Over Matriculation</u>				
B. Sc. Ag. (VLW's)	5.9	2.8	6.3	3.1
B.Sc. Ag. (Non-VLW)	22.6	15.8	24.4	16.8
B. Vet. Med.	11.7	7.1	12.5	7.7
B. Tech. (Ag. Eng.)	16.6	11.1	17.2	11.6
M. Sc. Ag.	16.0	10.9	16.7	11.5
M. Vet. Med.	10.4	6.4	10.9	6.8
<u>2. Over Bachelor Degree</u>				
M. Sc. Ag.	6.1	2.9	6.4	3.1
M. Vet. Med.	8.3	4.4	8.6	4.7

1. It is assumed that the fixed plant and equipment and the recurring or variable cost are allocated to teaching in the following manner. In 1960-61 when the university admitted its first group of students, 80.0% of the university's staff and plant was engaged in teaching activities. Over the decade this proportion of time devoted to teaching steadily declined at a constant rate with the increase in research and extension until it reached the 1970-71 proportions to teaching of 29.0 % in the College of Agriculture, 36.7 % in the College of Veterinary Medicine, and 43.3 % in the College of Technology.

2. It is assumed that the proportion of staff time devoted to teaching activities remained stable at the 1970-71 level throughout the period between 1960-61 and 1970-71. In the College of Agriculture, 29.0 % of staff and equipment were involved in teaching, 36.7 % in the College of Veterinary Medicine, and 43.3% in the College of Technology.

This would suggest that even basing assumption one on 100% of the staff's time in teaching in 1960 instead of the assumed 80% would not significantly change the results in table 11.

Given that earnings is a poor index of the benefit to society, its use tends to underestimate the social return. Therefore, it may be more appropriate to use 100% of the differential due to education as a proxy for the return to society. The results in columns two and four of table 11 suggests that measured against matriculation most degrees are probably socially profitable. This will, of course, depend on the minimum acceptable social return defined by society.

The exception would appear to be the Village Level Worker program. However, this exception indicates the difficulty of drawing hasty conclusions from this form of analysis. The low return to the total cost of educating VLW's at U. P. A. U. is in effect a social tax on the individual. This will become clear by referring to table 6. After 84 months the VLW was earning Rs. 5,124 per year whereas the average B.Sc. in agriculture was earning Rs. 8,287. If the VLW is equally valued to society as the regular B.Sc. in agriculture, the lower pay for the VLW suggests that he is being taxed by receiving an average rate of pay below the value of his social product.

10. Conclusions

1. The rates of return to the average graduate from U. P. A. U. is an insight into why pressure is being brought against "quality" agricultural educational institutions to relax admission standards. Given the rather high parental income of the average student enrolled at U. P. A. U. during 1970-71, it appears that the average graduate from U. P. A. U. comes from the very top echelons of Indian society. The controlled admission program

ensures that quality agricultural education will remain the prerogative of the wealthy. An increase in the average tuition payment by a reduction in annual scholarships would only ensure this.

2. If one of the goals of agricultural education is an increase in the level of training of personnel providing agricultural services in rural areas, programs such as the two year B. Sc. in agriculture for Village Level Workers should be expanded. Since the average VLW is substantially older than the average undergraduate and brings to the university several years of practical rural work, there is a lower probability of job dissatisfaction for work in rural areas.

3. Unemployment is a significant problem only among B. Vet. Med. This reflects the rigid employment market available currently to these graduates. The answer to the problem probably lies in developing rural veterinary programs, such as rural milk schemes, rather than drastic cutbacks or eliminations of veterinary programs.

4. Comparing the results of this analysis with those obtained by Mark Blaug in his book The Causes of Graduate Unemployment in India (London : Allen Lane the Penguin Press, 1969) suggest that the private and social returns from investments at U. P. A. U. are higher than the average for India. Blaug's "crude rate of return" for the individual would compare to this study's return allocating all of the differential to education. Blaug estimated a private rate of return of 14.3% for B.A.'s, B.Sc., and B.Com. over matriculation. In this study all degree categories measured against matriculation gave returns above 14%.

Blaug estimated the private rate of return to engineering degrees over matriculation at 21.2% (Blaug, op. cit., p. 219). This compares to a private return of 27.4% for agricultural engineers from U. P. A. U. assuming 100% of the differential due to education, which is the return closest to Blaug's estimation procedure.

Blaug's "crude social rate of return" corresponds to the social returns estimated in the study assuming 100% of the differential due to education. Blaug estimated a social return of 12.7% for the bachelor degrees (B.Sc., B.A., and B.Com.) over matriculation (Blaug, p. 218). This compares to this study's estimations of B.Sc. Ag. of 22.6%, B. Vet. Med. of 11.7%, and B. Tech. of 16.6%. Blaug's figure for engineering degrees was 16.6% also (Blaug, p. 218).

This comparison suggest that the rate of return to educational investments at U. P. Agricultural University is higher than the average for comparable degrees in India.

5. The results from U. P. A. U. suggest there may be a high premium on quality agricultural graduates in India. Since the employment market served by U. P. A. U. has been primarily the state of U. P. and given the regional cultural differences in India, there is every indication of ample opportunity to expand "quality" agricultural education in India. This would include the development of an agricultural university patterned after U. P. A. U. and P. A. U. in each major state to serve the state's teaching, research, and extension needs in agriculture.