

Developing a financial rank to assess the financial performance of farm households

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ABSTRACT: Agrarian distress in India took its worst manifestation in the form of farmers' suicides. There is an absence of measures to assess the financial performance of a farm household (FHH) and it has been studied for farmers' decision-making. The FHH financial ranks were developed to assess the financial status of FHH based on their liquidity, solvency, profitability, capital debt repayment capacity, and financial efficiency. A total 45 FHH financial ranks were developed theoretically and evaluated for the empirical data from Yavatmal (India). The maximum 30%, 33%, and 30% of FHHs respectively for 2016-17 to 2018-19 were having the FHH financial rank 41 that represents insufficiency of the farm income to meet the domestic expenses, FHH not earned profit and liabilities vary from 2% to 32% of the total FHH assets. The FHH financial ranks can further aid the policy makers, voluntary organizations, banks, and decision makers to help the farmers.

KEYWORDS: Agrarian distress, agrarian crisis, farm household financial analysis, farm household financial performance measures, financial rank of the farm household.

I. INTRODUCTION

The complexities involved in the interactions of agriculture industrialization and liberalization of food and agriculture market provoked the agrarian distress that further manifested into economic and financial distress (Ploeg, 2010). Agrarian distress in developing countries has manifested the problems of indebtedness and declining nutrition for the majority of the poor, which has resulted in adverse employment possibilities and declining income (Patnaik, 2003). Changes in the agriculture sector have been driven by economic growth and cost/price squeeze, technological changes, public policies, and population pressure (Smith, et al., 2007). In India, agrarian distress has been recorded from the past 150 years. It has been manifested as farmer suicides from the last two decades despite having various agriculture policies and programs to address the distress (IGIDR, 2006; TISS, 2005; NCRB, 2015). Agriculture has become non-viable because of the increased input costs, repetitive and heavy credits, poor returns from cultivation, adverse influences of policies and markets, and absence of people centric planning (Mishra, 2008; Dhas, 2009; TISS, 2005; IGIDR, 2006; Sahay, 2010; Siddiqui, 2015; Mishra, 2009). These causes of agrarian distress have been reflected as changes in land use pattern, natural resource deterioration, economic deprivation, increased uncertainties and risk in cultivation, and changes in the social structure (Mishra, 2008; Dhas, 2009; TISS, 2005; IGIDR, 2006; Sahay, 2010; Siddiqui, 2015; Mishra, 2009; Pujari & Biru, 2007).

Various authors focused on economic aspects of the agrarian distress that included agricultural GDP, agriculture labor, gross yield, gross production, input cost, and average debt (Ploeg, 2010; Mishra, 2008; Dhas, 2009; Jodhka, 2012). However, linkages among the agriculture income, livelihood alternatives to the farming, migration, cash flow in agriculture, family size, and cattle population are not yet established (Dhas, 2009; Mishra, 2008; Siddiqui, 2015). Moreover, changes in farm and FHH with cost/price squeeze and technology change have not yet been studied (Smith, et al., 2007). The resources, household system, and output have to be studied collectively to develop an understanding particularly in agrarian societies (Roza, et al., 2017). The farm income analysis (including the cost of cultivation and crop earning) can be used to estimate the level of variability among different farm groups and to study the household level economics of farming (Severini, Tantari, & Di Tommaso, 2016; Surjit, 2017). The effects of agrarian distress on the financial condition of various levels of farm and farm household (FHH) are not yet studied. The financial performance measures (FPMs) convey the total resources controlled by a business and total claims against those resources at a single point in time (Selvavinayagam, 1991) and can be used to understand, compare, and analyse different agriculture farms, farm cooperatives, and a cluster of farms across panel data (Chase, 2008; Rotan, 2005; Langemeier & Jones, 2000; Ahrendsen & Katchova, 2012). The FPMs indicate the capacity of the business to withstand risk

from future farming operations and provide a benchmark to measure the results of future business decisions. Moreover, the FPMs consider external forces (drought, heavy rain, etc.) and the results of operating and financing decisions made (Financial Guidelines For Agriculture Producers, 2011). There area total of 21 FPMsgrouped in five key measures:liquidity, solvency, profitability, financial efficiency, and repayment capacity (Chase, 2008; Financial Guidelines For Agriculture Producers, 2011; Ahrendsen & Katchova, 2012) as given in

Table 1. The necessary possible FPMs have to be selected from the listed 21 FPMs based on their attributes and limitations (Alan, Cole, Craig, & Michael, 2001; Chase, 2008; Sharma, 2012).The effects of agrarian distress on finances of the farm and FHH can be measured using the five key measures. In this study, a set of indicators representing the five key measures are combined to rank the FHHs. The developed rank, which is named as ‘Farm HouseholdFinancial Rank’ is computed for the empirical data collected from sampled FHHs from three different villages in Yavatmal district (Figure 1) of Maharashtra, India over a period of three years.Out of 270,940 farmer suicides reported in India from 1995 to 2015, maximumwere from Yavatmal district (Sarkunde, 2014; NCRB, 2015). The Yavatmal district represents the worst scenario of agrarian distress in India, and hence it is selected as study area.

Table 1: Financial Performance Measures

	Financial performance measures	Equation
I	Liquidity	
1	Current Ratio	Total current assets / Total current liabilities
2	Working Capital	Total current farm assets – Total current farm liabilities
3	Working Capital / Gross Revenues Ratio	Working capital / Gross revenues
II	Solvency	
4	Debt / Asset Ratio	Total farm liabilities / Total farm assets
5	Equity / Asset Ratio	Total farm equity / Total farm assets
6	Debt / Equity Ratio	Total farm liabilities / Total farm equity
III	Profitability	
7	Rate of Return on Farm Assets	(Net farm income + Farm interest expense – Unpaid labor and management) / Average total farm assets
8	Rate of Return on Farm Equity	(Net farm income – Unpaid labor and management) / Average total farm equity
9	Operating Profit Margin Ratio	(Net farm income + Farm interest expense – Unpaid labor and management) / Gross revenues
10	Net Farm Income, Accrual adjusted revenues	Expenses to create revenues + Gain or loss in business assets
11	Earnings before interest, taxes, depreciation, and amortization	Net farm income + Interest expense + Depreciation expense + Amortization expense
IV	Repayment capacity	
12	Capital debt repayment capacity	Net farm income + Miscellaneous earning + Non-farm income + Depreciation – Income tax – Owner withdrawals – Interest on term debt
13	Capital Debt Repayment Margin	Capital debt repayment capacity – Total uses of repayment capacity.
14	Replacement Margin	Capital debt repayment margin – Replacement allowance / Unfunded capital expenditures.
15	Term Debt and Capital Lease Coverage Ratio	Capital debt repayment capacity / Total principal and interest on term debt
16	Replacement Margin Coverage Ratio	Capital debt repayment capacity / (Total uses of repayment capacity + Replacement allowance)
V	Financial efficiency	
17	Asset Turnover Ratio	Gross revenues / Average total farm assets
18	Operating Expense Ratio	(Total operating expenses – Depreciation expense) / Gross revenues
19	Depreciation/Amortization Expense Ratio	Depreciation expense / Gross revenues
20	Interest Expense Ratio	Total farm interest expense / Gross revenues
21	Net Farm Income from Operations Ratio	Net farm income / Gross revenues

Developed using (FFSC, 2014; Selvavinayagam, 1991; Ahrendsen & Katchova, 2012).

Financial performance measures selected for developing the FHH financial rank.

II. METHODOLOGY

From the 21 FPMs listed under five key measures (liquidity, solvency, profitability, repayment capacity, and financial efficiency), representative FPMs were selected for each of the five key measures. The representative FPMs were classified under the good, average, and poor zones based on the benchmark values. The benchmark values to classify the zones of representative FPMs were decided based on their equations and obtained values. The indices for five key measures were developed based on the zones of representative FPMs and combined logically. The not plausible combinations were removed and plausible combinations of the indices for key measures were developed as the farm household financial ranks. The developed FHH financial ranks were computed for the empirical evidence. The survey was conducted at farm households to generate empirical evidence. The survey format included financial data for annual expenses on food, festivals, health education, agriculture, travelling, and annual earnings from agriculture, wages, trading, and service providing. The survey format also included the asset valuation of agriculture, non-farm livelihood, and household. The loan and saving details were captured in the survey along with the income from agriculture and non-farm livelihood. For the surveyed FHHs, the FPMs and FHH financial ranks were computed.

For conducting the survey, a quota sampling method was used to get the cases in each predominant category to reflect the diversity of the population (Neuman, 2013). The predominant categories of agriculture identified in Yavatmal are irrigated / non-irrigated land and tribal / non-tribal habitats (Census of India, 2011; Yavatmal Collector Office, 2012; Dongare, 2013). Three villages namely Indiragram, Malkhed, and Pathari, have been identified in Yavatmal for the study (Table 2 and Figure 1). The designed survey format was used to conduct 150 FHH surveys in three villages (50 FHHs in each village) to include maximum possible variations of the farm households and snowball-sampling method was used to consider different cases based on the referral by previous cases. The data was collected for three consecutive years 2016-17, 2017-18, and 2018-19 (with the same FHHs) to capture the annual variations due to external factors like drought, pest attack, and government scheme. The financial data was collected in the Indian currency Rupee (₹).

Table 2. Sampled villages

	Indiragram	Malkhed	Pathari
Tehsil	Maregaon	Ner	Kelapur
Households	192	575	385
Population	760	2,319	1,241
Working population	68%	37%	57%
Literacy rate	Male (80%), Female (59%)	Male (91%), Female (77%)	Male (82%), Female (67%)
Majority population	ST (95%)	OBC (74%)	SC (39%), ST (17%), OBC and NT (44%)
Irrigated land	0%	70%	40%
Non-irrigated land	100%	30%	60%
Remarks	2nd and 3rd generation farmers, hilly terrain, got the farm in the land sealing act.	Black soil, large landholding	Mixed population, mixed soil type

(Census of India, 2011)

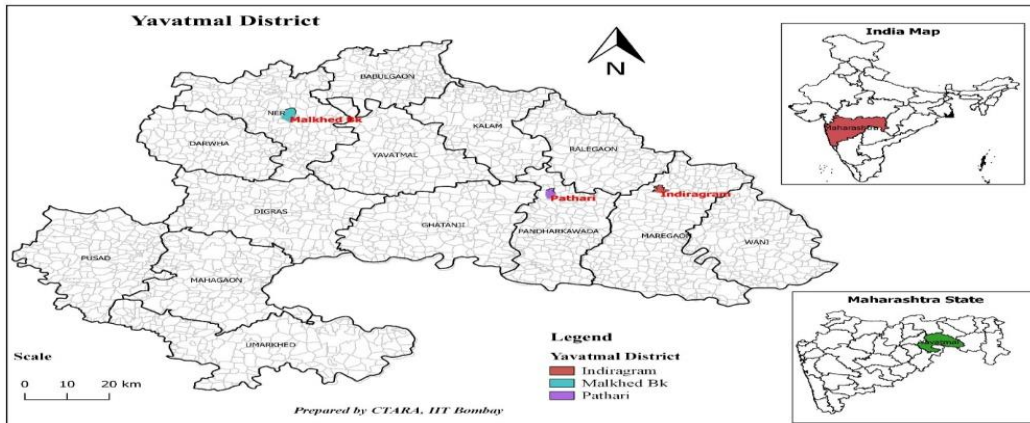


Figure 1. Yavatmal District Map
(SDG group CTARA, IIT Bombay, 2019)

III. FARM HOUSEHOLD FINANCIAL RANKING

Indices for developing a rank : The FHH financial rank have been developed to represent the financial behaviour of FHH with five key measures (liquidity, solvency, profitability, repayment capacity, and financial efficiency). The FPMs representing each of the five key measures have been selected from 21 listed FPMs in Table 1. As per the attributes and limitations of the FPMs (Alan, Cole, Craig, & Michael, 2001; Sharma, 2012), the selected FPMs must be aligned with the objective, it should be easily understood, it should measure the aspects controllable by the farmers, and it should convey the necessary information.

Liquidity index (LI) : The liquidity can be conveyed by three FPMs (Table 1, point 1, 2, and 3) current ratio, working capital, and working capital to gross revenue ratio. Out of these three FPMs, the current ratio is easy to understand, measurable at the farmers' end, and conveys the ability to meet financial obligations. As this study focuses on the financial performance of both the farm and farm household (FHH), the current ratio for both the farm and FHH has to be considered. The current ratio of a farm named as Farm Earning Ratio (FER) conveys the ability of a farm to meet the financial obligations (Equation 1) and the current ratio of FHH named FHH Earning Ratio (HER) conveys the ability of FHH to meet the financial obligations (Equation 4). The value of FER greater than one conveys that farm income is greater than farm expenses and the value of HER greater than one conveys that FHH income is more than FHH expenses.

$$\text{Farm earning ratio (FER)} = \frac{\text{Farm earning}}{\text{Farm expenses}} \tag{Equation 1}$$

$$\text{Farm earning} = \text{Sum of earnings from} \left(\begin{array}{c} \text{Renting out agriculture land and} \\ \text{equipment, Insurance,} \\ \text{Animal and animal based products} \\ \text{and Crop production} \end{array} \right) \tag{Equation 2}$$

$$\text{Farm expenses} = \text{Sum of expenses on} \left(\begin{array}{c} \text{Farm maintenance, Insurance amount,} \\ \text{Animal rearing, crop cultivation} \end{array} \right) \tag{Equation 3}$$

$$\text{Farm household earning ratio (HER)} = \frac{\text{Farm household earning}}{\text{Farm household expenses}} \tag{Equation 4}$$

$$\text{Farm household earning} = \text{Sum of the earning from} \left(\begin{array}{c} \text{Farm, Nonfarm livelihood} \\ \text{sources, Interest earned} \\ \text{on saving, and} \\ \text{Remittance economy} \end{array} \right) \tag{Equation 5}$$

$$\text{Farm household expenses} = \text{Sum of expenses on} \left(\begin{array}{c} \text{Farm, Nonfarm livelihood} \\ \text{sources, Interest paid on loan,} \\ \text{Domestic requirments} \end{array} \right) \tag{Equation 6}$$

The FHH earning ratio (HER) and farm earning ratio (FER) together cannot give the capacity of farm earning to meet the domestic expenses of the FHH. Hence, the Farm Net Income to Domestic Expenses ratio (FNIDE) has been newly introduced to give the relation between farm net income and total domestic expenses (Equation 7). The value of FNIDE greater than one indicates that the farm net income is sufficient for the domestic expenses and FNIDE less than one indicates that the farm net income is not sufficient for the domestic expenses.

$$\text{Farm net income to domestic expenses (FNIDE)} = \frac{\text{Farm net income}}{\text{Total domestic expenses}} \tag{Equation 7}$$

$$\text{Domestic expenses} = \text{Sum of expenses on} \left(\begin{array}{c} \text{Food, Festivals, Health,} \\ \text{Education, Domestic equipment,} \\ \text{Traveling, Miscellaneous} \end{array} \right)$$

$$\text{Farm net income} = \text{Farm income} - \text{Farm expenses}$$

Farm income – refer Equation 2

Farm expenses – refer Equation 3

The FER, HER, and FNIDE values below one are considered in a poor zone, and the value above one is considered in a good zone. The Liquidity Index (LI) is developed using the combinations of good zones and poor zones of FER, HER, and FNIDE. Among these three FPMs, HER describes the operational strength of overall

FHH and hence it is considered at the first position for the combinations. The FNIDE describes the strength of farm income to meet the domestic expenses, and is considered at second position for the combinations. The FER is considered at third position for the combinations describing the operational strength of farm. Logically, there are eight combinations of HER, FNIDE, and FER based on good and poor zones (

Table 3). The two combinations, NP1 and NP2 are not plausible because farm net income to domestic expenses ratio (FNIDE) cannot be in the good zone with the farm earning ratio (FER) in the poor zone and not taken ahead. The remaining six plausible combinations named as Liquidity Index one to six (LI1 to LI6) are described in

Table 3.

Table 3: Liquidity indices

LI	HER	FNIDE	FER	Description
LI1	G	G	G	Farm earning is sufficient to spend on domestic expenses, and FHH is in profit.
LI2	G	P	G	Farm earning is not sufficient to spend on domestic expenses, but FHH is in profit. It means that domestic expenses are taken care of by farm and non-farm livelihood sources.
LI3	G	P	P	Farm is at loss, but FHH is in profit. It means that personal expenses are managed by non-farm livelihood sources only.
LI4	P	G	G	Farm earning is sufficient to spend on personal expenses, but HH is at loss. It means that non-farm earning source is at loss.
LI5	P	P	G	Farm earning is not sufficient to spend on personal expenses, and HH is at loss. It means that HH loss is due to insufficient farm income and/or loss in non-farm income.
LI6	P	P	P	Farm is at loss, and HH is at loss. It means that HH loss is because of the loss in the farm and/or loss in non-farm income.
NP1	G	G	P	Not Possible - these combinations are not possible because FER in poor zone means net farm income is less than zero, and hence it is not possible to spend farm income on domestic expenses.
NP2	P	G	P	

LI – Liquidity index, HER – FHH earning ratio, FNIDE – Farm net income to domestic expenses ratio, FER – Farm earning ratio, G – Good zone HER/FNIDE/FER > 1, P – Poor zone HER/FNIDE/FER < 1

Solvency index (SI) : The solvency can be conveyed by three FPMs(

Table 1 point 4, 5, and 6) debt to asset ratio, equity to asset ratio, and debt to equity ratio. Out of these three FPMs, debt to asset ratio is easy to understand, measurable at the farmers' end, and conveys the ability to repay all financial obligations if all assets were sold. The debt to asset ratio of farm household (FHH) named as Debt to FHH Asset Ratio (HDAR) conveys the ability of FHH to meet the financial obligations if all assets were sold (Equation 8).

$$\text{Debt to farm household asset ratio (HDAR)} = \frac{\text{Total liabilities}}{\text{Total assets}}$$

Equation 8

$$\text{Total liabilities} = \text{Sum of} \left(\begin{array}{l} \text{farm expenses, expenses on nonfarm livelihood sources,} \\ \text{domestic expenses, interest paid on loan, pending liabilities} \end{array} \right)$$

$$\text{Total assets} = \text{Sum of} \left(\begin{array}{l} \text{farm earning, earning from nonfarm livelihood sources,} \\ \text{interest earned on saving, remittance economy, farm asset,} \\ \text{nonfarm livelihood asset, household asset, total savings} \end{array} \right)$$

Equation 9

The values of HDAR should be minimum and tends to zero with the less liabilities and more assets. The good, average, and poor zones of debt to FHH asset ratios for the FHHs in India are not available. Hence, the zones for HDAR are classified using mean value and standard deviation of the HDAR data. This can be applied in a context of geographical region and particular time, to understand the solvency of FHH as given in Table 4.

The increase in the value of HDAR indicates the increase in liabilities and/or decrease in the assets. Hence, the poor zone of HDAR is marked as the values greater than the sum of the mean value of HDAR and its standard deviation. The good zone of HDAR is marked as the values less than the mean value of HDAR minus its standard deviation. The average zone of the HDAR is in-between the good zone and the poor zone. The Solvency Index (SI) is further developed based on the good, average, and poor zones of debt to FHH asset ratio (HDAR). The good zone of the HDAR is marked as solvency index one (SI1), the average zone as solvency index two (SI2), and the poor zone of HDAR is marked as solvency index three (SI3), which is described in

Table 4: Solvency indices

SI	Zones	Description
SI1	Good zone = $HDAR < [mean(HDAR) - SD(HDAR)]$	Minimum liabilities against the available assets; hence the risk is minimum.
SI2	Average zone = $[mean(HDAR) - SD(HDAR)] < HDAR < [mean(HDAR) + SD(HDAR)]$	Moderate liabilities against the available assets; hence, the risk is moderate.
SI3	Poor zone = $[mean(HDAR) + SD(HDAR)] < HDAR$	Higher liabilities against the available assets; hence the risk is maximum.

SI – Liquidity index, HDAR – debt to FHH asset ratio, SD – Standard deviation

1.1.1. Profitability index (PI)

The profitability can be conveyed by five FPMs (

Table 1 point 7,8,9,10, and 11) rate of return on asset, rate of return on equity, operating profit margin ratio, accrual adjusted revenue, and EBTDA. Out of these five FPMs, the rate of return on asset is easy to understand, measurable at the farmers' end, and conveys the ability to generate a profit using the available assets. The rate of return on asset named as the Rate of Return on FHH asset (HROR) conveys the ability of farm households (FHH) to generate a profit using farm assets, assets of non-farm livelihood sources, and household assets (Equation 10).

$$\text{Rate of return on farm household asset (HROR)} = \frac{\text{Farm household net income}}{\text{Total farm household assets}}$$

Equation 10

$$\text{Farm household net income (HNI)} = \text{Farm household earning} - \text{Farm household expenses}$$

Equation 11

Farm household earning – refer Equation 5

Farm household expenses – refer Equation 6

Total farm household asset – refer Equation 9

The values of HROR should be maximum with more income against the assets and should be greater than zero. Because of the absence of good, average, and poor zones of rate of return on FHH asset for the FHHs in India, the zones for HROR are classified using mean value and standard deviation of the HROR data. This can be applied in a context of geographical region and particular time to understand the profitability of FHH as given in Table 5.

The increase in the value of HROR indicates the increase in the FHH net income and/or decrease in the total assets. Hence, the good zone of HROR is marked as a value greater than the sum of the mean values of HROR and its standard deviation. The value of HROR should be greater than zero to earn a profit, and hence a poor zone of HROR is marked below the zero value. The average zone of the HROR is in between the good zone and the poor zone. The Profitability Index (PI) is further developed based on the good, average, and poor zones of rate of return on FHH assets (HROR). The good zone of the HROR is marked as profitability index one (PI1), the average zone is marked as profitability index two (PI2), and the poor zone of HROR is marked as profitability index three (PI3), which is described in Table 5.

Table 5: Profitability indices

PI	Zones	Description
PI1	Good zone = $HROR > [mean(HROR) + SD(HROR)]$	Higher FHH net income against the available assets.
PI2	Average zone = $[mean(HROR) + SD(HROR)] > HROR > 0$	Moderate FHH net income against the available assets.
PI3	Poor zone = $0 > HROR$	Zero or negative FHH net income against the available asset.

PI – Profitability index, HROR – rate of return on FHH asset, SD – Standard deviation

Repayment capacity index (RI) : The repayment capacity can be conveyed by five FPMs(

Table 1 point 12, 13, 14, 15, and 16) capital debt repayment capacity, debt repayment margin, replacement margin, term debt and capital lease coverage ratio, and replacement margin coverage ratio. Out of these five FPMs, capital debt repayment capacity is easy to understand, measurable at the farmers' end, and conveys the

ability to repay the debt from the farm and nonfarm livelihood sources. There are no direct taxes applicable to the farmers in India, hence after removing the tax terms from capital debt repayment capacity it has been observed that the FHH Net Income (HNI)(

Table 1 point 2) is similar as of the capital debt repayment capacity. Therefore, capital debt repayment capacity has been named as farm household net income (HNI) and it conveys the net income of the FHH from the farm and non-farm livelihood. Moreover, HNI conveys the capacity of FHH to repay the debt (Equation 11).The values of HNI should be maximum with more income and less expenses in farm and non-farm livelihood sources. Because of the absence of good, average, and poor zones of FHH net income for the FHHs in India, the zones for HNI are classified using the mean value and standard deviation of the HNI data. This can be applied in a context of geographical region and particular time, to understand the repayment capacity of FHH as given in

Table 6.The increase in the value of HNI indicates the increase in FHH earning and/or decrease in FHH expenses. Hence, the good zone of HNI is marked as the values greater than the sum of the mean value of HNI and its standard deviation. The value of HNI should be greater than zero to repay the debt, and hence the poor zone of HNI is marked below the zero value. The average zone of the HNI is between the good zone and the poor zone. The Repayment capacity Index (RI) is further developed based on the good, average, and poor zones of FHH net income (HNI). The good zone of the HNI is marked as repayment capacity index one (RI1), the average zone is marked as repayment capacity index two (RI2), and the poor zone of HNI is marked as repayment capacity index three (RI3), which is described in

Table 6.

Table 6: Repayment capacity indices

RI	Zones	Description
RI1	Good zone = $HNI > [mean(HNI) + SD(HNI)]$	High FHH net income; hence high debt amount can be repaid.
RI2	Average zone = $[mean(HNI) + SD(HNI)] > HNI > 0$	Moderate FHH net income; hence, moderate debt amount can be repaid.
RI3	Poor zone = $0 > HNI$	Zero or negative FHH net income; hence unable to repay the debt.

RI – Repayment capacity index, HNI – farm household net income, SD – Standard deviation

Financial efficiency index (FI) : The financial efficiency can be conveyed by five FPMs(

Table 1point 17,18,19,20, and 21) asset turnover ratio, operating expenses ratio, depreciation/amortization expenses ratio, interest expenses ratio, and net farm income from operations ratio. Out of these five FPMs, asset turnover ratio is easy to understand, measurable at the farmers' end, and conveys the intensity to use the assets to generate gross revenues. It has been observed that the rate of return on farm household asset (HROR) (

Table 1point 7) is similar to the asset turnover ratio and it conveys the efficiency of the use of farm household asset to generate revenue. The HROR has been used to define the Profitability Index (PI) (section 1.1.1) and hence the same index has been used to define the Financial efficiency Index (FI).

Rank development : Out of the five indices, as mentioned in the earlier sub-section the profitability index and financial efficiency index are found to be similar. Hence, the combinations of four indices, liquidity index, solvency index, repayment capacity index, and profitability/financial efficiency index are used to develop a single indicator named as FHH Financial Rank. To build a sequence of occurrence of indices in the Table 7, the first index is profitability/financial efficiency index to indicate the ability of the FHH to earn a profit. The liquidity index is in the second position to indicate the ability of FHH to meet the financial obligations, ability of farm to meet the financial obligation, and ability of farm to meet the domestic expenses of FHH. The third position is for the solvency index to indicate the ability to repay all the financial obligations by dissolving the assets. The fourth position is for the repayment capacity index to indicate the ability of FHH to repay the debt. There are three profitability/financial efficiency indices (PI1 to PI3, Table 5), six liquidity indices (LI1 to LI6, Table 3), three solvency indices (SI1 to SI3, Table 4), and three repayment capacity indices (RI1 to RI3, Table 6). There are 162 logical combinations; from these 162 combinations, the not possible 117 combinations are removed (Table 7) and possible 45 combinations are given inTable 8. A FHH financial rank number 37 to 45 indicates the poor profit-earning efficiency, FHH is in loss, and such FHHs are not able to save money at the

end of the year. The FHH financial ranks from 7 to 18, 25 to 36, and 40 to 45 indicates that the farm income is not sufficient for domestic expenses and such FHHs need the non-farm livelihood source and/or to improvise the net farm income. The FHH financial ranks 13 to 18, 31 to 36, and 43 to 45 indicate the loss in farm income. The FHH financial ranks 5, 6, 11, 12, 17, 18, 23, 24, 29, 30, 35, 36, 39, 42, and 45 indicates the financial risk due to high liabilities of the FHH and ranks 37 to 45 indicates the poor debt repayment capacity of the FHH.

Table 7: Not-possible combinations of the indices LI, SI, PI, RI, and FI

Indices				Remarks
PI/ FI	LI	SI	RI	
PI1	LI4	x	x	9
PI1	LI5	x	x	9
PI1	LI6	x	x	9
PI2	LI4	x	x	9
PI2	LI5	x	x	9
PI2	LI6	x	x	9
PI3	LI1	x	x	9
PI3	LI2	x	x	9
PI3	LI3	x	x	9
PI1	x	x	RI3	9
PI2	x	x	RI3	9
PI3	x	x	RI1	9
PI3	x	x	RI2	9
Total not possible combinations				11
				7

PI – Profitability index, FI – Financial efficiency index, LI – Liquidity index, SI – Solvency index, RI – Repayment capacity index, G – Good zone, A – Average zone, and P – Poor zone, x – don’t care condition.

Table 8: Combinations of the indices LI, SI, PI, RI, and FI to develop a farm household financial rank

Rank	Indices			
	PI/FI	LI	SI	RI
1	PI1	LI1	SI1	RI1
2	PI1	LI1	SI1	RI2
3	PI1	LI1	SI2	RI1
4	PI1	LI1	SI2	RI2
5	PI1	LI1	SI3	RI1
6	PI1	LI1	SI3	RI2
7	PI1	LI2	SI1	RI1
8	PI1	LI2	SI1	RI2
9	PI1	LI2	SI2	RI1
10	PI1	LI2	SI2	RI2
11	PI1	LI2	SI3	RI1
12	PI1	LI2	SI3	RI2
13	PI1	LI3	SI1	RI1
14	PI1	LI3	SI1	RI2
15	PI1	LI3	SI2	RI1
16	PI1	LI3	SI2	RI2
17	PI1	LI3	SI3	RI1
18	PI1	LI3	SI3	RI2
19	PI2	LI1	SI1	RI1
20	PI2	LI1	SI1	RI2
21	PI2	LI1	SI2	RI1
22	PI2	LI1	SI2	RI2
23	PI2	LI1	SI3	RI1
24	PI2	LI1	SI3	RI2
25	PI2	LI2	SI1	RI1
26	PI2	LI2	SI1	RI2
27	PI2	LI2	SI2	RI1
28	PI2	LI2	SI2	RI2
29	PI2	LI2	SI3	RI1
30	PI2	LI2	SI3	RI2
31	PI2	LI3	SI1	RI1
32	PI2	LI3	SI1	RI2
33	PI2	LI3	SI2	RI1
34	PI2	LI3	SI2	RI2
35	PI2	LI3	SI3	RI1
36	PI2	LI3	SI3	RI2
37	PI3	LI4	SI1	RI3
38	PI3	LI4	SI2	RI3
39	PI3	LI4	SI3	RI3
40	PI3	LI5	SI1	RI3
41	PI3	LI5	SI2	RI3
42	PI3	LI5	SI3	RI3
43	PI3	LI6	SI1	RI3
44	PI3	LI6	SI2	RI3
45	PI3	LI6	SI3	RI3

PI – Profitability index, FI – Financial efficiency index, LI – Liquidity index, SI – Solvency index, RI – Repayment capacity index, G – Good zone, A – Average zone, and P – Poor zone.

It is mandatory to upgrade the FPMs from the poor zones and it is precautionary to stop degrading the FPMs below average zone by changing farm income, FHH income, and financial risk as given in Table 9. The farm income can be increased by increasing farm productivity with low cost and high yielding sustainable agriculture practices, by increasing cultivable land, or by selling the crop at a good price. The FHH income can be improved by increasing the farm income, increasing the income from non-farm livelihood activities, or by

reducing the domestic expenses. The risk involved in the financial operations of the FHH can be reduced by reducing the loan amount or increasing the assets.

Table 9: Mandatory and precautionary steps to improve and/or maintain 45 developed farm household financial ranks

T R	A	B	C	D	E	F	G	H	I	J	K
1											
2	P	P	P	P	P	P	P				P
3				P			P	P	P	P	P
4	P	P	P	P	P	P	P	P	P	P	P
5				M			M	M	M	M	M
6	P	P	P	M	P	P	M	M	M	M	M
7	M	M	M	M			M				
8	M	M	M	M	P	P	M				P
9	M	M	M	M			M	P	P	P	P
10	M	M	M	M	P	P	M	P	P	P	P
11	M	M	M	M			M	M	M	M	M
12	M	M	M	M	P	P	M	M	M	M	M
13	M	M	M	M			M				M
14	M	M	M	M	P	P	M				M
15	M	M	M	M			M	P	P	P	M
16	M	M	M	M	P	P	M	P	P	P	M
17	M	M	M	M			M	M	M	M	M
18	M	M	M	M	P	P	M	M	M	M	M
19	P		P	P		P	P				
20	P	P	P	P	P	P	P				P
21	P		P	P		P	P	P	P	P	P
22	P	P	P	P	P	P	P	P	P	P	P
23	P		P	M		P	M	M	M	M	M
24	P	P	P	M	P	P	M	M	M	M	M
25	M	M	M	M		P	M				
26	M	M	M	M	P	P	M				P
27	M	M	M	M		P	M	P	P	P	P
28	M	M	M	M	P	P	M	P	P	P	P
29	M	M	M	M		P	M	M	M	M	M
30	M	M	M	M	P	P	M	M	M	M	M
31	M	M	M	M		P	M				M
32	M	M	M	M	P	P	M				M
33	M	M	M	M		P	M	P	P	P	M
34	M	M	M	M	P	P	M	P	P	P	M
35	M	M	M	M		P	M	M	M	M	M
36	M	M	M	M	P	P	M	M	M	M	M
37	M	M	M	M	M	M	M				M
38	M	M	M	M	M	M	M	P	P	P	M
39	M	M	M	M	M	M	M	M	M	M	M
40	M	M	M	M	M	M	M				M
41	M	M	M	M	M	M	M	P	P	P	M
42	M	M	M	M	M	M	M	M	M	M	M
43	M	M	M	M	M	M	M				M
44	M	M	M	M	M	M	M	P	P	P	M
45	M	M	M	M	M	M	M	M	M	M	M

R – FHH financial rank, 1 to 45 referTable 8, T – Suggestions to improve the rank, A – Improve farm productivity, B – Increase cultivable land, C – Sell crop at a good price, D – Reduce farm expenses by maintaining or improving the productivity, E – Select non-farm livelihood options, F – Improve productivity of non-farm livelihood sources, G – Reduce unnecessary domestic expenses, H – Increase necessary farm asset, I – Increase necessary non-farm livelihood assets, J – Increase necessary domestic assets, K – Reduce loan amount, P – Precautionary measures, M – Mandatory measures.

Ranks of farm households in Yavatmal : The collected data is computed for FPMs of all 150 FHHs using the Equation 1 to Equation 11. The three years (2016-17, 2017-18, and 2018-19) average values (with standard deviation) of six different FPMs required for computing financial ranks of the FHH is given in Table 10 with the zones of each FPMs. The zones of the FPMs have been created as given in Table 3 (for HER, FNIDE, and FER), Table 4(for HDAR),Table 5(for HROR), and Table 6(for HNI).

Table 10: Financial performance measures computed for the collected data

FPM	U	Average	SD	Good zone	Average zone	Poor zone
PI & FI	HROR		0.005	0.057	HROR > 0.062	0.062 > HROR > 0
LI	HER		1.044	0.313	HER > 1	1 > HER
	FNIDE		0.551	0.663	FNIDE > 1	1 > FNIDE
	FER		1.913	0.879	FER > 1	1 > FER
SI	HDAR		0.175	0.156	HDAR < 0.019	0.019 < HDAR < 0.331
RI	HNI	₹	15264	92018	HNI > 107282	107282 > HNI > 0

FPM – Financial performance measures, U – Unit, SD – Standard deviation

The financial ranks of farm household (FHH) are computed and the percentage of FHHs in each of the rank has been plotted in Figure 2. The FHH financial rank is a pioneering concept and hence there is no other reference to compare. It is observed that maximum 30%, 33%, and 30% of FHHs respectively in the study duration (2016-17 to 2018-19) are having FHH financial rank 41 with poor profit earning efficiency, FHH is not earning income, and farm income is not sufficient for the domestic expenses. Moreover, FHH financial rank 41 informs that the FHHs are earning income from farm, liabilities are average (between 2% and 32% of total FHH assets), and debt repayment capacity is poor. It is mandatory for the FHHs in rank 41 to improve farm productivity, select non-farm livelihood options, and reduce unnecessary domestic expenses and loans. Moreover, it is precautionary for the FHHs in rank 41 to increase the farm and non-farm livelihood source assets.

Similarly, it is observed that 21%, 19%, and 18% of FHHs respectively in the study duration are having FHH financial rank 28 with average profit earning efficiency (0% to 6.2% of the FHH assets), FHH is earning income, and farm income is sufficient for domestic expenses. Moreover, FHH financial rank 28 explains that the FHHs are earning income from farm, liabilities are average (2% to 33% of FHH assets), and debt repayment capacity is average (₹ 0 to ₹ 107,282). It is mandatory for the FHHs with rank 28 to improve farm productivity and reduce unnecessary domestic expenses. Moreover, it is precautionary for the FHHs in rank 28 to select non-farm livelihood options, reduce the unnecessary loan amount, and increase farm assets and non-farm livelihood source assets. The drought (in the year 2017-18 and 2018-19), pink bollworm attack on the cotton (in the year 2017-18), and crop loan waiver scheme is reflected in the developed ranks. The continuous increase in the number of FHHs from the year 2016-17 to 2018-19 in the ranks 42, 44, and 45 indicate the loss in income of FHHs, insufficient income or loss in a farm, and moderate or high liabilities because of the drought and pest attack. The continuous decrease in the number of FHHs in the ranks 22, 28, and 30 from the year 2016-17 to 2018-19 is because of the decreased profitability of FHH, inability to meet the domestic expenses from farm earning, and increased liabilities of the FHH due to drought and pest attack.

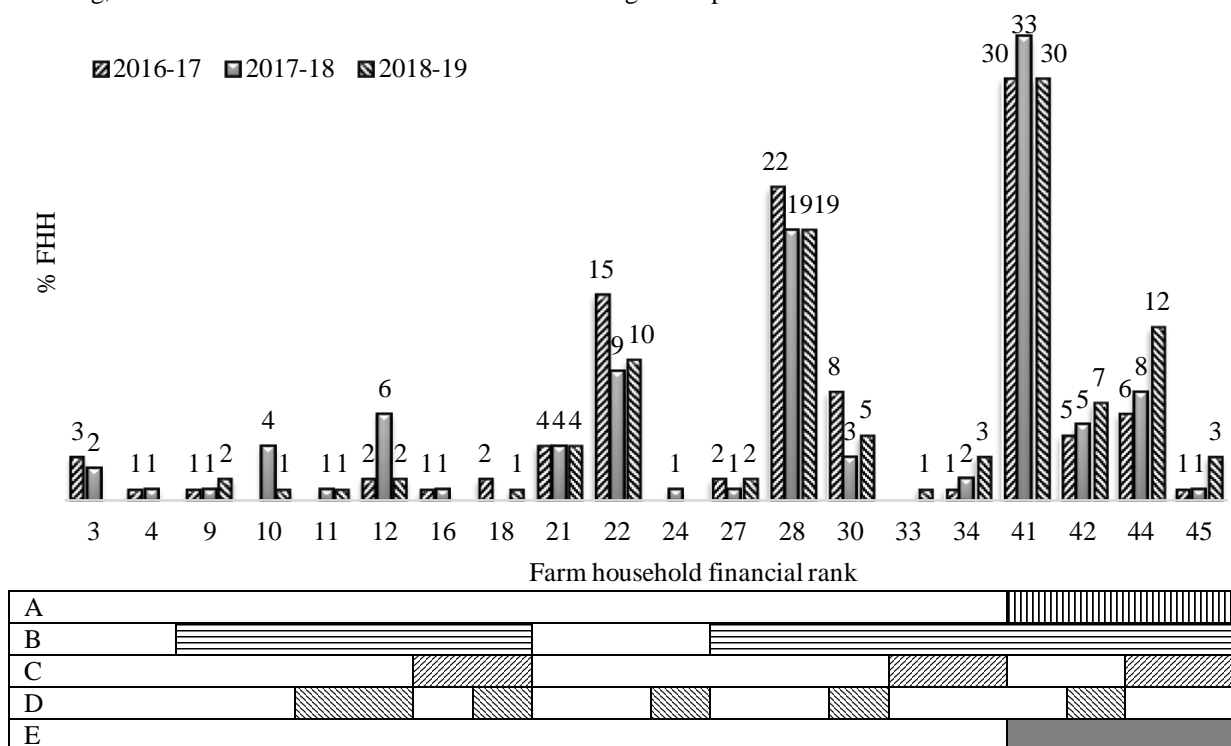


Figure 2: Farm household financial ranks computed for the sampled farm households in Yavatmal in study duration 2016-17 to 2018-19

Farm household financial rank – Table 8, Ranks not having representative FHHs are not considered in the graph. A – Loss of FHH, B – Inadequacy of farm income to meet domestic expenses, C – Loss in farming, D – Taking financial risk, E – Inability to repay the debt.

Of the surveyed FHHs, ranks of 21% FHHs were scaled down and ranks of 24% FHHs were scaled up in 2017-18 with respect to the ranks in 2016-17 (Figure 3). Of the surveyed FHHs, 37% FHHs were seen to scale down their financial ranks, and 16% of the surveyed FHHs were seen to scale up their financial ranks in 2018-19 with

respect to their financial ranks in 2017-18. Overall, 37% of the surveyed FHHs were seen to scale down their financial ranks, and 18% of the surveyed FHHs were seen to scale up their financial ranks in 2018-19 with respect to their financial ranks in 2016-17.

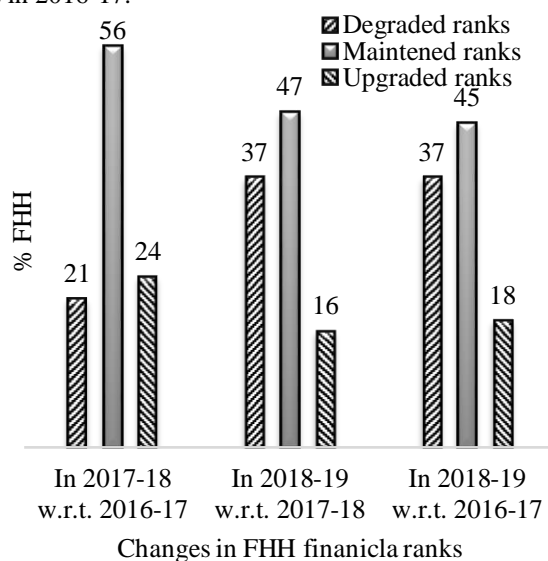


Figure 3: Changes in farm household financial ranks during 2016-17 to 2017-18, 2017-18 to 2018-19, and 2016-17 to 2018-19 computed for the sampled farm households in Yavatmal

IV. CONCLUSION

The developed 45 FHH financial ranks convey the profit earning efficiency of FHH, ability of the farm and FHH to meet financial obligations, and ability of farm income to meet the domestic expenses. Moreover, the FHH financial ranks also convey the ability of the FHH to meet all the financial obligations after selling all the assets and the capital debt repayment capacity of the FHH. The current work has been able to identify the FHHs trapped in a vicious cycle of debt based on the zones created for the six FPMs using the sampled data from the agrarian distress area Yavatmal and subsequently with the FHH financial ranking. In addition, the current work has been able to identify the farmers putting their assets at risk, inefficient utilization of assets, and finding the debt repayment capacity of the FHHs. The FHH financial ranks developed in the study area can be computed for the rest of the Yavatmal region. Moreover, the FHH financial ranks can help identify the possible defaulters in loan repayment, the FHHs entirely dependent on farming, and the need for upgrading/supplementing/changing the farming livelihood. In addition, the FHH financial ranks can be useful for policymakers and district planners in the design and implementation of farm-based policy interventions and the farmers in their financial decision-making. The methodology developed for the FHH financial ranking can be replicable in India and similar other regions.

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