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Pattern of human resource development in Indian agricultural universities

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ABSTRACT

Agriculture is the primary sector of Indian economy contributing substantially towards GDP of the country. Qualified and quality human resources contribute significantly towards agricultural sector in the economy. The present study (2021) attempts to analyze the human resource development in terms of enrollment pattern of students in undergraduate (UG) course of agriculture and allied sciences and reflects on evolving strategies for attracting talented students in this sector. Present study shows that there is a close correlation with State Value of Output in agricultural sector and number of students enrolled in higher agricultural and allied studies. Presently, there are 74 agricultural universities (AUs) under the National Agricultural Research Education System and the present study attempts to analyze the student enrollment patterns of under-graduate students in agricultural universities of India for meeting the scientific manpower needs towards achieving targeted agricultural growth. Five years of enrollment data (2015–20) across AUs was considered. Human resource development in terms of enrolment in the higher agricultural education of agricultural universities is quite low when compared to enrolment of students overall in higher education and pattern of enrollment of girls varied in different regions of the country. This study has brought out an important aspect linked to higher agricultural education that the State Value of Output in agriculture has a positive association with enrollment of the students in higher agricultural education from the state in agricultural sector. It is important to assess the future human resource needs for the various sub-sectors of agriculture.

Keywords: Agricultural universities, Enrolment, Higher education, Human resources

Agriculture contributes about 17% share in the Gross Domestic Product (GDP) and supports livelihood for more than 50% population. Demand for trained professionals is high in agriculture and there is a need for systematic manpower planning to offset shortfalls in the number of graduate and post graduates *vis-a-vis* the global job opportunities. Also, it is imperative to assess the future human resource needs in consonance with the targeted growth rates of the various sub-sectors of agriculture. The Gross Enrollment Ratio for Agricultural Education, out of the total eligible population is only 0.03% and out of the total eligible rural population in the country, it is reported to the order 0.04%, which is very low (Agnihotri *et al.* 2013). Kihla *et al.* (2019) suggested that the enrollment of the students is necessary for forecast purpose of student performance, for effective planning and implementation of educational management programmes. Similarly, Rami (2017) emphasized on gender, caste, and the region as well to address the concern of inclusion and access to higher agricultural education. Highly qualified and trained human resources are produced by strengthening higher educational institutions in India (Tamboli and Nene 2011, 2013). In Northern State Agricultural Universities (SAUs), 5.84% students dropped before completing their degrees in Home Science (Mittal *et al.* 2020).

There are concerns with the use of university-wise admission criteria as adequate predictors for the success of students enrolled in the colleges of agriculture (Koon *et al.* 2009). Set of factors related to student and college characteristics were highly correlated to the student's decision of enrolling in a particular course (Vasigh and Hamzaee 2004, Slim *et al.* 2018). Convenient location and amenities were two most important reasons among undergraduates for enrolling at universities and cost was least important (Aithal and Kumar 2016). The present study attempts to analyze the student enrollment patterns of undergraduate (UG) students in agricultural universities of India for meeting the scientific manpower needs towards achieving targeted agricultural growth. This study has linked higher agricultural education with the State Value of Output in agriculture and discusses the way forward so as to evolve strategies for enhancing/attracting the students.

MATERIALS AND METHODS

There are 63 State Agricultural Universities (SAUs), 4

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ICAR-Deemed to be Universities (ICAR-DUs), 4 Central Universities with agriculture faculty (CUs), 3 Central Agricultural Universities (CAUs) under the National Agricultural Research and Education System (NARES), to impart education in the field of agriculture in India, besides many affiliated colleges and some private universities offering degrees in various courses of agricultural sciences. Number of Universities (NoU) in various states is as follows: Uttar Pradesh has maximum 9 AUs, followed by six AUs in Karnataka, Maharashtra and Rajasthan. Rest of the states have one AU except Goa. Arunachal Pradesh, Sikkim and Tripura each have one college under Central Agricultural University, Imphal. Agricultural universities set up in India initially were multi-faculty mono-campus universities. With time, many of them have become sectoral, multi-campus. However, the extensive spread of agricultural universities and colleges has opened opportunities for higher agricultural education throughout the country that has paid rich dividends because of the integration of education, research and extension education.

The student enrollment data (BY) collected from all the agricultural universities in UG programs for 2015–20 is considered for the analysis of variation with respect to gender and state. The university with incomplete data is excluded from the analysis. One Way Analysis of Variance was used for determining the significance of the variation with respect to student gender and state as well as type of agricultural universities (Central/Deemed) or the region of the universities (2021).

State-wise State Value of Output (SVO) from agriculture, forestry and fishing (Sharma *et al.* 2020) and state-wise total undergraduate students studying in all agricultural universities have been used to identify the clusters with states having a similar pattern and to facilitate policy interventions for improving the situation. Correlation analysis is used for studying the linear association between student's enrollment and State Value of Output assuming that more agriculture graduates positively contribute towards agricultural development in the states and in turn contribute to State Value of Added and Gross Value Added (GVA) from agriculture sector in the economy.

The agriculture share in GVA depends upon the changes from predominantly agriculture-based to a services-dominated economy. The employment share on agriculture depends upon the changes in industry employment structure. Agricultural students passed out from the Agriculture universities get the employment in agriculture and allied sector industry.

RESULTS AND DISCUSSION

Regional pattern of enrollment, pass out and gender participation under UG courses: The analysis of the data collected from agricultural universities indicates distinct patterns of enrollment with student gender and state. The variation in enrollment patterns underscores the challenge for agricultural universities in attracting students' entry into their undergraduate (UG) programs of study on a uniform basis across the country. The results for UG courses reveal that the Central/Deemed Universities are having a higher female students' enrollment ratio (0.49) compare to State Agricultural Universities (0.42). Regional pattern analysis of universities shows that the Southern region has the highest average female students' enrollment ratio (0.55) followed by East (0.45), North (0.39) and West (0.34). This regional difference is found to be significantly varying at 95% level of confidence.

Analyzing pass out ratio for UG with respect to intake during the year, it has been observed that both DUs/CAUs and SAUs have similar pattern of the order 0.63. The remaining 37% of students either have not completed due to various reasons such as shifting to other general courses or dropping out or delayed completing the examination process. The low percentage of pass out may also be due to a change in the intake seat between the current year and four years earlier when these students took admission. Regional pattern analysis shows that West has the highest pass percentage (71%) followed by East (67%), South (65%) and North (56%). An important pattern is observed that the West region having low female ratio have the highest pass out ratio among three regions and North region has lower values for both female as well as pass out ratio. This may be due to regional characteristics or grouping effect of states.

The variation in state-wise enrollment may be due to more number of universities in west and south region. Year-wise enrollment ratio in the state (Table 1) indicates that the reported enrollment is higher in 2019 with respect to 2015 in Arunachal Pradesh, Assam, Bihar, Karnataka, Mizoram, Manipur, Odisha, and Tripura. The enrollment has been less than 50% in Chhattisgarh, Jharkhand, Punjab, Tamil Nadu, Telangana and Uttarakhand. The average enrollment of all the states in 2019 is of order 82% of enrollment in 2015. The enrollment ratios have been more than 1.0 in 2017 compared to the preceding year 2016 for all the states except Chhattisgarh, Kerala, and Uttar Pradesh having around 0.90. The enrollment ratios are observed to be significantly high in 2019 with respect to 2018 for Assam and Sikkim.

Pattern of state-wise enrollment vis-a-vis *Gross Value Addition in agriculture*: Gross Value Added (GVA) is an economic productivity indicator that measures the contribution of a component i.e. any institution like a corporate subsidiary, company, university or municipality to an economy, producer, sector or region which is further used to adjust Gross Domestic Product (GDP).The average of State Value Added towards GDP by states and their student enrollment ratio for UG reveals that the states having higher number of universities have higher number of student's enrollment. This may be due to the fact that 85% seats are generally reserved for the state and 15% seats are filled on all India basis, in UG courses. The state-wise pattern of students enrollment ratio (PBY) and State Value of Output from agriculture sector, was calculated (Fig 1). This indicates that the State Value of Output has been much higher than their students' enrollment ratio for Karnataka, Maharashtra, Haryana, Uttar Pradesh and lower in, Uttarakhand, Madhya

Table 1 Year-wise enrollment ratio in states

State	Ratio of enrollment in 2019 and 2015	Ratio of enrollment in 2019 and 2018	Ratio of enrollment in 2018 and 2017	Ratio of enrollment in 2017 and 2016	Ratio of enrollment in 2016 and 2015
Andhra Pradesh	0.9702	0.9036	0.7809	1.1603	1.1850
Arunachal Pradesh	1.5484	1.0909	0.9888	1.0854	1.3226
Assam	1.0457	5.9383	0.1828	1.1388	0.8457
Bihar	2.0275	0.9091	1.1952	1.5426	1.2096
Chhattisgarh	0.3769	1.9821	0.1466	0.9340	1.3888
Gujarat	0.9171	0.9359	0.9303	1.0647	0.9893
Himachal Pradesh	0.6101	0.7690	0.6981	1.1522	0.9864
Haryana	0.8500	1.3909	0.5213	1.2597	0.9306
Jharkhand	0.1299	0.7692	0.0371	3.7234	1.2208
Jammu Kashmir	0.5373	0.4504	0.6356	1.0473	1.7918
Karnataka	1.1430	0.9191	1.1159	1.0676	1.0438
Kerala	0.9389	0.9467	1.1771	0.8940	0.9424
Maharashtra	0.8906	0.8899	0.8358	1.0563	1.1335
Meghalaya	1.0278	0.7872	0.7833	1.8182	0.9167
Manipur	2.3019	0.9839	1.1171	1.4051	1.4906
Madhya Pradesh	0.8191	0.8397	0.8554	1.0867	1.0493
Mizoram	1.6400	1.0649	0.9277	1.0779	1.5400
Nagaland	0.5593	0.3511	1.1190	1.0370	1.3729
Odisha	1.2585	0.8436	1.2366	1.3307	0.9066
Punjab	0.3344	0.3042	0.8920	1.1437	1.0774
Rajasthan	0.7835	0.6009	0.7838	1.3318	1.2491
Sikkim	2.0000	2.6154	0.5909	1.2222	1.0588
Tamil Nadu	0.2812	0.6012	0.3913	1.2610	0.9478
Tripura	1.5385	0.8889	1.2857	1.2500	1.0769
Telangana	0.4633	0.8078	0.6205	1.0061	0.9187
Uttarakhand	0.1131	0.1543	0.8747	1.4510	0.5778
Uttar Pradesh	0.6910	1.0600	0.7718	0.8995	0.9390
West Bengal	0.5143	0.4843	0.9272	1.1425	1.0024
Total	0.8217	0.8595	0.8140	1.1129	1.0554

Pradesh, and West Bengal. In all other states, both these indicators are similar. The states contributing more to GDP have higher number of students' participation in agricultural education especially, under UG courses (Fig 2). Correlation coefficient, measuring linear association between these two indicators, is found to be 0.5322, which is significant at 1% level of significance. Identified clusters used for studying the pattern of student enrollment and State Value of Output from the agriculture sector and state-wise patterns are presented in Table 2.

Cluster 3 is characterized as the highest enrollment of students (65–72%) studying agriculture disciplines and a comparatively medium level of State

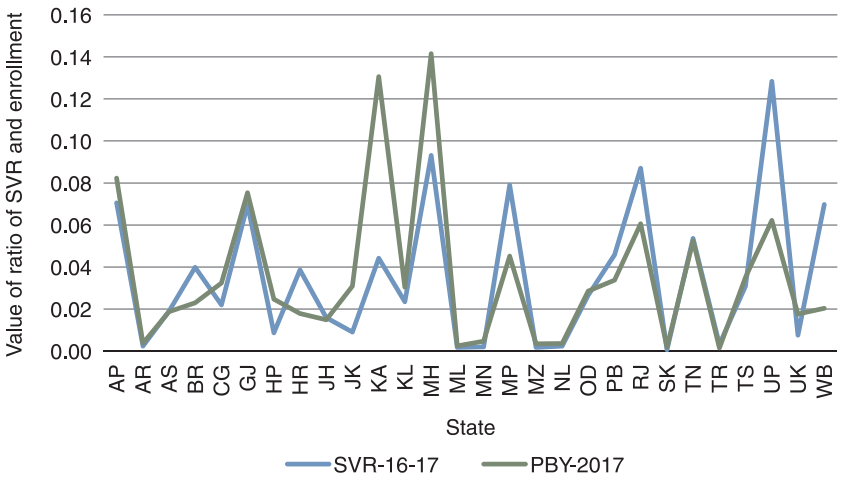

Fig 1 Pattern of state-wise ratio of student enrollment in all agriculture universities and State Value of Output to all India from agriculture, forestry and fishing for 2016–17.

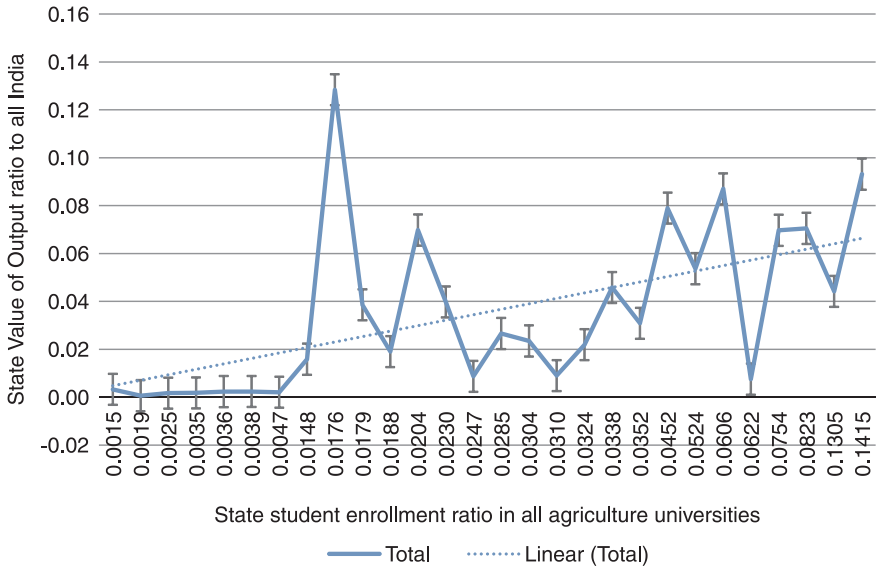

Fig 2 Linear Association Analysis between state wise undergraduate students enrollment ratio and State Value of Output ratio from agriculture and allied areas.

Value of Output from the agriculture sector (Table 2). Cluster 2 represents 21–25% enrollment and here states are characterized by hilly regions or coastal regions. These states have the second highest student enrollment and state value of the product. Uttar Pradesh is characterized as a separate cluster with second highest State Value of Output and comparatively lower student enrollment (5–9%). This is because Uttar Pradesh has the highest population as well as an agricultural area. This state also has the highest number of agricultural universities. Cluster 3 states have second highest number of universities (Table 2). This study helps in understanding the pattern of students joining agricultural education to contribute in agriculture

Table 2 Table depicts State Value of Output *vis-a-vis* total number of students' enrollment state wise

State	SVO-16-17*	SVR-16-17	BY-2017	PBY-2017	NoU	Clusters
Uttar Pradesh	28357322.61	0.1284	1468	0.0622	9	1
Arunachal Pradesh	522430.77	0.0024	89	0.0038	1	2
Assam	4204649.31	0.0190	443	0.0188	1	2
Chhattisgarh	4841565.09	0.0219	764	0.0324	2	2
Himachal Pradesh	1921553.95	0.0087	583	0.0247	2	2
Jharkhand	3501549.67	0.0159	350	0.0148	1	2
Jammu Kashmir	1989538.12	0.0090	730	0.0310	2	2
Kerala	5188063.10	0.0235	717	0.0304	3	2
Meghalaya	373032.32	0.0017	60	0.0025	1	2
Manipur	449253.71	0.0020	111	0.0047	1	2
Mizoram	395034.52	0.0018	83	0.0035	1	2
Nagaland	512460.78	0.0023	84	0.0036	1	2
Odisha	5873347.97	0.0266	672	0.0285	1	2
Sikkim	138237.60	0.0006	44	0.0019	1	2
Tripura	722372.96	0.0033	35	0.0015	1	2
Telangana	6821117.00	0.0309	830	0.0352	2	2
Uttarakhand	1661552.49	0.0075	415	0.0176	2	2
Andhra Pradesh	15571301.29	0.0705	1940	0.0823	3	3
Bihar	8790228.59	0.0398	543	0.0230	3	3
Gujarat	15397783.18	0.0697	1778	0.0754	5	3
Haryana	8517958.96	0.0386	422	0.0179	3	3
Karnataka	9759462.60	0.0442	3079	0.1305	6	3
Maharashtra	20575544.90	0.0931	3337	0.1415	6	3
Madhya Pradesh	17443167.17	0.0790	1065	0.0452	3	3
Punjab	10115998.22	0.0458	796	0.0338	2	3
Rajasthan	19218277.89	0.0870	1429	0.0606	6	3
Tamil Nadu	11852292.01	0.0537	1237	0.0524	4	3
West Bengal	15416656.74	0.0698	481	0.0204	4	3

**Source*: Sharma *et al.* (2020)

development. There is greater scope for enhancing student's intake to agricultural universities in the second cluster states. Differential strategies/policy interventions may be formulated to bring all states to the same level.

However, recent steps initiated by ICAR, have resulted in increased number of applicants in this field for All India Entrance Examination for Admission (AIEEA)-UG exam. During the XII plan period, various measures were taken up to attract and retain talent in the field of higher agricultural education. The support for emeritus professors from the council was initiated to address the faculty shortage of about 36% in AUs. Other means to make agricultural education more attractive were also initiated, viz. Student READY program to instill confidence and skill among UG students through hands on experience and to encourage them to take up entrepreneurship in future. The number and amount of fellowships were also enhanced, both national and international. These efforts certainly have yielded good results and further increase in number of talented and bright applicants was observed in AIEEA–UG. An increase was also observed in the number of rural students applying for higher agricultural education.

The study has also brought out an important pattern linked to the higher agricultural education that the State Value of Output in agriculture has a positive association with enrollment of the students in higher education from the state in this sector. There is an urgent need to develop suitable strategies for enhancing the pass out ratio from existing 63% to at least 75% in UG courses towards meeting the scientific/technical manpower requirement in the agriculture industry. There is a significant regional variation with respect to students opting for agricultural courses as a professional career. The strategies promoting agricultural education should focus to achieve the above target uniformly across the regions. Boumi and Vela (2019) revealed that at many universities student enrollment patterns can be much more complicated, as it is not uncommon for students to alternate between full-time and part-time enrollment each semester based on finances, scheduling, or family needs. Their finding suggests that increased engagement through the occasional full-time enrollment leads to better overall outcomes of students. Swan and De Lay (2014) recommended that to increase enrollment of students with agricultural experiences and skills, there is a need to encourage students to attend campus events early in their secondary careers to capture interest.

Universities across the country need to maintain their competitive advantage and also successfully retain their students as well as attracting new talented graduates. The knowledge and capability of post-graduates should make them highly employable in industrial sector. The education sector in India is estimated at US$ 91.7 billion in FY18 and is expected to reach US$ 101.1 billion in FY19 (Gandhi 2020). The number of colleges and universities in India reached 39,931 and 993, respectively in 2018–19. India had 37.4 million students enrolled in higher education in 2018–19 (AISHE report 2018–19). In higher agriculture education, girls constituted 43.1% of the total enrolment in 2018–19.

Mittal *et al.* (2020) suggested that there is a need to strengthen guidance and placement cells at the university level to facilitate students to compete for fellowships and prepare them for their professional growth and create linkages with the industry for enhancing job opportunities. ICAR in its revised curriculum stresses on this very important aspect (Fifth Dean's Committee report 2016). Agriculture is a science that can collaborate with any industry and is hence the need for active industry academia involvement. There is an imminent need to develop courses in fast evolving areas to make it more attractive, viz. artificial intelligence, nanotechnology, biocomputing, etc as in future these newer technologies will form the basis of growth in this sector too.

The showcasing of achievements, awareness campaigns or through alumni as social media ambassadors among school students, attractive fellowships, modern curriculum, and developing and commercializing technologies for small entrepreneurs will go a long way in attracting talented students towards higher agricultural education as a subject of choice rather than compulsion in absence of other lucrative options. Moreover, this study has brought out an important aspect linked to higher agricultural education that the State Value of Output in agriculture has a positive association with an enrollment of the students in higher education from the state in this sector. There is a need to give opportunities to the enrolled students to develop skills in the area. Possibly through initiation of one year certificate courses. This will lead to a drop in the attrition rate too. Some of the steps have already been initiated and need to be implemented in a country like India, wherein the improvement of agriculture means the improvement in rural society, environment and quality of life. The following guidelines have also been laid down in National Education Policy (NEP) 2020 and narrow loyalties of disciplines will give way to broader perception and broad base, as agriculture and allied sciences can no longer thrive in isolation and rigidity.

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