Development of agriculture model to measure survival income for different categories of 
agriculture land-holding farmers

By

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Abstract:
The rural population percentage decreased from 82.7% to 68.9% in 2011, even though there is 
an increase in the total rural population, which stands at 833.7 million, and the rural population 
were now more than three times compared to the population seven decades ago. Another 
obervation is the decrease in cultivators percentage from 71.9% to 45.1 %, while agriculture 
labour increase from 28.1% to 54.9% during the same period. Despite the increase in irrigated 
land and net area sown, the average holdings’ size under the farmers is continuously decreasing, 
and it requires a study to look into the reasons.

The research probes the role of Minimum Support Price (MSP) in supporting farmers and 
measuring market price above MSP needed to help marginal and small farmers remain above 
the poverty level. It explains how different market rates above MSP have a different impact on 
different categories of agriculture landholding. The study works on developing a common 
model that relates the impact of MSP on different farmers categories. The model can be 
generalized to all crops and regions and useful in designing policies that focus on uplifting the 
income of agricultural farmers.

Key Words:  Small and Marginal farmers, Minimum Support Price (MSP), Agriculture, 
Economics, Poverty, Agriculture Land-holdings

Introduction:

In the year 1951, when India’s total population was 361.1 million, in which 298.6 million live 
in rural areas (82.7%), out of which 69.9 million are cultivators (71.9%), and 27.3 million are 
aricultural labourers (28.1). Since then, the rural population percentage decreased from 82.7% 
to 68.9% in 2011, even though there is an increase in the total population, which stands at 833.7 
million, and the rural population were now more than three times compared to population seven 
decades ago. Another observation is the decrease in cultivators percentage from 71.9% to 45.1 
%, while agriculture labour increase from 28.1% to 54.9% during the same period (Pocket 
Book of Agricultural Statistics, 2017).

The forest cover that was 40.48 million hectares in 1951 was increased to 69.84 million hectares 
in 2001, later in 2014-15, it was estimated 71.79 million hectares whereas net area sowed 
increase from 118.75 million hectares to 141.43 million hectares. The net irrigated area also 
increase from 20.85 million hectares to 68.38 million hectares.

Despite the increase in irrigated land and net area sown, the size of average holdings under the 
farmers are continuously decreasing 1.33 ha in 2000-01 reduce to 1.08 ha in 2015-16. In 2000- 
01 the number of less than 1-hectare holdings with the marginal farmers was 7,54,08,000
In terms of area, marginal farmers owned 29,814,000 hectares (18.7%) in 2000-01, it increased to 37,923,000 hectares (24.03%) while small farmers holdings increased to 36,151,000 hectares (22.91%) from 32,139,000 hectares (20.2%) in 2015-16. Decrease in area for the semi-medium, medium and large farmers. For semi-medium area decrease from 38,193,000 hectares (24%) to 37,619,000 hectares (23.84%), while medium (4-10 hectares) decrease from 38,217,000 hectares (24%) to 31,810,000 hectares (20.16%) and large farmers area decrease from 21,072,000 hectares (13.2%) to 14,314,000 hectares (9.07%).

Despite the increase in net irrigated area from 20.85 million hectares in 1951 to 68.38 million hectares in 2014-15, it remains a mere 49% of the total net area sown. The electricity available in the rural agriculture field is also a problem as the sector only consume 20.06% or 173,185 GWh (2015-16).

According to the World Bank- India’s Poverty profile, from the total 270 million poor, 80% of the poor population live in rural areas. (Mehta, 2019) in his article, he states more than 20% of farmers are living below the poverty line (BPL), the majority of them belong to cultivators and agriculture labourers (144.3 million) and holders of marginal and small fields 11,76,05,000 (85%). The per capita availability of food grain is also 177.9 kgs per year (2016), and despite the food grain production increase almost five times from 50.8 million tonnes (1951) to 244.5 million tonnes (2011), the per capita availability also increases by 33.8 Kgs to 170.9 Kgs, from 144.1 Kgs per year in 1951.

Literature Review:

(Marta Kozicka, 2014) in her studies describe Indian food policies related to procurement, storage, distribution, and trade. She concludes that government involvement in food subsidy is responsible for price distortion, where government announcement of minimum support price (MSP) initiates the procedure to adjust the crop prices. (Lalit Kumar, 2019) also, elaborate on the same subject but suggest multiple strategies and the role of MSP in farmers income.

The research agrees with (Mehta, 2019) that the future of India rests with extending opportunities, especially to marginal and small farmers, and there is an urgent need to correct market mechanisms to help farmers in getting the just price for their produce.

(Gollin, 2018), work on farm size and productivity and its relationship with yield is in agreement with the current research, as research assumed yield does not depend solely on farm size. Even my earlier work (Ahmed, Inadequate Land Reforms Reason for Poverty and Social Unrest, 2014), (Ahmed, Multidimensional Poverty Index and Need to Revise the Methodology for Counting Poor, 2018) and (Ahmed, Poverty and Deprivation: Study of a most impoverished population for better management of resources, 2021) support the argument that land reforms are necessary as multidimensional poverty prevails in marginal and small farmers.

The research depends on government authenticate data for reliable statistics, government publication in different years like (Cost of Cultivation/Production & Related Data , 2017-18), (Pocket Book of Agricultural Statistics, 2017), (Agriculture Statistics at a Glance 2018, 2019), (All India Report on Number and Area of Operational Holdings, Agriculture Census 2015-16, 2019), (Rangarajan Report on Poverty, 2014) and (Economic Survey 2020-21) are
used. Another source of data includes Government Press notifications for CPI-All and MSP, besides consulting the FAO website for studying the latest development in the field.

The Masood’s Input-Cost- Survival model:

The input-cost and Survival model is a simple exploration of the production cost associated with crop cultivation. Data for different states was taken from government sources (Cost of Cultivation/Production & Related Data, 2017-18), and for this research, rice crop and the State of Andhra Pradesh was chosen. It is second in terms of product value behind Haryana and Punjab state, but Haryana and Punjab are much smaller in comparison to the Andhra Pradesh population and rice cultivation area.

The data provide details on operational cost, which consist of Human Labour (Family, attached and casual), Animal and Machine Labour, purchase of seeds, insecticide, fertilizer and manures, irrigation charges, crop insurance, payment to contractor and interest paid on working capital along with any miscellaneous charges needed for agricultural purposes under variable expenses category. At the same time, fixed cost expenses include rent paid for leased land, tax-related to agricultural land, depreciation on fixed assets, and interest on fixed assets.

The Minimum Support Price (MSP) 2021 is taken as the base for calculating income from the cultivation in Table 2, and the cost of production (2017-18) is adjusted for the current level of inflation.

(Gollin, 2018), from IFAD, research point out that yield is not affected much by farm size in India. The profitability depends on farm size due to the law of averages where labour productivity, use of technology, agriculture inputs give an advantage to farmers with the increase in farm size.

FAO statistics for productivity per hectare is preferred for uniformity, instead of taking a range of 2500-4366 Kgs/ha prevailing in different states and districts. However, the calculation based on the minimum and maximum yield provides the wide income gap between the rice farmers, who belong to different states, regions, and different quality, sizes, and are with or without irrigation facilities in their agricultural land-holdings.

Survival income denotes efforts by the farmer and his family, through which the family saves the amount they need to pay to outsiders during the process of agriculture production. It is the income that keeps a farmer to continue the occupation instead of moving to other areas. In the absence of survival income, if he sells the produce on MSP, the probability of loss is high.

Working of the model:
Results:

1. Marginal farmers (less than 1 hectare) remain in extreme poverty at the lower yield level (Table 6, 7 & 8), but even at a higher yield of cultivation, Marginal farmers are not earning enough, which can put them above the poverty level. They will remain in extreme poverty due to the unavailability of land and resources to cultivate it properly.

2. The analysis represents 99.85 million agriculture holdings belonging to marginal farmers and why they are forced to sell their land and work as either farm labour or manual labour in the unorganized sector.

3. In Andhra Pradesh, 5.94 million marginal farmers face extreme poverty and are subject to extreme hardship in the absence of just income from cultivation.

4. In the case of small farmers (1 to 2 hectares), a higher yield and if they can sell at MSP, they fall in a safe category while at a lower yield, their income is not enough, and they face moderate poverty (Table 6, 7 & 8). In Andhra 1.65 million, agriculture farmers belong to this category out of a total of 25.77 million in India.

5. Farmers who have to semi-medium, medium and large are safe under high yield and if they can get MSP rate for their crop. But semi-medium farmers find themselves in the vulnerable category at lower yield and while the other two categories are safe even at the lower rate of yield.

6. At the national level, holding agricultural land of an average size of 1.08 hectare higher side income means a farmer belong to the vulnerable category, while at the lower side, it falls straight into the extreme poverty category.

Conclusion:

When farmers able to get more than 20% over the listed MSP rate (Table 7), marginal farmers move up from the extreme poverty category to moderate poverty from high yield cultivation, while other categories move into the safe zone category. On low yield cultivation, marginal farmers remain in the extreme poverty category, but small and average farmers move up a category to the vulnerable and moderate poverty level.
If farmers can get a price 40% above MSP (Table 8) for their produce, then only marginal farmers remain moderately poor from high yield cultivation of rice variety. If they get a low yield for their cultivation, marginal farmers remain in extremely poor conditions while small and average holding farmers move to the vulnerable category.

The analytical data state that even a price above 40% of MSP is insufficient for marginal farmers cultivating rice, and very little relief is possible when they cultivate with a high yield variety. Data from (Agriculture Statistics at a Glance 2018, 2019) state that only 42% of marginal and 35% of small farmers has access to irrigation facilities. The agriculture land-holding pattern from the agriculture census shows that marginal, small and semi-medium categories operational holdings increase in 2015-16 compared to 2010-11 (All India Report on Number and Area of Operational Holdings, Agriculture Census 2015-16, 2019), while medium and large decline.

(Rangarajan Report on Poverty, 2014) state that Rs. 4,860 per month will be the poverty line for a family of five residing in a rural area. After adjusting the inflation rate, the current income must be above Rs 5931.63 per month in rural areas. On relating it with the income of marginal and small farmers, at a lower yield, both categories remain in extreme poverty condition, while at a higher yield, only marginal farmers suffer.

The research concludes that marginal and small farmers need different market rates well above MSP along with subsidies for agriculture inputs to improve their living. In the absence of a government safety net, the marginal and small farmers will face hardship and slowly move to the manual labour category.

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### Table 1: Cost of Production

|  | Prices: 2017-18 In Rs./ha | Inflation adjusted Cost of production Prices: 2020-21 Rs./ha. |
|---|--------------------------|----------------------------------------------------------|
| 1.1.1 | Human Labour | | |
| 1.1.1.1 | Family | 9797.35 | 10382.10 |
| 1.1.1.2 | Attached | 266.53 | 282.44 |
| 1.1.1.3 | Casual | 13124.70 | 13908.04 |
| 1.1.1.4 | Total | 23188.58 | 24572.58 |
| 1.2.1 | Animal Labour | | |
| 1.2.1.1 | Hired | 244.68 | 259.28 |
| 1.2.1.2 | Owned | 653.25 | 692.24 |
| 1.2.1.3 | Total | 897.93 | 951.52 |
| 1.3.1 | Machine Labour | | |
| 1.3.1.1 | Hired | 9731.30 | 10312.11 |
| 1.3.1.2 | Owned | 459.17 | 486.58 |
| 1.3.1.3 | Total | 10190.47 | 10798.68 |
| 1.4 | Seed | | |
| 1.4.1 | Fertilizer & Manure | | |
| 1.4.1.1 | Fertilizer | 7472.11 | 7918.08 |
| 1.4.1.2 | Manure | 750.85 | 795.66 |
| 1.4.1.3 | Total | 8222.96 | 8713.74 |
| 1.6 | Insecticides | | |
| 1.7 | Irrigation Charges | | |
| 1.8 | Crop Insurance | | |
| 1.9 | Payment to Contractor | | |
| 1.10 | Miscellaneous | | |
| 1.11 | Interest on Working Capital | | |
| 1.12 | Operational Cost (Total) | | |
| 2 | Fixed Costs (Total) | | |
| 2.1 | Rental Value of Owned Land | | |
| 2.2 | Rent Paid For Leased-in-Land | | |
| 2.3 | Land Revenue, Taxes, Cesses | | |
| 2.4 | Depreciation on Implements & Farm Building | | |
| 2.5 | Interest on Fixed Capital | | |
| 3 | Total Cost [1+2] | | |

Adopted from: DIRECTORATE OF ECONOMICS & STATISTICS, INDIA (2017-18)

Average Per hectare production is between 2500 - 4366 kgs in different Indian States

Adjusting impact of inflation (5.16%) increase in agricultural production prices between 2018 to 2021

Operational Cost = (1.1.1.1 + 1.2.1.1 + 1.3.1.1 + 1.4.1.1 + 1.5.1.1 + 1.6 + 1.7 + 1.8 + 1.9 + 1.11)

Fixed Cost = 2.1 + 2.2 + 2.3 + 2.4 + 2.5
Table 2: Calculation of Survival Income at different MSP

| Income | Income at MSP | 20% increase in SP over MSP | 40% increase in SP over MSP |
|--------|---------------|----------------------------|----------------------------|
| a1     | 96690.73      | 96690.73                   | 96690.73                   |
| a2     | 1888          | 2265.6                     | 2643.2                     |
| a3     | 18.88         | 22.656                     | 26.432                     |
| a4     | 4057          | 4057                        | 4057                        |
| a5     | 76596.16      | 91915.392                  | 107234.624                 |
| a6     | 4685.04       | 4685.04                    | 4685.04                    |
| a7     | 81281.20      | 96600.43                   | 111919.66                  |
| a8     | -15409.53     | -90.30                     | 15228.94                   |

Survival Income & Savings

| Income | Income at MSP | 20% increase in SP over MSP | 40% increase in SP over MSP |
|--------|---------------|----------------------------|----------------------------|
| b1     | 24572.58      | 24572.58                   | 24572.58                   |
| b2     | 5590.75       | 5590.75                    | 5590.75                    |
| b3     | 29246.24      | 29246.24                   | 29246.24                   |
| b4     | 444.34        | 444.34                     | 444.34                     |
| b5     | 2967.28       | 2967.28                    | 2967.28                    |
| b6     | 62821.18      | 62821.18                   | 62821.18                   |

Possible range of Income

| Income | Income at MSP | 20% increase in SP over MSP | 40% increase in SP over MSP |
|--------|---------------|----------------------------|----------------------------|
| c1     | 144102.38     | 159421.61                  | 174740.85                  |
| d1     | 47411.65      | 62730.89                   | 78050.12                   |

Table 3: International Poverty Criteria

| Poverty (World Bank) | $1=Rs 73.6 | Per month (Rs) |
|----------------------|------------|----------------|
| Extreme Poverty      | 1.9        | 139.84         |
| Moderate Poverty     | 3.1        | 228.16         |
| less than $5.5 vulnerable | 5.5      | 404.8          |

Table 4: Income range (High and Low yield) and at different MSP

| Rice Cultivation 120-150 days (4-5 months) |
|-------------------------------------------|
| Min. Support Price | 20% increase in SP over MSP | 40% increase in SP over MSP |
| Net Income | Net Income | Net Income | Net Income |
|------------|------------|------------|------------|
| Total income from cultivation (Rs.) from 4057 Yield (FAO) | 47411.65 | 62730.89 | 78050.12 |
| Per Month Income (Rs.) | 9482.33 | 12546.18 | 15610.02 |
| Total income from cultivation (Rs.) Min. Yield (2500) | 18015.49 | 27455.49 | 36895.49 |
| Per Month Income (Rs.) | 3603.10 | 5491.10 | 7379.10 |
Table 5: Categories of Land-Holdings

| Category                              | Year 2015-16 | %    | Area  | Avg. Size | In Andhra Pradesh |
|---------------------------------------|--------------|------|-------|-----------|-------------------|
| Marginal (Less than 1 hectare)        | 99858000     | 68.52| 37960 | 0.38      | 5904039           |
| Small (1.0 to 2.0 hectares)           | 25777000     | 17.69| 36435 | 1.41      | 1646246           |
| Semi-Medium (2.0 to 4.0 hectares)     | 13776000     | 9.45 | 37168 | 2.7       | 769843            |
| Medium (4.0 to 10.0 hectares)         | 5485000      | 3.76 | 31367 | 5.72      | 189034            |
| Large (10.0 hectares and above)       | 831000       | 0.57 | 14212 | 17.1      | 14748             |
| Total                                 | 145727000    | 100  | 157142| 1.08      | 8523910           |

Adapted from: Department of Agriculture, Cooperation & Farmers Welfare (Agriculture Census 2015-16, Phase-I)
Area Operated: ('000 Hectares)
Average size: (Hectares)

Table 6: Income-based on MSP at High and Low Yield

| Category                        | Avg. Size | Monthly Income at higher yield | Poverty Status (Higher Side) | Monthly Income at a Lower yield | Poverty Status (Lower Side) |
|---------------------------------|-----------|--------------------------------|-------------------------------|--------------------------------|------------------------------|
| Marginal (Less than 1 hectare)  | 0.38      | 3603.29                        | EP                            | 1369.18                        | EP                           |
| Small (1.0 to 2.0 hectares)     | 1.41      | 13370.1                        | S                             | 5080.37                        | MP                           |
| Semi-Medium (2.0 to 4.0 hectares)| 2.7       | 25602.3                        | S                             | 9728.37                        | V                            |
| Medium (4.0 to 10.0 hectares)   | 5.72      | 54238.9                        | S                             | 20609.7                        | S                            |
| Large (10.0 hectares and above) | 17.1      | 162148                         | S                             | 61613                          | S                            |
| Average Holdings                | 1.08      | 9482.33                        | V                             | 3891.35                        | EP                           |

Extreme Poverty=EP, less than $1.9 per day or Rs. 4195.02 per month
Moderate Poverty=MP, less than $3.1 per day or Rs. 6844.8 per month
Vulnerable =V, less than $5.5 per day or Rs. 12144 per month
Safe=S
Table 7: Income, when the market rate is 20% above MSP

| Size                              | Avg. Size | Monthly Income at higher yield | Poverty Status (Higher Side) | Monthly Income at a Lower yield | Poverty Status (Lower Side) |
|-----------------------------------|-----------|--------------------------------|-----------------------------|---------------------------------|-----------------------------|
| Marginal (Less than 1 hectare)   | 0.38      | 4767.548                       | MP                          | 2086.618                        | EP                          |
| Small (1.0 to 2.0 hectares)       | 1.41      | 17690.11                       | S                           | 7742.449                        | V                           |
| Semi-Medium (2.0 to 4.0 hectares) | 2.7       | 33874.68                       | S                           | 14825.97                        | S                           |
| Medium (4.0 to 10.0 hectares)     | 5.72      | 71764.14                       | S                           | 31409.08                        | S                           |
| Large (10.0 hectares and above)   | 17.1      | 214539.6                       | S                           | 93897.79                        | S                           |
| Average Holdings                   | 1.08      | 13549.87                       | S                           | 5930.387                        | MP                          |

Extreme Poverty=EP, less than $1.9 per day or Rs. 4195.02 per month
Moderate Poverty=MP, less than $3.1 per day or Rs. 6844.8 per month
Vulnerable =V, less than $5.5 per day or Rs. 12144 per month
Safe=S

Table 8: Income, when the market rate is 40% above MSP

| Size                              | Avg. Size | Monthly Income at higher yield | Poverty Status (Higher Side) | Monthly Income at a Lower yield | Poverty Status (Lower Side) |
|-----------------------------------|-----------|--------------------------------|-----------------------------|---------------------------------|-----------------------------|
| Marginal (Less than 1 hectare)   | 0.38      | 5931.808                       | MP                          | 2804.057504                     | EP                          |
| Small (1.0 to 2.0 hectares)       | 1.41      | 22010.13                       | S                           | 10404.52916                     | V                           |
| Semi-Medium (2.0 to 4.0 hectares) | 2.7       | 42147.05                       | S                           | 19923.56648                     | S                           |
| Medium (4.0 to 10.0 hectares)     | 5.72      | 89289.31                       | S                           | 42208.44454                     | S                           |
| Large (10.0 hectares and above)   | 17.1      | 266931.3                       | S                           | 126182.5877                     | S                           |
| Average Holdings                   | 1.08      | 16858.82                       | S                           | 7969.426592                     | V                           |

Extreme Poverty=EP, less than $1.9 per day or Rs. 4195.02 per month
Moderate Poverty=MP, less than $3.1 per day or Rs. 6844.8 per month
Vulnerable =V, less than $5.5 per day or Rs. 12144 per month
Safe=S