

POLICY BRIEF

**AGRI ENTREPRENEURSHIP
FOR RURAL LIVELIHOOD**
Evidence Based Policy Implications



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List of Abbreviations

AICRP	All India Coordinated Research Project
ANOVA	Analysis of Variance
ARYA	Attracting and Retaining Youth in Agriculture
ASF	African Swine Fever
ATT	Average Treatment Effect on Treated
BC Ratio	Benefit Cost Ratio
BSEC	Basic Scale of Entrepreneurial Competency
BSF	Black Soldier Fly
BSFL	Black Soldier Fly Larvae
CAGR	Compound Annual Growth Rate
COVID	Corona virus disease
DARE	Department of Agricultural Research and Education
EC	Entrepreneurial Competency
FSSAI	Food Safety and Standards Authority of India
GOI	Government of India
HMNEH	Horticulture Mission for North East & Himalayan States
ICAR	Indian Council of Agricultural Research
ICAR-DMR	Directorate of Mushroom Research
IIHR	Indian Institute of Horticultural Research
IPA	Impact Pathway Analysis
KM	Kernel Matching
KVK	Krishi Vigyan Kendra
LVI	Livelihood Vulnerability Index
MIDH	Mission for Integrated Development of Horticulture
MVU	Mobile Veterinary Units
NAAS	National Academy of Agricultural Sciences
NHM	National Horticulture Mission
NNM	Nearest Neighborhood Matching
NSO	National Statistical Office
PSM	Propensity Score Matching
RM	Radius matching
ROI	Return on Investment
SRF	Senior Research Fellow
UNICEF	United Nations International Children's Emergency Fund
YP	Young Professional

I. INTRODUCTION

About 65 per cent of the Indians are under the age of 35 (GOI, 2020), majority live in rural areas and have the potential to drive agriculture sector but survey indicates the declining youth preferences towards agriculture (NSO, 2021). Mobilizing the youth for national development is a proven phenomenon (Afande *et. al.*, 2015) and quite appropriately, India has started entrepreneurship promotion rigorously, through the “Self-reliant India” drive. National Rural Livelihoods Mission, Make in India, Skill India, Startup India and Mudra Yojana are some of the government-supported programmes for the rural youth to take up the self-employment and entrepreneurial activities. Since large numbers of unemployed rural youth are migrating to cities in search of work, agriculture-based entrepreneurship development is an important approach to minimize the outward migration (Singh *et al.*, 2014; Ray *et al.*, 2022). Creating and sustaining livelihood opportunities in rural areas is fundamental to retain the youth in agriculture. Agriculture-based entrepreneurship development is an important approach to minimize the outward migration (Singh *et. al.*, 2014; Ray *et. al.*, 2022). Scientifically managed and business-oriented farms provide household wellbeing, food security and livelihoods for millions of rural poor (Proctor and Lucchesi, 2012).

Realizing the importance of rural youth in agricultural development especially from the point of view of food security of the country and to empower rural youth, the Indian Council of Agricultural Research (ICAR) has initiated a programme on “Attracting and Retaining Youth in Agriculture (ARYA)” during 2015-16. Under this scheme, special efforts are being taken up to attract the rural youth through income generating opportunities. The oriented youth function as role model for other youths by demonstrating the potentiality of the agri-based enterprises and also by imparting training to others. Skill development of rural youth is helping in regaining their confidence levels to pursue farming as a profession, besides generating additional employment opportunities to absorb underemployed and unemployed rural youth in secondary agriculture and service related activities in rural areas. The first phase ARYA

project was implemented in 25 States through KVKs covering one district from each State and in the second phase, the project was extended to 100 KVKs in the country during 2018-19.

Brief progress of the scheme as per DARE reports (2017-18 to 2022-23) reveal that a total of 2727 skill oriented training programmes were organized on various agro-based industries like mushroom production, fruits and vegetable processing units, horticulture nursery, protected cultivation, fish farming, poultry, goat farming, piggery, duck farming, bee keeping and vermicomposting units etc., under ARYA, benefiting 65661 youth. Among those trained under the project, a total of 14983 entrepreneurial units were established. The rural youth could earn a net income up to Rs. 2,38,000/unit/annum in 2020 which was increased to Rs. 5,39,699/unit/annum in 2022-23. (Source: DARE Reports 2017-18 to 2022-23).

2. Research Project to assess the Impact of ARYA

ARYA interventions have enabled large number of youth to take up agri-business opportunities (Singh *et. al.*, 2019). Considering the importance of these interventions and possible outcomes on the national goal-setting and policy making, the research project on “Impact assessment of ARYA on agri entrepreneurship and alternative livelihood” was designed to study the performance of enterprises promoted under the programme during 2017-2020.

Using the impact pathway analysis (IPA) and result framework methods, the return on investment of agri entrepreneurship promotion was also attempted. Unlike the past impact assessment of agri entrepreneurship which covered any one of the areas in agriculture, horticulture, livestock, fisheries, processing or allied separately, the present investigation compared multiple types of project interventions together and comprehensively. Much of the impact assessment in the past was restricted to economic dimensions, with little or no emphasis on technical and social dimensions of entrepreneurship. The present investigation was an attempt to fill the vacuum through

an innovative and unique 360-degree perspective covering respondents from functional, discontinued, not-started beneficiaries of the programme, all compared with a control category.

The research project was taken up with following specific objectives:

1. To assess the performance and identify the factors contributing towards establishing and sustainably managing the agri enterprises under ARYA
2. To assess the livelihood status of youth attracted to/engaged in agribusiness enterprises across socio-cultural situations in India
3. To ascertain the socio-economic, situational and institutional determinants of the success and failure of enterprises across the value chain segments
4. To analyze the influence of successful agri-entrepreneurship on other enterprises/entrepreneurs
5. To undertake process documentation of the sustainability of selected enterprises using cross case study approach

3. METHODOLOGY

Data were elicited from 2773 respondents (both individual and groups) under four categories viz., functional, discontinued, not-started and control (841+406+454+1072).

- The entrepreneurial units, which were operational for a minimum of one year and were functioning at the sampling stage of the research project during the year 2021, were the functional units.
- Those that had functioned for at least one year during 2017-2020, but non-functional at the time of sampling were categorized as discontinued units. Responses were collected from 406 discontinued units, including 349 individual and 57 group units.

- Those individuals/groups who got trained but could not start the enterprise were targeted as not-started. Responses were collected from a total of 454 respondents, including 433 individuals and 21 groups.
- Those who were not involved in ARYA activities in the same villages where the functional/discontinued units existed were randomly considered for sampling under control category. A total of 1072 individuals served as control.

Enterprise performance: Each enterprise performance was quantified using the data collected on following parameters:

- i. Gross turnover (Rs/annum) – year-wise for 2017-18, 2018-19, 2019-20, 2020-21
- ii. Gross value of inputs used (Rs/annum) – year-wise for 4 years
- iii. Net income (Rs/annum) - year-wise for 4 years
- iv. Employment generated (person days/annum) - year-wise for 4 years
- v. Operational duration (days/annum) - year-wise for 4 years
- vi. Value of assets created/possessed (Rs.) - year-wise for 4 years
- vii. Value of loan/debt outstanding at the end of each year (Rs.) - year-wise for 4 years
- viii. Innovations/ Technologies/ Modern Processes used/adopted
- ix. Institutional support received (Scheme benefits in kind, cash subsidy, grants etc.)
- x. Expansion of the enterprise in terms of scale, activities and processes

Questionnaire related to General Information, the information related to socio-economic factors and the enterprise performance indicators was developed on GOOGLE FORMS. It also included the Household Livelihood Vulnerability Index (LVI) including Five Capital (Minh *et. al.*, 2019) with 28 items. The Basic Scale of Entrepreneurial Competency (BSEC) (Cardenas-Gutierrez *et. al.*, 2021) with 14 statements was used to assess the entrepreneurial competencies.

The data was subjected to statistical analysis using Kruskal-Wallis test, t test, F test ANOVA and Compound Annual Growth Rate (CAGR). Propensity Score Matching (PSM) was carried out for impact assessment of functional vs. discontinued, functional vs. non-starters and functional vs. control.

4. KEY RESULTS

4.1. Basic profile of the respondents

There was significant difference in the basic profile of all the four categories except for cultivated area and income from cultivated area during 2016-17 and 2020-21, and family total net income during 2016-17. The average family size of the respondents was five, out of which two of them were engaged in agriculture and allied activities and one of the family members was engaged in non-farm activities. Prior to the ARYA (2016-17), among the four categories of respondents, discontinued group/units generated highest income from cultivated area (Rs. 98,910/annum) and allied activities (Rs. 36,567/annum) than other respondents. Whereas, in 2020-21, ARYA functional enterprises generated higher income (cultivated area- Rs. 1,40,270/annum; allied activities-Rs. 1,16,351/annum) than other respondents. In 2020-21, the highest total family net income from all sources was recorded in functional (Rs. 3,65,884/annum) units whereas least in not-started category (Rs. 2,27,623/annum).

The functional units exhibited better entrepreneurial competency (EC) compared to others with higher operational marketing, socio business, financial and entrepreneurial competencies. The functional enterprise units could utilize the information and communication sources in a better way as indicated by significantly higher communication source use score of 59.08, compared to an average communication use score of 38.72 among discontinued units out of a possible score of 120. Total livelihood capital was better for functional category although natural capital was more for control category and social capital was highest for not-started category.

4.2. Functional Enterprises

4.2.1. Progress achieved by Functional enterprise units established under ARYA

- The cumulative number of functional units increased over the years from 322 during 2017-18 to 841 during 2020-21. Most of these enterprises were taken up by the youth as an additional source of livelihood, besides their regular activities in farming and daily-wage activities.
- On an average, each functional unit functioned for 179 days during 2017-18, 206 days during 2018-19, 226 days during 2019-20 and 253 days during 2021.
- The average gross turnover increased from Rs.197163 (2017-18) to Rs.328499 (2020-21), which indicated the slow and steady progress in the rural enterprises.
- There was huge variation in the gross returns among enterprises. Gross returns during 2020-21 was least with vermicompost enterprises (Rs.39082/unit) and highest for nursery units (Rs.679459/unit) and processing and value addition units (Rs.775084/unit).
- Average net income increased from Rs. 92276/unit during 2017-18 to Rs. 197553/unit during 2020-21. The BC ratio values were 1.89, 2.73, 2.91 and 3.28 for 2017-18, 2018-19, 2019-20 and 2020-21 respectively.
- Employment generation (person days) increased from 272 days/unit during 2017-18 to 352 days/unit during 2020-21. There was an increasing trend over the years. On an average, each enterprise generated about 1.5 days of employment for every operational day of the enterprise.
- About one third of the units received credit support from banks and cooperatives. About 21 per cent of the units received subsidy support available under ongoing schemes of the central/state governments. About 63 percent of the enterprises received grants in kind under ARYA project. Almost every unit (96.6 %) invested from their own sources to establish and run the enterprises. The value of support received under ARYA was to the tune of Rs.52030/unit,

whereas the amount of subsidy availed was Rs. 113383/unit and the credit support was to the extent of Rs. 146061/unit.

4.2.2. Factors contributing to success of the functional enterprises

Among the personal factors, age of the functional entrepreneurs was positively correlated with gross turnover. Education level was negatively correlated with benefit cost ratio and employment generation due to the fact that the educated entrepreneurs opted for higher investment on technology, automation, and mechanization in the functioning of the enterprises. Women entrepreneurs had lesser assets creation as indicated by the negative and significant correlation with gender. Entrepreneurial competencies were the key determinants of the enterprise performance in terms of gross turnover, gross value of inputs used, net income, per day income and assets worth of the functional enterprises. The positively significant relationship was visible for the two sub-components viz., operational marketing competency and socio-business legal organization competency. Contrary was evident for the economic financial competency which has negatively significant relationship with benefit cost ratio, may be due to long-term impact based investments such as automation and mechanization.

4.2.3. Impact Pathway Analysis

Using the result framework approach, impact pathway analysis was carried out for the project as a whole based on the data for 14 out of 25 KVKs.

Input: Expenditure made by 14 KVKs out of the budget released under ARYA was Rs. 1071.14 lakh during 2017-18 to 2020-21. This included the entire amount spent by the KVK under ARYA for capacity development, inputs / material provided to the trained youth, visits made, office contingencies, emoluments paid to contractual staff (SRF/YP) etc. In addition, the salary component of regular staff who were involved in ARYA (at the rate of one day per week for each enterprise promoted) was estimated (Rs. 310.61 lakh) and added to the project cost. Thus, the total project input cost was Rs. 1381.75 lakh for four years.

Process: Under the project, a total of 13625 youth were trained through 68125 trainee days. The trained youth were supported with handholding and on-site technical and technological support to facilitate establishment and management of the enterprises. KVK Subject Matter Specialists visited these units and also provided online/telephone advisory services throughout the enterprise lifecycle.

Output: Out of 13625 trained, 2352 functional units were recorded at the time of research study. Thus, the physical effectiveness of the project was 17.26%. This included 576 mushroom units, 347 nursery units, 329 poultry units, 230 bee keeping units, 204 processing and value addition units, 180 vermicomposting units, 165 goat units, 103 piggery units, 45 fisheries units, and 142 other enterprises.

Outcome: On an average, each functional unit generated a gross turnover of Rs.560440 and a net income of Rs.333381/unit during four years. Thus, the total value of gross income generated by 2352 functional units in 14 centres was Rs.13182 lakh and the total net income generated was Rs.7841 lakh. In addition, each project had created enterprise assets worth Rs.297752, which is added to net income and arrived at the total net worth of 2352 units as Rs.14844 lakh. The return on investment (ROI) is calculated to be 10.74, which means, every rupee spent under ARYA project has generated Rs. 10.74 rupees benefit to the entrepreneurs. Each unit under the ARYA project generated 878 person-days of employment during the four years' period. When extrapolated to 2352 units, the total employment generated worked out to 20.38 lakh person days of employment.

Impact: On an average, each ARYA entrepreneur added Rs.1.52 lakh/annum to the family income of Rs. 3.75 lakh/annum during 2020-21, adding 40.53% income to the family of ARYA entrepreneurs. About 46 % of the functional enterprises were able to create household assets out of income generated from the ARYA enterprise, which was worth Rs.186239/unit. Access to resources required for livelihood was increased substantially. The discontinued entrepreneurs' livelihood vulnerability index (LVI) was 32.23, compared to 30.00 LVI for functional units, a reduction of 2.23 index points in livelihood vulnerability.

4.3. Discontinuation of ARYA enterprises

When enterprise-wise discontinuation was examined, 34% overall discontinuation rate was found on the basis of total business units started under the ARYA project. Piggery enterprises were the least discontinued (14.55%), followed by vermicomposting (22.48%) and goat-farming (23.14%) units. The highest proportion of discontinued business units was in processing and value addition (53.85%), followed by fisheries (46.81%). Among the primary reasons for discontinuing the processing and value-addition enterprises was the lack of market for the products. Many enterprise units could not sell their quality products against the cheaper products available in the markets. COVID was a factor for premature closure of many enterprises, and some of whom were willing to start again later as and when the situations become favourable.

4.3.I Reasons for discontinuation

- Discontinued entrepreneurs (31.80%) could not plan for enterprise diversification and could not sustain revenue required to meet the operational costs.
- Many could not establish required contacts / linkages to expand the enterprise (29.80%).
- Raw material non-availability, high cost of the raw material and poor quality of the inputs were the reasons for 25.50% of the discontinued enterprises.
- Non-profitability of the enterprises was a strong reason for discontinuation in about 20 per cent of the discontinued enterprises.
- Less than desired level of performance of technologies and practices adopted was the reason for about 20 per cent of the enterprises.
- Inability to adopt the suggested technologies or practices was also a reason for about 19 percent of the enterprises.

4.3.2. Enterprise- wise comparative difference in performance indicators between functional and discontinued units

Performance in terms of operational duration and employment generation (Table I) indicated wide variation both within the group and between the two groups. Within the functional group, poultry, goat farming, nursery and piggery activities showed sustained performance through longer operational duration and higher employment generation. The longer an enterprise operated, the more it could establish its market presence, built a customer base and generated greater revenue. A longer operational duration also allowed an enterprise to gain experience, expedite operations, and adapt to changing market conditions. Sustaining the operations by successfully passing through the COVID disturbances was the key differentiating indicator between the functional and discontinued units. Functional units (616 days per unit) functioned almost double the duration compared to discontinued units (313 days per unit) during the period 2017 to 2021. Except for the piggery enterprises (511 days per unit), all the discontinued enterprises were in operation for less duration than the shortest period of operation among functional enterprises (vermicomposting, 416 days per unit). The discontinuation level for the operational duration was highest for the fisheries (75.92%), followed by processing and value addition (62.86%).

The functional units performed significantly better in employment generation also, as indicated by the large difference of nearly three times compared to discontinued units. The functional units could generate 834 person-days of employment per unit as compared to only 310 person-days of employment per unit among discontinued units (Table I). The discontinued enterprises in piggery could do better to generate 507 person-days of employment/unit, and thus performed more comparably (with just a loss of 44.41% person-days of employment) to the functional piggery enterprises. Poultry enterprises also showed a smaller difference (45.28%) due to better performance in both functional (689 person-days/unit) and discontinued units (377 person-days/unit). The highest difference in employment generation was recorded in fisheries (87.95%) enterprises. Mushroom enterprises also showed wider differences in employment

generation between the discontinued (181 person-days/unit) and functional units (532 person-days/unit).

Table I: Differences in performance indicators within the enterprises and between the groups

Enterprises	Operational duration (days/ unit)		Employment generation (person-days/ unit)		Gross Turnover (Rs./ unit)		Net Income (Rs./ unit)	
	F	D	F	D	F	D	F	D
Poultry	835	403	689	377	957459	179147	525720	91616
Goat farming	810	399	1299	375	372479	62627	294322	37824
Nursery	717	348	1068	472	911198	250419	607824	182692
Piggery	628	511	912	507	594044	148438	500805	98300
Fisheries	573	138	3211	387	267683	60227	79392	23543
Processing and value addition	517	192	599	143	881053	156323	485772	105686
Beekeeping	479	295	728	272	634341	119438	399641	52995
Mushroom	474	243	532	181	508586	137915	248025	78730
Vermicomposting	416	276	355	225	72163	41741	52585	26992
Average	616	313	834	310	566826	142214	343026	82525
t value	16.95**		10.05**		12.28**		10.23**	
F value	92.54**		54.00**		113.74**		98.68**	

** Significant at the 0.01 level

F-functional; D- discontinued

Functional units performed the best on economic parameters, with average gross turnover (Rs. 566826/unit) being four times greater than the discontinued units (Rs. 142214/unit) and the average net income being 4.15 times more than the discontinued units. Sound economic performance is critical for the survival of agribusiness enterprises. The poultry units generated the highest gross turnover (Rs. 957459/unit) among the functional units. In case of the discontinued units, nursery enterprises generated the highest average gross turnover (Rs. 250 thousand/unit), although it was 72.52% lower than that of the functional units. The difference in average gross turnover between the functional and discontinued groups was the highest in goat farming (83.19%). The reason being, the discontinued goat-farming enterprises depended mainly on pasture-land grazing, which led to a slower growth rate, reduced body-weight gain and lower turnover.

The extent of the difference in gross turnover between the discontinued and functional enterprises was also high in processing and value addition (82.26%).

Processing and value-addition enterprises required capital to establish and scale up. It was challenging for the small-scale enterprises to produce high-quality value-added products that could meet market standards and compete with established brands.

The difference between functional and discontinued units was least among vermicomposting enterprises due to the extremely low performance by both functional and discontinued units. Vermicomposting enterprise units were smaller in scale of operation than other enterprises, resulting in the least employment generation and revenue among all other studied enterprises.

In terms of net income per unit, the differences were further widened in favour of functional units (Rs. 343026/unit) as discontinued units could only earn net income of Rs.82525/unit. Nursery enterprises generated the highest net income per unit both in the functional (RS. 607824/unit) and in discontinued (Rs. 182692/unit) category, and hence the net difference was less (69.94%). The discontinued goat-rearing units had the highest difference (87.15%) in income, thus demand additional impetus through integration of ongoing government schemes for scaling up the goat farming as profitable venture. The discontinued bee-keeping units also generated lower net income and reported wider difference (86.74%) compared to functional units. Beekeeping units suffered from variety of reasons such as migration of colonies and destruction due to heavy rains in Kerala state and destruction by wild rock-bee in Jharkhand state. Cost-ineffectiveness and lack of resources are the common reasons for business discontinuation. Poor economic conditions and the inability of the entrepreneurs to obtain sufficient quantities of economic resources could precipitate closure of businesses. This reiterates the importance of sustained economic performance for the survival of agribusiness enterprises.

4.3.3. Propensity Score Matching (PSM) analysis

Propensity Score Matching is generally used to estimate the impact of an intervention between two groups usually treated and control groups. Here, it was used to estimate the impact of ARYA on the income of the rural youths wherein, functional

group was considered as treated group and other three groups (discontinued, not started and control groups) were considered as control.

Functional vs. Discontinued category of respondents

The probit regression between functional and discontinued categories revealed that the variables such as age and family size have negative and significant influence on the treatment groups, whereas education, gender, family members engaged in agriculture and cultivated area have positive and significant influence on treatment groups.

Table 2: Impact estimates of ARYA on total income of farm households (Functional vs. Discontinued)

Matching methods	ATT	S.E.	t
Nearest neighborhood matching (NNM)	149133.20	10469.34	14.25***
Kernel matching (KM)	153901.00	16254.53	9.47***
Radius matching (RM)	157801.30	15843.37	9.96***
Stratification matching	154419.10	14185.84	10.89***

Note: *** indicates significance at ten per cent level of probability

ATT estimates were obtained from the analysis which indicates the difference between the average income of the ARYA functional group and the average income of the discontinued category. It was observed that the entrepreneurs under functional groups received an additional income ranging from Rs. 1,49,133 (NNM method) to Rs. 1,57,801 (RM method). Thus, it can be clearly stated that out of the average income obtained by functional enterprises, an amount of Rs. 1,57,801 was attributed as the impact of ARYA (Table 2).

4.3.4. Alternative livelihoods pursued by 'Discontinued' entrepreneurs

The discontinued ARYA entrepreneurs pursued various other alternative options for livelihood as depicted in Figure 1. In 2020-21, the average income from all these alternate livelihood activities was Rs. 115406/annum which was almost 40 per cent less than the average income earned by ARYA functional entrepreneurs (Rs.161315/annum). Only exception was those who engaged in family enterprises after discontinuing ARYA, earned a slightly higher level of income (Rs. 189145/annum). The discontinued entrepreneurs who got a job/employment, or joined an activity started

by friends /relatives or started a new enterprise earned 29%, 39% and 110% less than average income of ARYA functional enterprises, respectively. The majority (115 out of 345) of the discontinued entrepreneurs who were engaged in miscellaneous livelihood activities earned the least income (Rs. 73270/annum) which was 120 % less than the ARYA income.

The ARYA enterprises like nursery (Rs. 276343/annum), piggery (Rs. 257529/annum), poultry (Rs. 213936/annum), bee keeping (Rs. 205636/annum) and processing and value addition units (Rs. 196742/annum) performed better than all the alternate livelihoods pursued by discontinued entrepreneurs.

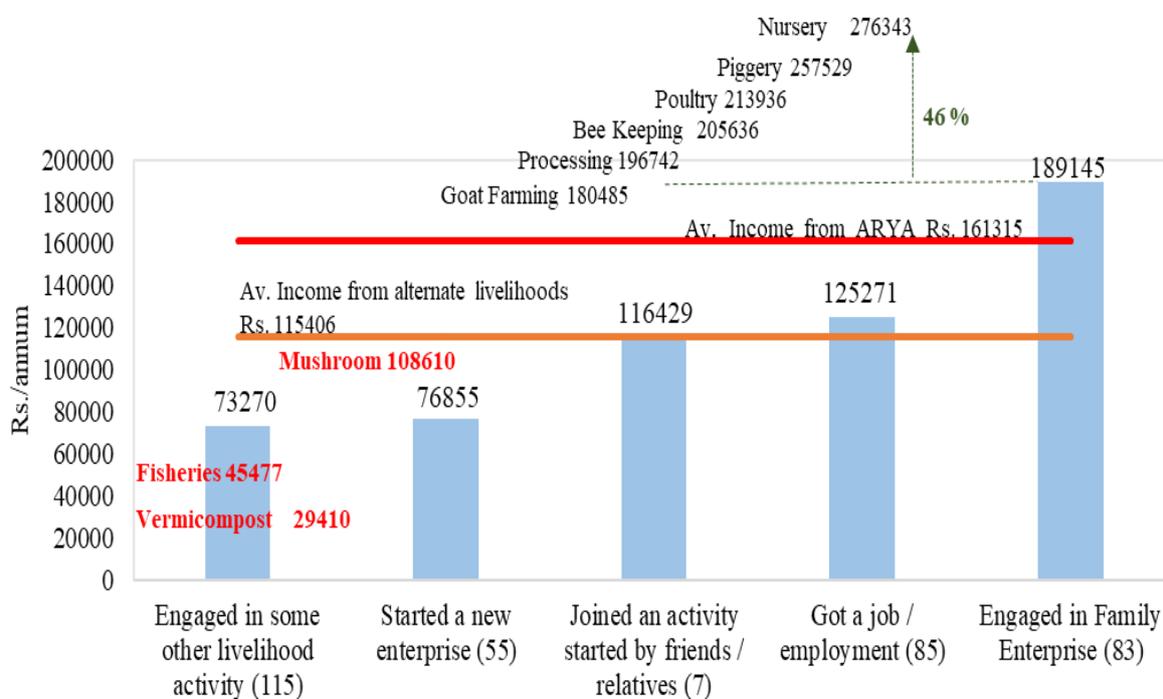


Figure I: Performance of functional ARYA enterprises in comparison to the alternative livelihoods pursued by discontinued entrepreneurs

4.4. Not-started category of respondents

4.4.I Reasons for not-starting enterprise under ARYA:

Some of the trained youth under ARYA could not start the enterprise for various reasons as listed below.

Table 3: Reasons for Not Starting

Sl. No.	Reasons	No.	%
1	Waiting for suitable programs and schemes for assistance	161	37.20
2	Continuing the activity that was being done prior to ARYA training	150	34.65
3	Lacked confidence in the new enterprise / business	142	32.80
4	Needed more time to mobilize resources for the new enterprise	142	32.80
5	Could not establish required contacts for the new enterprise	90	20.79
6	Lacked confidence in the new Production Process	85	19.63
7	Need more training and handholding for the new enterprise	80	18.48
8	Lack money to start a new enterprise	25	5.77
9	Unable to avail subsidy as land owners are parent/grand parent	10	2.31
10	Guideline for funding for Purchase of Equipment not available	9	2.08
11	Damage by wild animals	8	1.85
12	Migration problem of bee colony	6	1.39

4.4.2 Functional vs. Not-Started category of respondents

The estimates of the probit regression between functional and not-started category revealed that education and family members engaged in agriculture significantly and positively influenced the treatment effect.

Table 4: Impact estimates of ARYA on total income of farm households (Functional vs. Not-Started)

Matching methods	ATT	S.E.	T
Nearest neighborhood matching (NNM)	109081.7	13833.87	7.885***
Kernel matching (KM)	102264.7	18532.87	5.518***
Radius matching (RM)	102827.7	10592.29	9.708***
Stratification matching	103000.5	19879.84	5.185***

Note: *** indicates significance at ten per cent level of probability

The results of PSM shows that the rural youths engaged in ARYA enterprises received higher income compared to not-started category. The average treatment effect

on treated (ATT) was found to be significant in all the methods (Table 4). The impact of ARYA was evident as the functional entrepreneurs earned higher income ranging from Rs. 102264/unit/annum (KM method) to Rs. 109081/unit/annum (NNM method).

4.4.3 Alternative livelihoods pursued by 'Not-starters'

Not-started respondents pursued various options for livelihood ranging from being unemployed to employed in a secured job (Figure 2). However, income from all these options (average Rs.57882/annum) was less than the income earned by ARYA entrepreneurs (Rs.161315 during 2020-21). The income earned by alternative livelihoods was highest for those who were employed (Rs.154127/annum), but even this income was less than the annual income earned by ARYA entrepreneurs.

Majority (40.6%, out of 433) was jobless and did not show any income. There were 37 (8.5%) trained youth who tried to start an enterprise of their own, but earned 250% less than the income earned by ARYA entrepreneurs. Those who were engaged with farming and family enterprises earned about Rs.1.23 lakh/annum, 31.2% less than income earned by ARYA entrepreneurs.

The ARYA enterprises like nursery, piggery, poultry, bee keeping, processing and value addition, and goat farming generated a higher income than all the alternative livelihoods pursued by non-starters. However, some enterprises yielded lesser income than the best of the alternative livelihoods pursued by the 'non-starters'. Income from mushroom enterprise (Rs. 1,08,610/annum) was lesser than the alternative livelihood earned by joining farming and family enterprises (Rs.122981/annum), combination of enterprises (Rs.136160/annum) and job/employment (Rs. 154127/annum). Further, fisheries (Rs. 45477/annum) and vermicomposting (Rs. 29410/annum) enterprises also earned far lesser income than the income earned by non-starters through daily wages and petty works (Rs.78417/annum) and who tried to start own enterprises (Rs.46127/annum).

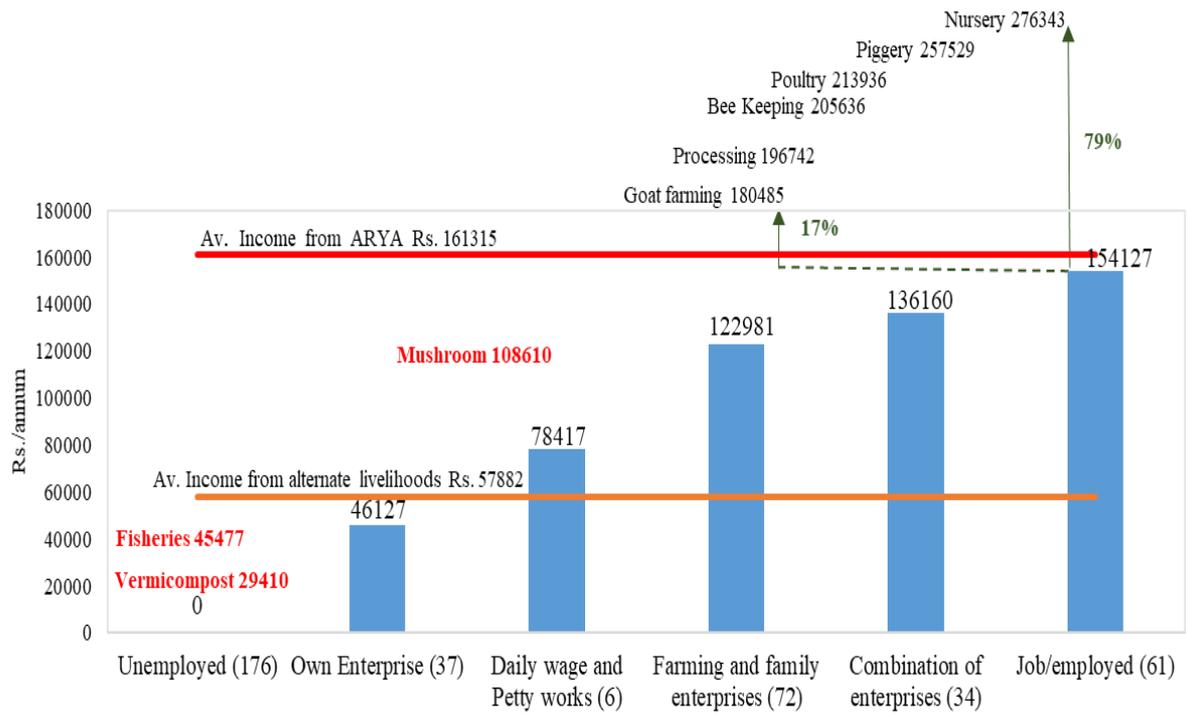


Figure 2: Performance of functional ARYA enterprises in comparison to the alternative livelihoods pursued by Non-starters

4.5 Control category of respondents

4.5.I. Functional vs. Control category of respondents

The estimates of the probit regression between functional and control categories revealed that the factors such as education, gender and family members engaged in agriculture have significant and positive influence on treatment groups.

Table 5: Impact estimates of ARYA on total income of farm households (Functional vs. Control)

Matching methods	ATT	S.E.	t
Nearest neighborhood matching	80544.07	6607.02	12.19***
Kernel matching	79647.27	7842.04	10.16***
Radius matching	80525.76	8809.04	9.14***
Stratification matching	80219.42	13186.20	6.08***

Note: *** indicates significance at ten per cent level of probability

The PSM findings indicated that in all the matching methods, the ATT was significant. It was observed that due to ARYA, the functional entrepreneurs received an additional income over control ranging from Rs. 79647 to Rs. 80544 (Table 5). The impact of ARYA is clearly observed for the treatment group, which has higher income by Rs. 80544 (NNM method).

4.5.2. Livelihood pursued by non-ARYA (control), extent of income during 2020-21

Comparison of ARYA enterprises as a source of livelihood over control category revealed that ARYA entrepreneurs earned more income than all alternative livelihood options pursued by control respondents (average Rs.82486/annum). ARYA entrepreneurs earned at least about 7% more than the highest income earning option of pursuing combination of enterprises (Rs.150797/annum) by the control group. Even the 'employed' control respondents earned Rs.145813/annum, which was 10.6 % less than the income earned by ARYA entrepreneurs. Other options generated less than half of the annual income (103% to 106% less) compared to ARYA entrepreneurs.

As observed, the average income obtained from the functional ARYA enterprises was Rs. 1,61,315/annum. Among the functional ARYA enterprises, nursery (Rs. 2, 76,

343/annum) units generated highest income, whereas, the combination of enterprises (Rs. 1,50,797/annum) generated highest income among the alternative livelihoods pursued by the control category (Figure 3). The fisheries and vermicomposting units managed to produce income just higher than unemployed (Rs. 3,143/annum) but lesser income than all other alternative livelihoods pursued by control category.

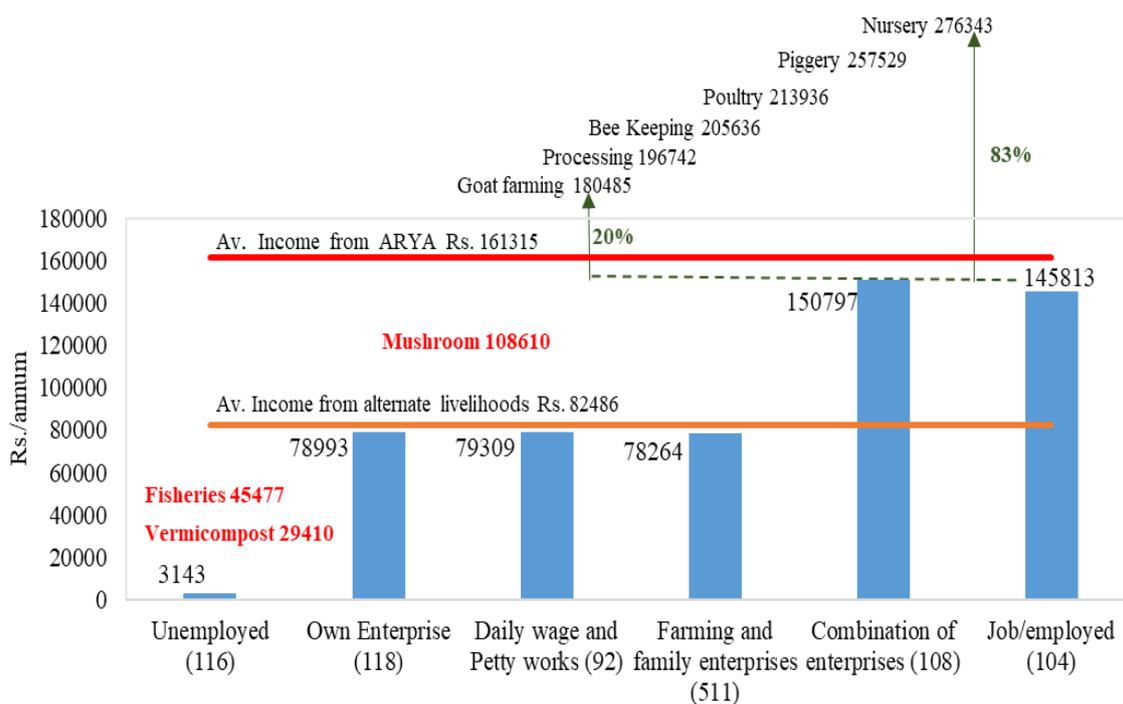


Figure 3: Performance of functional ARYA enterprises in comparison to the alternative livelihoods pursued by Control category

4.6. Income attributed to ARYA Impact

The additional income attributable to ARYA project derived through Propensity Score Matching analysis is given in Figure 4. The average treatment effect on treated (ATT) values were higher for discontinued category (Rs.157801), indicating that by discontinuing the enterprises under ARYA, the discontinued respondents stood to lose more than the other category of respondents. The ATT value for not-started category was Rs.109081 and Rs.80544 for control category of respondents. So by any means of livelihood, ARYA functional enterprises earned Rs.80544 to Rs.157801/annum more during the year 2021, which is solely attributed as the impact of ARYA.

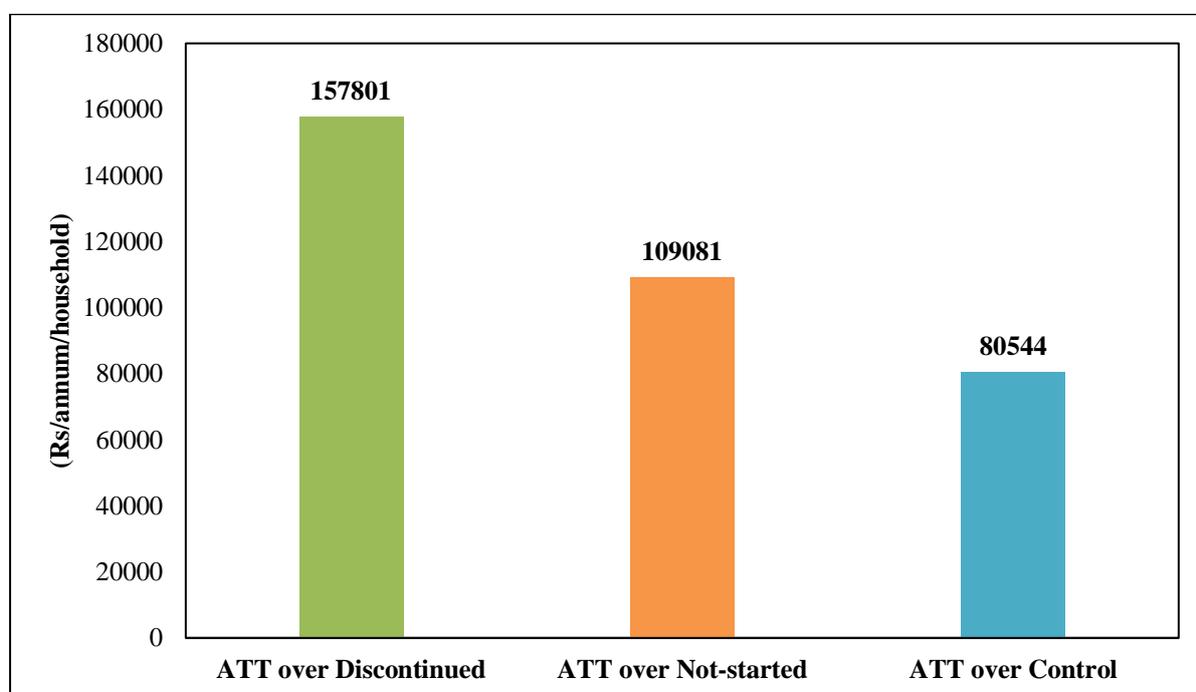


Figure 4: Additional income attributed to ARYA confirmed through PSM's Average Treatment Effect on Treated (ATT) during 2020-21

5. ENTERPRISE-WISE PERFORMANCE ACROSS REGIONS: SPECIFIC POLICY IMPLICATIONS

Summary of comparative performance of functional enterprises across States

- Mushroom rearing was most profitable in Punjab followed by Himachal Pradesh and Odisha among the 12 ARYA centres.
- Poultry farming was profitable in Punjab followed by Odisha and Uttarakhand, among the 12 ARYA centres.
- Nursery enterprises were most profitable in Maharashtra followed by Kerala and Haryana among 10 ARYA centres.
- Bee keeping was most profitable in Punjab among six ARYA centres.
- Goat farming was most profitable in Madhya Pradesh among the six locations.
- Processing and value addition enterprises were most profitable in Himachal Pradesh, among four ARYA centres.
- Piggery was most profitable in Jharkhand whereas fisheries were most profitable in Bihar among the three ARYA centres each.
- Vermicomposting was least profitable among all enterprises, but was better in Telangana, compared to other three ARYA centres.

Specific activity-wise performance across the States and the policy implications are presented below:

5.1 Mushroom Enterprises

Performance of mushroom enterprises across 12 ARYA centres is given in Table 6. Mushroom enterprises in Punjab recorded the highest average income (Rs.504784/unit) followed by Himachal Pradesh (Rs.441100/unit). During the period 2017 to 2021, mushroom units functioned for longer duration (755 days) in Himachal Pradesh followed by Manipur and Odisha. Supported by higher investment (Rs.942561/unit), mushroom enterprises in Haryana created more household assets,

worth Rs.351875/unit. Mushroom enterprises in Odisha had to spend more (Rs.583281/unit), but were successful in creating more employment (1027 person days).

Table 6: Performance of Mushroom enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Andhra Pradesh	325	13173	27920	90647	238	44466
2.	Bihar	401	0	10960	83935	589	40965
3.	Chhattisgarh	301	48500	21210	107494	292	132560
4.	Haryana	370	351875	238498	412614	413	942561
5.	Himachal Pradesh	755	15300	292900	441100	307	117500
6.	Kerala	221	263	17424	117589	193	80512
7.	Madhya Pradesh	364	96500	300131	248891	439	144072
8.	Manipur	675	20000	61805	284695	627	113700
9.	Nagaland	600	0	47611	97889	601	40000
10.	Odisha	658	122906	583281	413671	1027	171438
11.	Punjab	420	0	832060	504784	543	141975
12.	Uttarakhand	566	8333	348083	152750	431	433333
	<i>F value</i>	7.271	3.256	3.951	3.215	1.831	4.165
	<i>Sig.</i>	0.000**	0.001*	0.000**	0.001*	0.061	0.000**

Note: *, ** indicates significance at five and one percent level of probability

Policy support for mushroom enterprise promotion

Having a separate mushroom shed was essential for successful mushroom enterprise. Those who could not establish separate sheds attributed to the high cost and lack of support from developmental departments. Low cost mushroom sheds designed by IIHR called as “Solar Power Integrated Outdoor Mushroom Growing Unit” could be a viable alternative which need to be promoted through developmental departments (www.iihr.res.in).

Maintenance of sanitation and congenial temperature/moisture inside the mushroom sheds was instrumental in harvesting a good mushroom crop. Temperature and humidity are to be maintained at appropriate level in different locations and are location-specific. Hence, customized use of hygrometers and foggers are essential to regulate moisture and temperature, which demand technical guidance for usage and maintenance. Some of the entrepreneurs designed their own foggers and some entrepreneurs designed their own

strategy to remove carbon dioxide accumulated inside the mushroom shed by strategically placing the exhaust fans at lower heights (carbon dioxide being heavier than air tend to accumulate at lower heights), instead of the standard positions. **These kind of location-specific adjustments need to be part of technical guidance and advisory services.**

Paddy straw is the most commonly used substrate in oyster and paddy straw mushroom. Substrate plays a crucial role in mushroom quality as it's the nutritional source for the mushroom growth. Sizing of straw is one of the most labour-intensive yet crucial processes in mushroom cultivation, as sizing aids in further process like sterilization, compacting and bagging/bed preparation. This difficulty has led many farmers' to innovate and develop user friendly location specific paddy straw cutters. **Such technologies need to be standardized and promoted on location specific basis to reduce labor costs and improve efficiency.**

Spawn is one of the critical inputs in mushroom production (www.nhb.gov.in). Currently, Indian market demand for commercial spawn is 8000-10000 tonnes, out of which, share of public organizations (including ICAR-DMR, AICRP networks centers and KVKs) in spawn supply is less than 10 %. The demand for quality spawn is still fulfilled by private spawn suppliers in India (Sharma *et. al.*, 2017). Thus, **establishment of spawn production centers at district and state levels, which requires a major policy and development intervention.**

Highly perishable nature of the mushroom (water content: 85-95 %) force the growers to sell the produce on the same day of harvest as these cannot be stored for more than 24 hours at the ambient conditions of the tropics. Lack of cold chain facilities and saturated local markets has led to smaller scale of operations. Therefore, processing and value addition of surplus and/or unsold mushroom not only aids in extending the shelf life, supplementing farmers' income and contribute to nutritional security as mushrooms are nutri-rich food. Awareness and capacity building programmes should also be organized to promote and popularize various mushroom processed products (dried mushroom, mushroom soup powder, mushroom vermicelli, mushroom papad,

mushroom pickle etc.). Efforts have to be made at the demand side to create and increase consumption of mushroom products.



Ms. Molly Dominica, Kannur, Kerala

5.2 Poultry Enterprises

Poultry enterprise was promoted by 12 ARYA centres during the period 2017-2021. Poultry enterprises in the state of Punjab were most profitable as evident from data in Table 7. Net income generated by the poultry units in the state was very high (Rs.1426383/unit), although the expenditure (Rs.1285019/unit) and investment were also high (Rs.1250300/unit). The next best performance was reported in Odisha with a net income of Rs.766273/unit with half the expenditure compared to Punjab, but created lesser employment as most of these units were managed by family members. Poultry enterprises in Madhya Pradesh functioned for shorter duration (441 days during the period), but were able to generate reasonably good income (Rs.489607/unit).

Table 7: Performance of Poultry enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Assam	746	81000	166022	330443	370	141006
2.	Bihar	888	283333	833383	53394	579	134100
3.	Chhattisgarh	878	94500	115485	510453	795	148000
4.	Madhya Pradesh	441	184928	159964	489607	457	83886
5.	Manipur	1177	14547	410377	444273	598	121190
6.	Nagaland	682	0	77824	187471	676	46765
7.	Odisha	666	190000	645316	766273	330	456222
8.	Punjab	930	1070000	1285019	1426383	1079	1250300
9.	Rajasthan	1356	20174	107179	158193	1356	50000
10.	Sikkim	750	95000	102500	328750	791	323000
11.	Uttarakhand	753	134166	819617	547217	738	263500
12.	West Bengal	569	0	127775	145225	1858	81994
	<i>F value</i>	<i>11.402</i>	<i>1.177</i>	<i>8.601</i>	<i>4.874</i>	<i>17.027</i>	<i>40.826</i>
	<i>Sig.</i>	<i>0.000**</i>	<i>0.311</i>	<i>0.000**</i>	<i>0.000**</i>	<i>0.000**</i>	<i>0.000**</i>

Note: ** indicates significance at one percent level of probability

Policy support for poultry enterprise promotion

High mortality due to frequent disease outbreaks is one of the major causes for failure in rural poultry production. Availability of vaccine in smaller doses is a constraint for small poultry farmers. Therefore, community level medication and vaccination keeping a village as unit should be promoted to reduce the incidence of disease (Panda *et.al*, 2019). **Strict regulations have to be enforced by government on mandating timely**

vaccination of poultry birds through the establishment of vaccination schedules and providing free vaccines to poultry farmers.

In any natural calamity, be it flood, earthquake, etc. the livestock is first to be affected. According to UNICEF (2020), 0.85 million livestock were affected across 6,944 villages due to Amphan Cyclone during 2020. Nivar Cyclone, in the same year affected 2706 animals, 8130 poultry birds and 5 lakh acres crops in Andhra Pradesh (Uppala Gopayya, 2021). **Agri-business units need to be protected with appropriate insurance packages for rebuilding the damages caused.**

The rapid expansion of poultry sector has increased challenges in waste disposal and management. Poultry wastes are posing serious environmental pollution problems, through offensive odour causing resentment among neighborhoods (Adeoye *et. al.*, 1994). Therefore, appropriate waste disposal or poultry waste management practices is need of the hour, which adds to the income from waste and also protects from its unwanted side-effects (Singh *et. al.*, 2018). **Awareness campaigns, training programs and workshops have to be organized to educate poultry farmers about sanitation and waste disposal and precautionary measures.**

Composting the poultry waste is one promising alternative, but it must be managed and monitored carefully. BSF larvae (BSFL) modify the micro flora of manure and reduce harmful pathogens and at the same time, the BSF larvae serve as the feed for poultry birds and has the potential to reduce poultry feed requirement (Moula *et. al.*, 2018). **Hence, there is a need for a policy to promote large scale production and supply of black soldier fly to poultry farms, both commercial and small scale poultry units.**



Ms. Jigisa Samantaray, Nayagarh, Odisha

5.3 Nursery enterprises

Nursery enterprise is one among the highly profitable activities promoted under ARYA. Nursery production in Maharashtra was operational for longer duration (1403 days) and also generated higher net income (Rs.1979833/unit) than other centers. Nursery enterprises were also highly profitable in Kerala (Rs.1483000/unit). Nursery enterprises in Haryana invested more and created greater household assets compared to other states, and generated income of Rs.943881/unit (Table 8). The nursery units of West Bengal generated highest employment (3870 person days/unit).

Table 8: Performance of Nursery enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Andhra Pradesh	290	43529	106991	125201	247	83072
2.	Haryana	538	616250	880494	943881	718	2647000
3.	Himachal Pradesh	1049	120416	175363	741304	715	345542
4.	Karnataka	544	0	165200	606100	403	309000
5.	Kerala	600	0	217000	1483000	570	200000
6.	Madhya Pradesh	1143	77666	395337	515333	1160	101333
7.	Maharashtra	1403	183333	390000	1979833	3160	420667
8.	Nagaland	863	0	220000	202000	863	220000
9.	Rajasthan	510	20000	39600	121150	510	26667
10.	West Bengal	554	28000	504340	217460	3870	89210
	F value	15.52	6.413	6.985	7.846	2.947	7.729
	Sig.	0.000**	0.000**	0.000**	0.000**	0.008**	0.000**

Note: ** indicates significance at one percent level of probability

Policy support for nursery enterprise promotion

Plant nurseries are often subjected to natural calamities, mostly cyclones, thunderstorms and high speed winds. These can damage the infrastructure as well as the entire stock of planting material. **It is important to insure all the nurseries promoted under ARYA so that the enterprise discontinuity could be avoided.**

The nurseries established under ARYA provide genuine plants at higher cost but face stiff challenge from private nurseries providing un-authentic plants at cheaper rates. In the absence of any formal system of quality assurance for horticulture planting material,

it has not been feasible to put any kind of quality control related restrictions on horticulture nurseries which do not have adequate production-related infrastructure and pedigreed mother plants. **Therefore, uniform quality standards have to be formulated on quality control measures for nurseries, such as traceability, standards for disease-free seedlings/saplings, varietal purity and seedling quality.**

A well-equipped structure is a basic necessary for nursery unit. The construction of well-equipped permanent nursery structure/unit is a costlier affair. Therefore, financial assistance under various schemes (Credit linked back-ended subsidy @ 50% of the total project cost) (www.nhb.gov.in), assistance for vegetable seed production, hi-tech nursery (2-4ha unit), small nursery (1ha unit) under various sub schemes of NHM & HMNEH under MIDH (www.rkvy.nic.in) need to be channelized. **Creating awareness among the nursery growers about various state and central government schemes and programs for infrastructure development is necessary for the further spread and success of the nursery enterprise.**

Location of nurseries is very important to minimize transportation time and cost and hence should be located as closely as possible to the planting area. Road-side location or road connectivity is very essential to be accessible throughout the year. However, many young and new entrepreneurs may not have land in ideal locations and are also unable to invest on such properties to buy or to rent / lease. **Hence a policy is needed to facilitate the leasing of the unutilized government or community lands located on road-sides for establishing plant nurseries.**



Sneha Community Nursery, Nalgonda, Telangana

5.4 Bee keeping

Bee keeping was promoted by six KVKs under ARYA during 2017-2021. Among the six centres, bee keeping in Punjab was found to be more profitable with an average net income of Rs.946664/unit, followed by Uttarakhand (Rs.525500/unit). Bee keeping activity generated higher employment in Jharkhand (1395 person days/unit) and a net income of Rs.492681/unit (Table 9), whereas, bee keeping units were least operational in Kerala (305 days).

Table 9: Performance of Bee keeping enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Bihar	665	60000	245500	324500	995	520000
2.	Jharkhand	570	65298	34222	492681	1395	79487
3.	Karnataka	376	0	2630	14968	153	48150
4.	Kerala	305	6538	44315	88531	285	41476
5.	Punjab	539	0	1194592	946664	581	213700
6.	Uttarakhand	613	7000	75000	525500	604	322500
	F value	6.534	4.194	15.252	11.56	42.501	32.963
	Sig.	0.000**	0.005*	0.000**	0.000**	0.000**	0.000**

Note: ** indicates significance at one percent level of probability

Policy support for bee keeping enterprise promotion

The purity of commercially available honey is always debatable and honey is often mentioned as an example of a product that can be counterfeited in various ways (composition, infused flavors etc.,) (Zak and Wilczynska, 2023). Competing with cheaper but poor quality material has been a major problem for genuine products. **Quality testing facility and consumer awareness campaigns about the quality and authenticity of honey and bee products must be organized.**

Tropical bee colonies frequently abscond during extreme climatic conditions for safety and in search of areas with better resources (Mark, 1987; Koeniger and Koeniger, 1980, Pradeepa and Bhat, 2014). Keeping colonies with adequate food stores and avoiding broodlessness by providing 1-2 frames of young healthy brood are essential. **All these**

efforts need specific policy interventions in the form of project support, support from developmental departments and proper education to the apiculturists.



Mr. M. J. Jomon, Kannur, Kerala

5.5 Goat farming

Goat farming was promoted in six ARYA centres as detailed in Table 10. Goat farming was most profitable in Madhya Pradesh with an average net income of Rs.1463750/unit, with an investment of Rs.105333/unit and an average operational expenditure of Rs.206250/unit. Goat farming was also profitable in Telangana with an average net income of Rs.416818/unit. Even though goat units were operational for longer period in Haryana (1460 days), Jharkhand goat units generated higher employment (3541 person days/unit).

Table 10: Performance of Goat farming enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Bihar	755	11388	22901	43814	343	54967
2.	Haryana	1460	272500	102938	316005	1485	80756
3.	Jharkhand	980	115800	25195	340608	3541	90869
4.	Madhya Pradesh	824	466660	206250	1463750	764	105333
5.	Rajasthan	753	49843	127921	134560	810	156922
6.	Telangana	557	144615	46905	416818	566	144231
	F value	13.224	3.448	4.452	4.655	86.208	0.923
	Sig.	0.000**	0.007**	0.001**	0.001**	0.000**	0.47

Note: ** indicates significance at one percent level of probability

Policy support for goat enterprise promotion

Since ages, the traditional grazing grounds have been the lifeline of pastoral economy in arid regions (Prasad *et. al.*, 2017). Though traditional method of grazing provides a livelihood for rural landless goat rearing units, they rarely get commercial importance (Anonymous, 2023). Hence, economically viable alternate goat rearing/feeding methods should be explored to fulfill the growing meat demands of the country and also to cater/improve the socio-economic condition of the rural landless and poor. Efforts are also required to conserve, manage and restore grasslands (NAAS, 2016).

Integrated health management plays a significant role in the success of goat rearing. Therefore, capacity building to recognize early symptoms of disease, basic preliminary treatments and preventive measures is needed. To ensure timely access to veterinary

services in rural areas, “Mobile Veterinary Units (MVU)” (1 MVU approximately for one lakh livestock population) have been launched by GOI with an aim of providing veterinary services at farmer’s doorstep. **Necessary steps have to be taken at community level to create awareness about these mobile units.**

Because of high straw bedding costs, hard soil bedding is used and the manure is stored on hard ground throughout the year of goat production. Despite higher initial investment, the simplified waste management makes the raised floor sheds a cost-effective and sustainable solution. **The related schemes of central and state governments should make provision for these new technologies, both for commercial as well as home-stead level goat enterprises.**



Goat unit of Mr. Shrikanth, Nalgonda, Telangana

5.6 Processing and value addition

Processing and value addition as a vocation was promoted by four KVKs. The processing and value addition activities promoted in Himachal Pradesh have generated maximum returns to the entrepreneurs (Rs.868813/unit) with an investment of Rs.248125/unit and operational cost of Rs.490938/unit. The processing and value addition units of Punjab were operational for 594 days with a total expenditure of Rs. 661218/unit (Table II) and earned net income of Rs. 461438/unit.

Table II: Performance of Processing and value addition enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Chhattisgarh	467	37142	35357	138360	411	81750
2.	Himachal Pradesh	526	347500	490938	868813	799	248125
3.	Kerala	180	0	22000	48000	170	150000
4.	Punjab	594	17500	661218	461438	617	231125
	<i>F value</i>	<i>0.474</i>	<i>6.175</i>	<i>9.103</i>	<i>6.254</i>	<i>1.021</i>	<i>1.734</i>
	<i>Sig.</i>	<i>0.63</i>	<i>0.008**</i>	<i>0.002**</i>	<i>0.008**</i>	<i>0.378</i>	<i>0.202</i>

Note: ** indicates significance at one percent level of probability.

Policy support for value addition enterprise promotion

Continuous experimentation and development of innovative products and flavors is crucial in the success of a processing and value addition unit. It is essential to conduct timely market and consumer surveys, sensory analysis to know the consumers' opinion, preference, attitude and expectations towards the product which helps in lowering down the probability of product failure in the market.

Quality products are the key to the consumers trust. Packaging aids in maintaining the quality of the product. Thus, quality and packaging play a prominent role in the success of these enterprises. Therefore, product certification and quality assurance components should be incorporated in the vocational training programmes in addition to product preparation. Institutional support should be provided in obtaining FSSAI certification/license and regular renewal of the license.



Ms. Pooja Sharma, Gurugram, Haryana

5.7 Vermicomposting

Vermicompost production as a commercial activity was promoted under ARYA, by south Indian states. The scale of operation was limited and the income generated was meager, with highest net income of Rs.102311/unit in Telangana (Table 12). The analysis of variance ANOVA result shows that there is a statistically significant mean difference in all the given outcome variables across the states for vermicomposting enterprise.

Table 12: Performance of Vermicomposting enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Andhra Pradesh	494	8434	14579	39586	307	36680
2.	Karnataka	245	0	16808	22582	211	218158
3.	Tamil Nadu	194	4100	9630	47687	174	14027
4.	Telangana	766	48590	42123	102311	788	54909
	<i>F value</i>	85.128	24.027	42.59	41.212	91.542	35.319
	<i>Sig.</i>	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**

Note: ** indicates significance at one percent level of probability

Policy support for vermicomposting enterprise promotion

There is an increased demand for vermicompost, but ARYA units are not generating enough income to the farmer's vermicompost units. **Massive institutional support mechanisms are needed to support the initial investment in establishing vermicompost units. Identifying and certifying quality vermicompost production unit's for procuring under government schemes is also needed.**



Mr. N. Sukumaran, Nellore, Andhra Pradesh

5.8 Piggery

Piggery enterprise has been promoted, mostly by the ARYA centres in eastern and north-eastern India. ARYA piggery units in Jharkhand were profitable with an average net income of Rs.701959/unit and also generated higher employment (1161 person days/unit). Piggery units in Assam were functional for longer duration (1095 days) during the period 2017-2021 and generated Rs.387630/unit net income (Table 13).

Table 13: Performance of Piggery enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Assam	1095	232000	287912	387630	757	163514
2.	Jharkhand	438	137545	85310	701959	1161	77984
3.	Nagaland	695	0	65477	334386	721	56591
	F value	11.61	8.884	7.013	9.213	6.963	72.625
	Sig.	0.000**	0.001**	0.002**	0.000**	0.002**	0.000**

Note: ** indicates significance at one percent level of probability.

Policy support for piggery enterprise promotion

In recent years, the Indian pig sector has been devastated by an acute epidemic of African swine fever (ASF- an infectious, deadly, transboundary, hemorrhagic viral illness of farmed and wild pigs with a 100% mortality rate) in the north-eastern area, which has moved rapidly to neighboring states, inflicting catastrophic mortality and economic losses to pig producers (Chaudhary N., 2023). **Timely technical guidance and awareness campaigns on various control measures such as disease identification, diseased animal quarantine, feed management, waste disposal, sanitation, disinfection and precautionary measures for restocking after infection is necessary for efficient prevention and control.** Appropriate insurance packages have to be designed and promoted for the benefit of small scale agri-preneurs.



Mr. Ajay Mahali, Gumla, Jharkhand

5.9 Fisheries

Fisheries activities were promoted by ARYA centres in Bihar, Odisha and West Bengal. Fisheries units promoted under ARYA in Bihar were operational for 850 days and generated an average net income of Rs.518500/unit, by incurring an expenditure of Rs.406500/unit (Table 14). Fisheries units in Odisha generated more employment, but could not generate adequate income.

Table 14: Performance of Fisheries enterprises across the States

Sl. No.	State	Total OP Days	Total HH assets created	Total Exp. (All Years)	Total Net Income	Total Employment	Total Investment (Rs.)
1.	Bihar	850	65000	406500	518500	370	197000
2.	Odisha	662	0	202509	-35671	4866	130445
3.	West Bengal	338	25000	107081	185356	820	103313
	<i>F value</i>	28.161	2.822	4.103	11.89	135.377	1.946
	<i>Sig.</i>	0.000*	0.081	0.031*	0.000**	0.000**	0.167

Note: **, * indicates significance at one and five percent level of probability

Policy support for Fisheries enterprise promotion

The supply of quality fish seed is a key factor to the expansion of fish farming (Bisht *et. al.*, 2013). In 2020-21, the total fish seed production of India is 5,40,690 lakh fry (GOI, 2022). Fish seed demand is strong and expected to expand further. Therefore, fish seed production units/hatcheries have to be promoted and setup in large-scale by providing technical assistance and organizing skill oriented training programmes on various aspects of fish –seed production, and financial assistance to small-scale fish farmers to shift into seed production (Bisht *et. al.*, 2013). **Fish seed farms have to be educated about the “FISHMARK” mark provided by the accreditation Board/agency as per the guidelines of Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India once the prescribed quality standards are met (GOI, 2010).**



Mr. Ranjit Mondal, South 24 Parganas, West Bengal

6. COMMON POLICY IMPLICATIONS

The study contributes novelty to the existing body of knowledge on the drivers of functioning of small-scale agricultural entrepreneurship in rural India. Unlike previous studies that often focused only on successful entrepreneurs, this research adopts a holistic approach by taking into account the functional, discontinued, not-started and control category of respondents. To enrich the analysis, integration of both qualitative and quantitative research methodologies was adopted. By combining in-depth interviews, case studies, and surveys, it captured not only the statistical trends but also the experiences, narratives, and qualitative nuances that contributed to a more comprehensive and contextually grounded understanding of the agri entrepreneurship.

Sustainable rural entrepreneurship in the farming and related activities is a challenging proposition, particularly in the case of small-scale agri enterprises. Operational duration was the survival indicator, employment generation was the growth indicator, however, a certain degree of economic success was the ultimate indicator of enterprise sustainability. Propensity score matching analysis of the ARYA functional entrepreneurs over discontinued, not-started and control category respondents clearly indicated the net gains from the agri-entrepreneurship, reiterating the importance of continuation and strengthening of ARYA like programmes. The return on investment was estimated at Rs.10.74, which meant that every rupee spent under ARYA project generated Rs. 10.74 benefit to the entrepreneurs proving the economic viability of the programme within a short period of time and these benefits are likely to rise manifold in the subsequent years. Successful entrepreneurship confirms the possibilities for attracting and retaining youth in rural areas through technology-supported agribusiness. Planned capacity development and handholding by KVKs were crucial in establishing and sustaining the enterprises. The contribution of technical back up of Krishi Vigyan Kendras was brought out clearly in the case studies of the successful entrepreneurs.

Within the functional enterprises, some enterprise activities were more likely to fetch higher net returns (nursery, poultry, piggery, processing& value addition), although

youth in rural India showed preference for less-profitable enterprises as well like mushroom, vermicompost, and goat farming as these enterprises were easy to start and there was demand for these products in the local markets. Some of the reasons behind the rural youths' choice of these enterprises are;

- Mushroom cultivation could be taken up with different species in different regions of the country, and most units were started with smaller investment using technical assistance and support from institutions.
- The vermicompost production has the potential to utilize the main product on their own farm, which created interest and enthusiasm to start enterprises. Further interest on vermicomposting was triggered by the impetus given by Government of India for organic farming.
- Goat farming units were started as part of the traditional activities of the households which were reared in a moderate housing with outdoor grazing and limited external feed requirement.

Few region-specific factors could also be the drivers of choice of enterprises, like comparative advantages for enterprises for certain areas. Goat farming was more profitable in a state like Madhya Pradesh which had more opportunities for both semi-intensive (with outdoor grazing option) as well as intensive rearing. Hill and low-temperature areas were more favourable for mushroom, plant nursery and processing enterprises. Poultry enterprises performed better in hot and dry climate, but demanded more technology and investment support.

Despite the prevalence of the bio-physical limitations, including COVID turbulence, the functional units survived and progressed slowly and steadily. Besides the choice of enterprises and scale of operation, the performance was influenced by other socio-economic and personal factors.

- Business performance was determined by entrepreneurial competencies of the entrepreneurs, as they could harness the opportunities better than those who

lacked the necessary competencies. Considering the constraints under which the rural enterprises operated particularly during COVID related restrictions, entrepreneurial competencies were key for the economic performance. Entrepreneurial competencies have emerged as strong predictors of business performance even in small scale enterprises. In particular, the functional entrepreneurs were able to ‘organize resources’ as per the requirements and were able to ‘choose a management model’ suitable to their enterprise. Economic and financial competencies were generally low in all categories as many were unable to do ‘results account’ and ‘explain accounting book’. Strong relationship between performance of small enterprises and entrepreneurial competencies demand for entrepreneurship education as part of the formal education programmes in schools and universities.

- College educated individuals were more successful entrepreneurs as they could perceive the risks in advance and planned to overcome those. Higher education contributed to business turnover by adopting technology and efficient utilization of the manpower employed. As an integral part of human capital, formal education strengthened their ability to pursue different livelihood options. Formal education added to entrepreneurs’ self-confidence and thereby enhanced success. Efforts targeting the young and college educated rural youth should be the feature of sustained rural entrepreneurship.
- The gender-inclusive entrepreneurship promotion is vital for the sustainable livelihoods in rural areas. Women entrepreneurship uplifted the entire family, not only alleviating the present poverty levels, but built a solid foundation for the future of the young family members. Women’s psychological, social, economic and political empowerment through entrepreneurship provides an opportunity to attain autonomy and reduce dependence on the limited resources of the family.
- Information collection, organization, processing and maintaining skills are part of the information management. Using these skills for keeping track of technological advancements was a crucial survival strategy for the entrepreneurs.

The use of smart phones to access digital content on pest and disease management was found to be critical for the effective management of small-scale enterprises. Information access and utilization behaviour of the rural entrepreneurs need to be strengthened as part of technological and entrepreneurial capacity building activities.

- Successful functional enterprises were adequately supported by family members of the entrepreneurs. This aspect has to be given adequate attention during the skill development stage, so that the interested family members are also enrolled for capacity development at some stages of the enterprise promotion.
- Access to various marketing channels helped the entrepreneurs to capture a wider market and realize better income. Thus, providing training and resources on new marketing avenues viz., digital marketing, e-commerce platforms and international market access assumes greater relevance. Also, Government-sponsored trade missions, export promotion programs and trade fairs can facilitate networking and market expansion opportunities for enterprises.

An analysis of the reasons for discontinuation revealed further insights, which are summarized below.

- The discontinued enterprises exhibited signs of failure from the very beginning, as the difference was visible right from the first year. The lack of entrepreneurial competencies and family support made them struggle to survive during second and third years and succumbed under the COVID influence.
- Difficulty in scaling-up, lower turnover and inability to meet the operational costs caused discontinuation of 31.80% of the enterprises. On the other hand, functional units diversified their product portfolio (for example, from fish production to fish-seed production) to overcome the slow and low returns. Vermicompost enterprise units were smaller in scale of operation than other enterprises, resulting in least employment generation and revenue among all other studied enterprises.

- Inability to ensure raw material availability continuously, high cost of the raw material and poor quality of the inputs were the reasons for 25.50% of the discontinued enterprises. Mushroom production in Kerala was dependent on neighboring states for paddy straw and spawn, which often resulted in high cost. The poor-quality straw and spawn added to infection and crop failure.
- Cost-ineffectiveness and lack of resources were the common reasons for business discontinuation. Processing and value-addition enterprises required capital to establish and scale-up. Some of the processing activities required more investment for equipment, machineries, and infrastructure during the early stages, making it difficult for the poor rural families to take up such enterprises. Poor economic conditions and the inability of the entrepreneurs to mobilize sufficient quantities of economic resources precipitated the premature closure of businesses, which demands greater attention of the entrepreneurship promotion agencies.
- Non-profitability of the enterprises was a strong reason for discontinuation in about 20 per cent of the discontinued enterprises. It was challenging for the small-scale enterprises to produce high-quality value-added products that could meet market standards and compete with established brands. Many enterprise units could not sell their quality products against the cheaper products available in the markets. Capacity development of aspiring entrepreneurs must also cover the value chain wide liaison, networking and logistics management.
- About 20 per cent of the discontinued enterprises cited the reason that the technologies and practices could not give the desired level of performance. That indicated the technical inefficiency, inappropriate selection of technologies and lack of competency to handle the technologies. Beekeeping units suffered from variety of reasons such as migration of colonies and destruction due to heavy rains in some areas and destruction by wild rock-bee in some other areas. In particular, young agri-entrepreneurs require information and technical services to establish and expand agri businesses. Rural entrepreneurs need constant support

with information on technical, regulatory and financing aspects of their enterprises.

- Inability to adopt the suggested technologies or management practices was also a reason for about 19 percent of the enterprises. On the contrary, every functional entrepreneur had regular contact with subject matter specialist concerned in the KVK for technical back-up.

There were also activity-specific constraints that added to the enterprise discontinuation;

- Fishery enterprises showed greater level of discontinuation as these required continuous availability of water resources and had long waiting periods for first harvest and income. Resource-poor entrepreneurs struggled to carry on during the zero-income period. Those who could pull-on, experienced difficulty in arranging the fish-seedlings for the next batch, which was also a reason for discontinuation. High mortality of young fishes, slow growth, low yields, and lack of market for poor-sized fishes demotivated the budding aquaculture entrepreneurs. The COVID-19 outbreak severely affected the small-scale fishery enterprises due to low consumer demand, limited market access, and restricted transportation. Its effect could be seen on seed- and feed-supply disruptions up to the village level. The association of the Wuhan wet market with the COVID-19 pandemic probably had a psychological barrier to fish demand.
- Amphan cyclone that hit eastern coastal areas of West Bengal and Odisha destroyed many livestock enterprises during May 2020. Similarly, Nivar cyclone struck the eastern coastal areas of Andhra Pradesh during November 2020 and destroyed many outdoor enterprise activities. Most of the destroyed units could not be re-started as these were not covered under insurance. It is necessary to cover all the enterprises promoted under ARYA with insurance tailored to agri-enterprises to mitigate the financial losses.
- Livestock activities like piggery, goat farming and poultry were severely affected by disease outbreaks. The enterprises started under ARYA in Assam, Nagaland,

West Bengal, Odisha and Jharkhand were affected leading to discontinuation of many enterprises. It is very much necessary to cover all the enterprises promoted under ARYA with insurance packages as part of the scheme itself.

Not-starting an enterprise by the trained persons was studied for the reasons and also for ascertaining the alternative path chosen by such respondents. The study proved that all the alternative livelihood opportunities pursued by non-starters fetched less income than the successful agri-preneurs under ARYA, which should inspire them to adopt the technology driven entrepreneurship. Some of the trained youth under ARYA could not start the enterprise for various reasons such as waiting for suitable programs and schemes for assistance (37.20 %), lack of confidence in the new enterprise / business and more time required to mobilize resources for the new enterprise (32.80 %) and many more. Many non-starters expressed willingness and readiness to take up ARYA supported entrepreneurial activities, which augurs well for the future of such rural youth. These need to be addressed appropriately with necessary programmatic support and confidence building measures.

7. REFERENCES

- ADEOYE, G. O., SRIDHAR, M. K. C. AND MOHAMMED, O. E., 1994, Poultry waste management for crop production: Nigerian experience. *Waste Manag. Res.*, 12(2), 165-172.
- AFANDE, F.O., MAINA, W. N. AND MAINA, F. M. P., 2015, Youth engagement in agriculture in Kenya: Challenges and prospects. *J. of Culture, Society and Development*, 7:4-19.
- ANONYMOUS, 2023, From grazing to zero-grazing (stall fed) goat farming in India. *Pashudhan Praharee*, May 19, 2023. (<https://www.pashudhanpraharee.com/from-grazing-to-zero-grazing-stall-fed-goat-farming-in-india/>)
- BISHT, A., SHALINI, A., SUSHIL, B. AND PAL, D. K., 2013, Fish seed production and hatchery management: A Review. *N Y Sci. J.*, 6(4): 442-48.
- CARDENAS-GUTIERREZ, A. R., BERNAL-GUERRERO, A., MONTORO-FERNANDEZ, E., 2021, Construction and validation of the basic scale of entrepreneurial competencies for the secondary education level. A study conducted in Spain. *PLoS ONE*, 16 (4), e0249903.
- CHAUDHARY, N., 2023, A Review on African Swine Fever in India. SSRN Electronic Journal. (Available at SSRN: <https://ssrn.com/abstract=4336480> or <http://dx.doi.org/10.2139/ssrn.4336480>)
- DARE, 2018, Annual Report, 2017–18. Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. https://dare.gov.in/sites/default/files/DAREAnnual%20Report-2017-18_%28English%29.pdf

DARE, 2019, Annual Report, 2018–19. Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. <https://dare.gov.in/sites/default/files/DARE-ICAR-AR-2018-19.pdf>

DARE, 2020, Annual Report, 2019–20. Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. <https://dare.gov.in/sites/default/files/ICAR-DARE-AR-2019-20.pdf>

DARE, 2021, Annual Report, 2020–21. Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. <https://dare.gov.in/sites/default/files/ICAR-DARE-AR-2020-21.pdf>

DARE, 2022, Annual Report, 2021–22. Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. <https://dare.gov.in/sites/default/files/ICAR-DARE-AR-2021-22.pdf>

DARE, 2023, Annual Report, 2022–23. Department of Agricultural Research and Education, Ministry of Agriculture and Farmers Welfare, Government of India. <https://dare.gov.in/en/document/annual-reports/dare-annual-report-2022-23>

GOI, 2010, Guidelines for developing fish seed certification and accreditation system in India. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.

GOI, 2020, Census of India 2011, Population projections for India and states 2011–2036. Report of the technical group on population projections, July 2020. National Commission on Population, Ministry of Health and family Welfare.

GOI, 2022, Handbook on Fisheries Statistics (2022). Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, New Delhi.

KOENIGER, N. AND KOENIGER, G., 1980, Observations and experiments on migration and dance communication of *Apis dorsata* in Sri Lanka. *J. Apic. Res.*, 19(1): 21- 34.

MARK, L. WINSTON., 1987. *The biology of the honey bee*. Harvard University Press, Cambridge, 217-218.

MINH, D. D., PHILIPPE, L., DANG, H. N., PHILIPPE, B. AND MINH, H. H. T., 2019, The dynamics of livelihood vulnerability index at farm household level: An empirical analysis of the causal sandy zone in ThuaThien Hue Province, Vietnam. *International Journal of Economics and Financial Issues*, 9 (5): 77-89.

MOULA, N., HORNICK, J. L., CABARAUX, J. F., KORSACK, N., DAUBE, G., DAWANS, E., ANYONIE, N., TAMINIAU, B. AND DETILLEUX, J., 2018, Effects of dietary black soldier fly larvae on performance of broilers mediated or not through changes in microbiota. *J. Insect Food Feed*, 4 (1):31 - 42

NAAS, 2016, Augmenting forage resources in rural India: policy issues and strategies. Policy Paper No. 80, National Academy of Agricultural Sciences, New Delhi: 16 p.

NSO, 2021, Situation assessment of agricultural households and land and livestock holdings of households in rural India, 2019, National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India.

PANDA, A. K., PATTANAIK, S., SAHOO, B., KUMAR, A. AND SRIVASTAVA, S. K., Empowering Farm Women through Rural Poultry Production. POLICY BRIEF, ICAR - Central Institute for Women in Agriculture, September 2019.

- PRADEEPA, S. D. AND BHAT, N. S., 2014, Survey on absconding of *Apis cerana indica* F. colonies at different traditional beekeeping areas of Karnataka. *Current Biotica.*, 8(2):174-178.
- PRASAD, R., MERTIA, R. S., CHATURVEDI, O. P., TEWARI, R. K., SHUKLA, A. AND SINGH, P., 2017, Need to revitalize grazing resource management practices for sustainable use of forage in arid Rajasthan. *Indian J. of Agroforestry*, 19(1):24-31.
- PROCTOR, F. AND LUCCHESI, V., 2012, Small-scale farming and youth in an era of rapid rural change. Knowledge Programme Small Producer Agency in the Globalised Market. International Institute for Environment and Development (IIED).
<https://www.iied.org/sites/default/files/pdfs/migrate/14617IIED.pdf/>
- RAY, P., PANIGRAHI, R. S., AND SHASANI, S., 2022, Determinants of skill levels of farm youth with regard to agripreneurship: A multinomial regression approach. *Indian J. Ext. Educ.*, 58 (1), 58-62.
- SHARMA, V. P., ANNEPU, S. K., GAUTAM, Y., SINGH, M. AND KAMAL, S., 2017, Status of mushroom production in India. *Mushroom Res.*, 26 (2): 111-120.
- SINGH, A. K, RANDHIR, S., ADHIGURU, P., GOWDA, C. M. J., THIMMAPPA, K. AND HANJI, B. AND MALLIKARJUN, 2019, *ARYA –Attracting and retaining rural youth in agriculture*. New Delhi: Division of Agricultural Extension, Indian Council of Agricultural Research.
- SINGH, P., MONDAL, T., SHARMA, R., MAHALAKSHMI, N. AND GUPTA, M., 2018, Poultry Waste Management. *Int. J. Curr. Microbiol. App. Sci.*, 7(8): 701-712.

SINGH, R., NAIN, M. S., SHARMA, J. P., MISHRA, J. R., AND BURMAN, R. R., 2014, Institutional convergence of synergistic strengths for developing women agripreneurs. *Indian J. Ext. Edu.*, 50(3&4), 1-7.

UNICEF, 2020, India Bhubaneswar cyclone Amphan situation report. 21 May, 2020. (<https://www.unicef.org/documents/india-bhubaneswar-cyclone-amphan-situation-report-21-may-2020>)

UPPALA GOPAYYA, 2021, Nivar Cyclone: Its impact on Andhra Pradesh. *Int. J Multidiscip. Educ. Res.*, 10:1(3): 180-185.

ZAK, N. AND WILCZYNSKA, A., 2023, The Importance of Testing the Quality and Authenticity of Food Products: The Example of Honey. *Foods*, 12.

<https://www.iihr.res.in/solar-power-integrated-outdoor-mushroom-growing-unit>

<https://rkvy.nic.in/static/schemes/horticulture.html>

https://nhb.gov.in/report_files/button_mushroom/button%20mushroom.htm

https://www.nhb.gov.in/online_application_nhb_scheme_2020_21.aspx?enc=3ZOO8K5CzcdC/Yq6HcdIxFfgWqd9Zpsh5GgGF2IJ/Sbjhzna+ksD2hsqVFhQhiDh

AGRI ENTREPRENEURSHIP FOR RURAL LIVELIHOOD

Evidence Based Policy Implications



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