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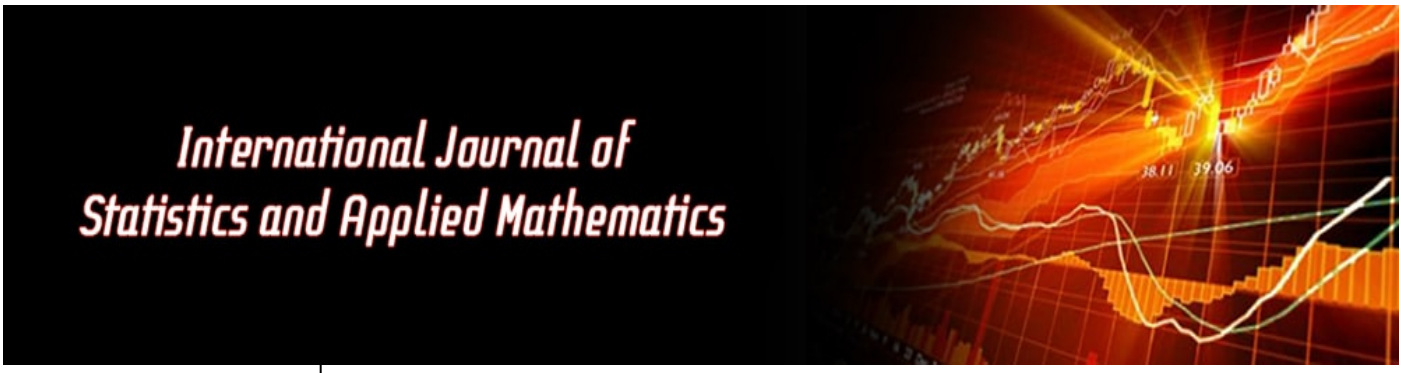

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Farm diversification as a suitable tool for addressing risk in farming: An empirical evidence from economic evaluation of farming systems in central dry zone of Karnataka

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Abstract
Farming in the Central Dry Zone (CDZ) of Karnataka is predominantly rainfed and majority of farmers are small and marginal, facing numerous challenges. Given the situation, diversification becomes imperative to address economic hardships of farmers. The present study was conducted to analyze performance of farming systems Credit and savings behaviour of farmers in CDZ. Four major farming systems *viz*., Crop+ Sheep, Crop+ Dairy, Crop+ Horticulture+ Dairy and Crop+ Horticulture were considered for indepth analysis. The required data were collected using pre tested schedules through personal interview from 180 respondents, comprising of 45 farmers practicing each of these chosen farming systems. Data were analysed using descriptive statistics and suitable functional analysis. The results on Herfindahl index used to know the diversification in sources of income revealed that the farming systems comprised of diary component were emerged as the most diversified farming systems. Among the four farming systems, Crop+ Horticulture+ Dairy system was found to be the most profitable with higher per acre net returns (₹ 4,04,757) followed by Crop+ Sheep, Crop+ Dairy and Crop+ Horticulture. The results on credit behaviour of farmers showed that 31.11 per cent farmers practicing C+H+D farming system, o fall under 50 to 75 per cent repayment category followed by 28.89 per cent of them in 25 to 50 per cent repayment category, nearly one-fourth showed high repayment (75-100%) rate and only 15.56 per cent belonged to poor (0 to 25%) repayment category. Further, C+H+D farming system practicing farm households could save more (₹ 1,98,703) compared to other farming systems. Better performance of C+H+D farming system can be attributable to higher net return in this system. The results on multiple linear regression to delineate factors determining saving by farm household showed that area under annual crops, number of livestock and area under horticulture crops were the major determinants in all the farming systems.

Keywords: Farming systems, CDZ, Diversification, herfindahl index

Introduction
Food is an essential requirement for all, yet regrettably, the harsh reality in India is that the farmers who toil to produce this sustenance often find themselves at the lowest rung of the economic hierarchy. The agricultural sector serves as the lifeblood of the Indian economy, as demonstrated by its remarkable resilience. During the initial quarter of the 2020-21 financial year, when India's economy contracted by 24 per cent due to the COVID-19 pandemic, the agriculture sector not only withstood the crisis but also managed to achieve a positive growth rate of 3.4 per cent. This provided a glimmer of hope for economic recovery. India accounts for 48 per cent of the world's arable land and is home to 25 per cent of the global farming population. The agricultural sector contributes approximately 17 per cent to the nation's revenue and offers direct or indirect employment to roughly two-thirds of the total population (Srivastava, 2020) [15]. However, the Indian agricultural sector grapples with a multitude of challenges that have often overshadowed its opportunities. These obstacles include inconsistent policy frameworks, convoluted land records, unsustainable and unscientific

cropping patterns, limited adoption of modern technologies, insufficient irrigation infrastructure, bottlenecks in both backward and forward linkages, all of which render farmers susceptible to exploitation by middlemen and ill-equipped to cope with the impacts of shifting climate patterns.

It is commonly observed that bumper agricultural production often results in lower income for farmers due to price crashes and the inelastic nature of demand. This paradox, where poverty persists despite abundant agricultural output, vividly illustrates the challenges facing the agricultural sector. India has indeed emerged as a prominent producer of various agricultural commodities and has transitioned from a state of dependency during its post-independence era to a significant player in global agricultural trade. The issue of agrarian distress is complex and multifaceted, and it tends to exacerbate over time. Among the contributing factors are the lack of profitability in agricultural production, the ineffectiveness of the Minimum Support Price system, unfavourable terms of trade despite inflation in agricultural commodity prices, which effectively turns farmers into net buyers, an inability to repay their debts, and an inefficient value chain in reaching final consumer. These factors collectively push farmers into a vicious cycle of poverty (Bhoi and Dadhich, 2019) [5]. This factors ultimately results poor economic condition of farmers and poor financial behaviour of farmers.

Diversification represents a promising solution to above stated problems where one agricultural enterprise complements or supplements another. This strategy is particularly crucial for small-scale farmers, whose income often falls short of covering their family's consumption expenses. Apart from increasing income, diversification offers several additional benefits, including food and nutritional security, employment generation, poverty alleviation, prudent land and water use, environmental betterment and sustainable agricultural development. Additionally, diversification involves deriving income from multiple sources. Landless and marginal farmers often rely heavily on wages, while within the farm, livestock plays a pivotal role. The contribution of livestock to farm income has seen a notable increase, rising from four percent in 2002-03 to 12 percent in 2012-13 (Satyasai and Mehrotra, 2016) [10]. This underscores the ample potential to boost farmers' income by adopting a farming systems approach within the farm. Thereby, improves financial credibility of farmers.

Agriculture in Central Dry Zone (CDZ) of Karnataka

Agriculture in the CDZ of Karnataka has traditionally been characterized by dryland farming practices, and a significant proportion of the farming community consists of small and marginal landholders. Initially, farmers in this region relied on dryland farming techniques. However, in recent times, the proliferation of borewell irrigation has prompted farmers to transition towards cultivating high-value commercial crops that demand more water for sustainable growth over the long term. With natural resources depleting rapidly, a farmer struggles to achieve net returns of about ₹ 10000 from cultivating an acre. As the average landholding size continues to shrink over the years and profit margins remain slim, farmers find it increasingly challenging to even meet their basic needs. Given these circumstances, the imperative for diversification is not only evident but also essential.

Within this framework, current study was initiated with primary objective to uncover a viable integrated farming system model rooted in the existing farming practices. With this background, the present study was taken up to know the profitability of major farming systems and analyse the factors influencing credit and saving behaviour of farmers practicing different farming systems in the study area.

Materials and Methods

Study area

The present study was taken up in the Central Dry Zone (CDZ) of Karnataka (Zone-4) which was known for frequent hit by droughts. This zone covers an area of 1.94 million hectares. The annual rainfall ranges from 454-718 mm of which more than 55 per cent is received during *kharif* season. The elevation ranges between 450-900 m and the soils are red sandy loams in major areas, shallow to deep black in the remaining areas.

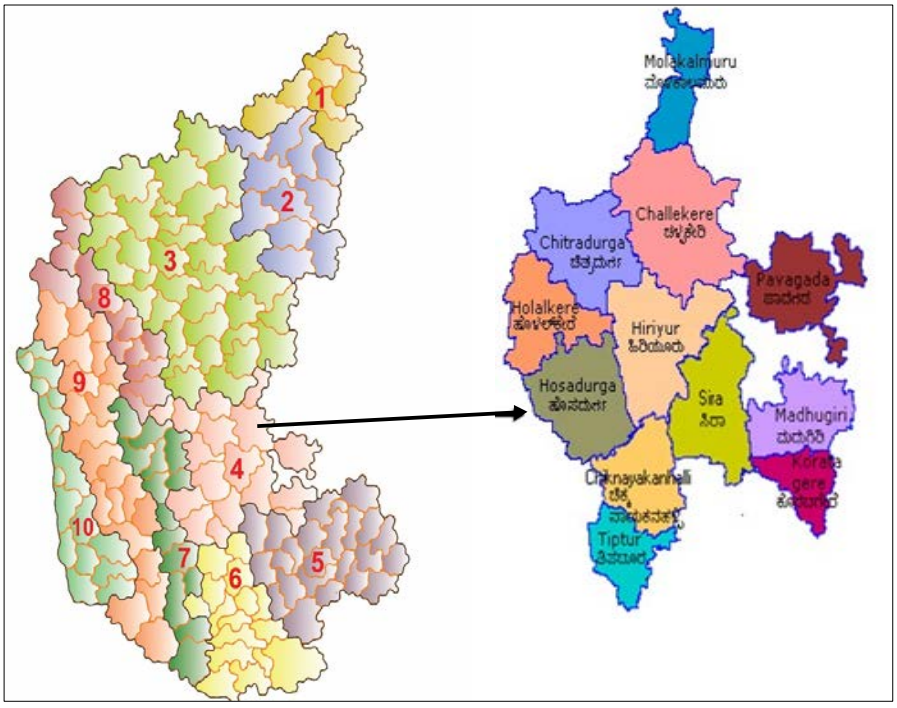


Fig 1: Map of the study area

Sampling procedure

For the present study purposive multistage random sampling procedure was used. Seven taluks *viz*., Hiriyur, Holalkere and Hosadurga in Chitradurga district, Arsikere taluk in Hassan district and Chikkanaykana Halli, Sira and Tiptur taluks in Tumakuru districts were selected in proportion to the geographical size of these three study districts of the CDZ. These three districts make up the cynosure of the entire Central Dry Zone.

Among the numerous farming systems prevalent in the study area, four major farming systems of *viz*., Crop+ Sheep, Crop+ Dairy, Crop+ Horticulture+ Dairy, Crop+ Horticulture were considered for indepth analysis. Primary data were collected from the 180 randomly selected farmers at the rate of 45 farmers practicing each of the farming system considered for analysis, using the pre-tested well-structured schedule through personal interview method during May-June, 2023. Data regarding activities of the farming practices like details on cost incurred in cultivation of the field crops and horticulture crops, economics of the livestock enterprises, inventories, details of by-products and their usage in other enterprises and output derived from various enterprises including price realised and marketing details were collected from the sample farmers practicing the identified farming systems. The data were analysed using descriptive statistics and various cost and returns concepts. In order to know the diversity in sources of household income was assessed using Herfindahl index while factors influencing savings of sample farm households were delineated using the multiple linear regression analysis.

Herfindahl index

It is the sum of the square of the proportion of income from an enterprise to the total income of a farm household.

It is represented as:

$$HI = \sum_{i=1}^{N} Yi^2 \quad (1)$$

Where, $Y_i = \frac{Y_j}{Y_t}$

Y_j = Income from j^{th} enterprise for a farm household

Y_t = Total income of a farm household

The index value approaching one indicate specialization and value moving towards zero indicates higher degree of diversification.

Multiple linear regression analysis

To determine the factors influencing savings of the farm households, multiple linear regression model as specified below was employed, which was estimated using OLS method.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 \quad (2)$$

Where,

Dependent variable

Y – Savings of the farm household

Independent variables

X_1 – Age of the head of the household (Years)

X_2 – Area under annual crops (acres)

X_3 – Family size (No.)

X_4 – Education level of the head of the household [Years of schooling]

X_5 – Milch animal (No.)

X_6 – Sheep (No.)

X_7 – Area under horticulture crops (acres)

Results and Discussion

Socio-economic features of respondents

It is established fact that the socio-economic factors of the farmers have great bearing on the farm business, composition of enterprises, production, financial behaviour, marketing practices and decision-making ability. Hence the information on some of the important features of respondents were collected, analysed and are presented in Table-1.

Table 1: Socio-economic characteristics of farmer respondents in the study area (in numbers)

Particulars	C+S (n=45)	C+D (n=45)	C+H+D (n=45)	C+H (n=45)	Test value
I. Age Group					
Below 35 years	15 [33.33]	16 [35.56]	12 [26.67]	10 [22.22]	χ^2=5.79^{NS}
35-50 years	19 [42.22]	23 [51.11]	24 [53.33]	21 [46.67]	
Above 50 years	11 [24.44]	6 [13.33]	9 [20.00]	14 [31.11]	
Average age (Years)	**50**	**49**	**49**	**50**	
II. Education					
Illiterate (0 years)	6 [13.33]	2 [4.44]	3 [6.67]	5 [11.11]	χ^2=23.72 **
Primary (5 years)	17 [37.78]	9 [20.00]	6 [13.33]	4 [8.89]	
Secondary (10 years)	10 [22.22]	16 [35.56]	14 [31.11]	17 [37.78]	
PU (12 years)	11 [24.44]	12 [26.67]	13 [28.89]	9 [20.00]	
Degree (15/16 years)	1 [2.22]	6 [13.33]	9 [20.00]	10 [22.22]	
Average Years of Schooling	**7**	**8**	**9**	**10**	
III. Family Size					
a. Small (1-3)	7 (15.56)	5 (11.11)	9 (20.00)	13 (28.89)	χ^2=6.77^{NS}
b. Medium (4-5)	21 (46.67)	26 (57.78)	24 (53.33)	22 (48.89)	
c. Large (>5)	17 (37.78)	14 (31.11)	12 (26.67)	10 (22.22)	
Average family size	5.82	6.07	5.44	5.08	
Average land holding (ha)	2.58	3.18	4.36	4.31	

Note: figures in brackets represent percentage to the respective totals: C+S: Crop + Sheep, C+D: Crop + Dairy, C+H+D: Crop + Horticulture + Dairy and C+H: Crop + Horticulture

It could be noticed from the results that majority of farmer respondents fall in the medium sized family category (4 to 5 no.) across all farming systems. In all the four farming systems, majority of the respondents belong to middle age group category (35-50 years of age). Most of the respondents were literates and the proportion of illiterates was higher in C+S (13.33 %) fallowed by C+H (11.11 %) system. The Chi-square value indicated that there was a significant difference

in education level of the sample respondents practicing different farming systems, indicating literacy has positive relation with extent of enterprise selection and extent of farm diversification. There was no significant divergence between the groups with respect to the other socio- economic characteristics indicating that the samples were homogeneous and hence they can be meaningfully compared.

Cost and return structure from different farming systems on sample farms

The details on cost and return structure from the identified farming systems as a whole are represented in Table 2. It could be observed from the table that C+H+D gave the highest profits (₹ 4,04,757/annum) to the farmer with a net returns per rupee expenditure of 1.46. The C+S system was found to be the next best system with net returns of ₹ 2,98,352 per farm/annum and returns per rupee of expenditure of 1.60. These findings are in line with the study conducted by Kavyashree (2016) [6] wherein she reported integrated farming system comprising of Crop+ Dairy+ Small ruminents was relatively more profitable. Net returns from C+D and C+H were ₹ 2,82,274 per farm/annum and ₹ 2,19,180 per farm/annum, respectively, with the corresponding returns of ₹ 1.53 and ₹ 1.33 for every rupee of expenditure. Thus, the farming systems with animal component, dairying proved to be economically more viable.

Table 2: Costs and returns of major farming systems in the study area (₹/annum)

Particulars	C+S (n=45)	C+D (n=45)	C+H+D (n=45)	C+H (n=45)	F value
Cost incurred	4, 95, 072	5, 37, 455	8, 87, 486	6, 64, 879	22.145**
Gross Returns	7, 93,424	8, 19, 729	12, 92, 243	8, 84, 059	22.819**
Net Returns	2, 98, 352	2, 82, 274	4, 04, 757	2, 19, 180	30.787**
Returns per rupee of expenditure	1.60	1.53	1.46	1.33	
Herfindahl Index	0.74	0.63	0.48	0.73	

Note: ** indicates significant at five per cent level of probability
C+S: Crop + Sheep, C+D: Crop + Dairy, C+H+D: Crop + Horticulture + Dairy and C+H: Crop + Horticulture.

Herfindahl index used to know the extent of income diversification across the farming systems confirmed that the C+H+D system (0.48) was found to be the more diversified system followed by C+ D farming system (0.63), C+H farming system (0.73) and C+S farming system (0.74).

Purpose of credit borrowed by farmers across major farming systems

As mentioned earlier, the study region is prone to be more vulnerable to various natural calamities and comprised of higher proportion of small farmers. Hence, due to lower marketable surplus and lower income level, they have adopted diversified farming systems and dependent on various financial intermediaries to meet the fund requirement for their farm operations. It could be observed from the results presented in table -3 that in case of C+D farming system, little more than forty per cent of the farmers borrowed loans for purchase of livestock followed by crop loan (40 %), bore well (13.33%), pump set (13.33%) and land development (8.89%).

Table 3: Purpose of credit borrowed by farmers across major farming systems (No. of farmers)

Purpose	C+S (n=45)	C+D (n=45)	C+H+D (n=45)	C+H (n=45)
Crop cultivation	12 (26.67)	18 (40.00)	39 (86.67)	34 (75.56)
Livestock purchase	5 (11.11)	20 (44.44)	14 (31.11)	-
Education	5 (11.11)	5 (11.11)	12 (26.67)	7 (15.56)
Borewell	6 (13.33)	6 (13.33)	13 (28.89)	10 (22.22)
Dwelling House construct	-	2 (4.44)	5 (11.11)	5 (11.11)
Pump Set purchase	4 (8.89)	6 (13.33)	11 (24.44)	10 (22.22)
Tractor purchase	4 (8.89)	6 (13.33)	7 (15.56)	5 (11.11)
Land development	5 (11.11)	4 (8.89)	9 (20.00)	6 (13.33)
Retail shop	2 (4.44)	1 (2.22)	-	-
Vehicles purchase	1 (2.22)	2 (4.44)	6 (13.33)	3 (6.67)

Note: Figures in parentheses indicates percentage to total sample size: C+S: Crop + Sheep, C+D: Crop + Dairy, C+H+D: Crop + Horticulture + Dairy and C+H: Crop + Horticulture

Similarly, in the case of farmers following C+H+D farming system 87 per cent of the farmers borrowed loans for cropcultivation, followed by purchase of livestock (31.11%), bore well (28.89 %) and education (26.67%). One-fifth (20 %) of the farmers availed loan for land development since respondents under this farming system depend more on income from agriculture than from animal husbandry. Similarly, in C+H farming system also majority of the farmers' borrowings were for crop production (75.56 %) followed by borewell (22.22 %), pump set (22.22 %), and land development (13.33%). Crop loans were the main category of loans availed by the respondents practicing chosen farming systems in the study. In case of C+H+D and C+H, borewell, pump set and land development loans were more compared to C+S and C+D farming systems since both in C+H+D and C+H farming systems, farmers were growing horticulture crops, which require higher investment on the land development, planting and other activities requiring more investment during establishment period, besides these crops require more water for irrigation than field crops.

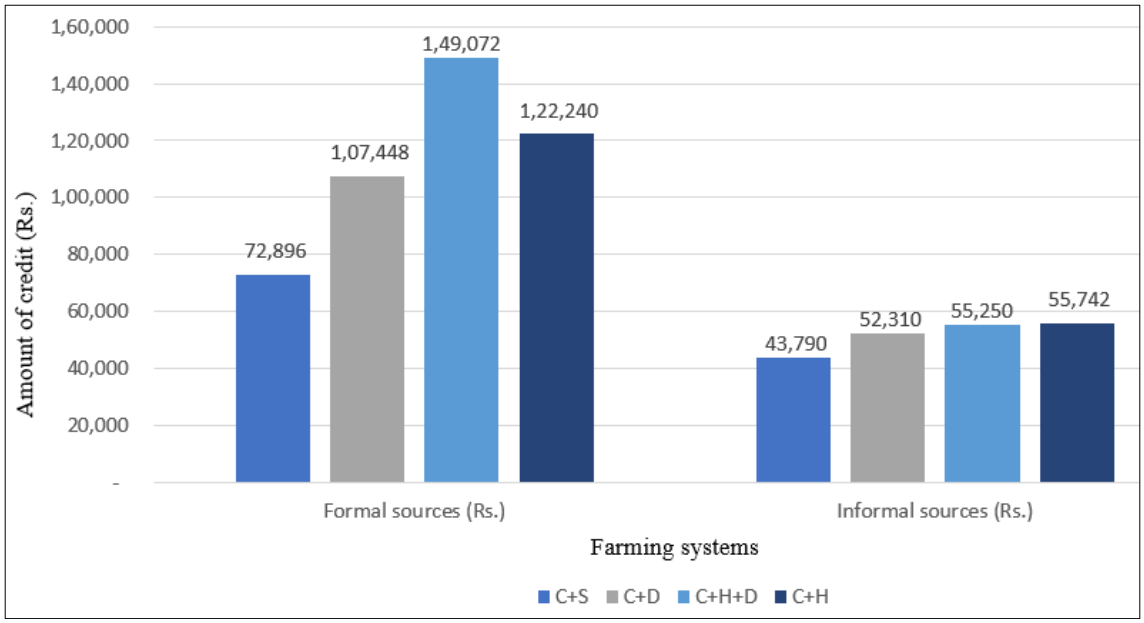


Fig 2: Total credit borrowed from different sources across major farming system Note: C+S: Crop + Sheep, C+D: Crop + Dairy, C+H+D: Crop + Horticulture + Dairy and C+H: Crop + Horticulture.

Source-wise credit borrowed by the respondents following different farming systems

Total credit borrowed from different sources across the different farming systems indicated that the quantum of credit borrowed was more in the case of farmers practicing C+H+D (₹ 2,04,322) farming system followed by C+H (₹ 1,77,982) farming system, C+D (₹ 1,59,758) farming system and C+S (₹ 1,16,686) farming system (Fig. 2). It is evident from the results that the proportion of amount borrowed from formal sources out of total credit borrowed by the respondents worked out to be 62.47 per cent, 67.26 per cent, 72.96 per cent and 68.68 per cent, by C+S, C+D, C+H+D, C+H farming systems respectively.

It is worth noting that farmers practicing of C+S farming system borrowed more from informal sources compared to farmers of other farming systems, as these farmers have least exposure to formal source of finance might be due to poor financial literacy and education. However, across all the farming systems, the quantum of credit borrowed was more from the formal sources compared to informal sources. These results are in accordance with those reported by Anwarul and Prerna (2015) [3].

Utilization pattern of credit by the respondents

The nature and extent of credit utilization availed from the institutional and non-institutional sources for agriculture and non-agriculture purpose revealed there was diversion of credit from the purpose for which it was borrowed, as the utilization was not cent per cent to the purpose for which it was borrowed. The utilization pattern of credit in respect of farmers practicing four major farming system is presented in Table 4. The crop loan obtained by the respondents practicing C+S farming system, C+D farming system, C+H+D farming system and C+H farming system were not utilized cent per cent for the purpose of crop production, instead they utilized only 41.67 per cent, 44.44 per cent, 58.97 per cent and 55.88 per cent for crop production. This may be attributable to the fact that lower savings with the farmers prompted them to divert to meet their urgent personal and household needs.

Table 4: Utilization of credit for the purpose it was intended (%)

Particulars	C+S		C+D		C+H+D		C+H	
	Purpose (No.)	Utilized (No.)	Purpose (No.)	Utilized (No.)	Purpose (No.)	Utilized (No.)	Purpose (No.)	Utilized (No.)
Crop loan	12	5(41.67)	18	8(44.44)	39	23(58.97)	34	19(55.88)
Live Stocks Purchase	5	4(80.00)	25	25(100.00)	14	14(100.00)	-	--
Education	5	6(120.00)	6	8(133.33)	12	16(133.33)	7	8(114.29)
Borewell	6	6(100.00)	8	9(112.50)	13	15(115.38)	10	10(100.00)
Dwelling House	-	--	4	4(100.00)	5	5(100.00)	5	5(100.00)
Pump Set purchase	4	4(100.00)	6	12(200.00)	11	21(190.91)	10	18(180.00)
Tractor purchase	4	4(100.00)	6	6(100.00)	7	7(100.00)	5	6(120.00)
Land development	5	5(100.00)	7	4(57.14)	9	5(55.56)	6	2(33.33)
Retail shop	2	2(100.00)	1	1(100.00)	-	--	-	--
Vehicles purchase	1	1(100.00)	2	3(150.00)	6	5(83.33)	3	5(166.67)

Note: Figures in parentheses represent per cent utilization: C+S: Crop + Sheep, C+D: Crop + Dairy, C+H+D: Crop + Horticulture + Dairy and C+H: Crop + Horticulture

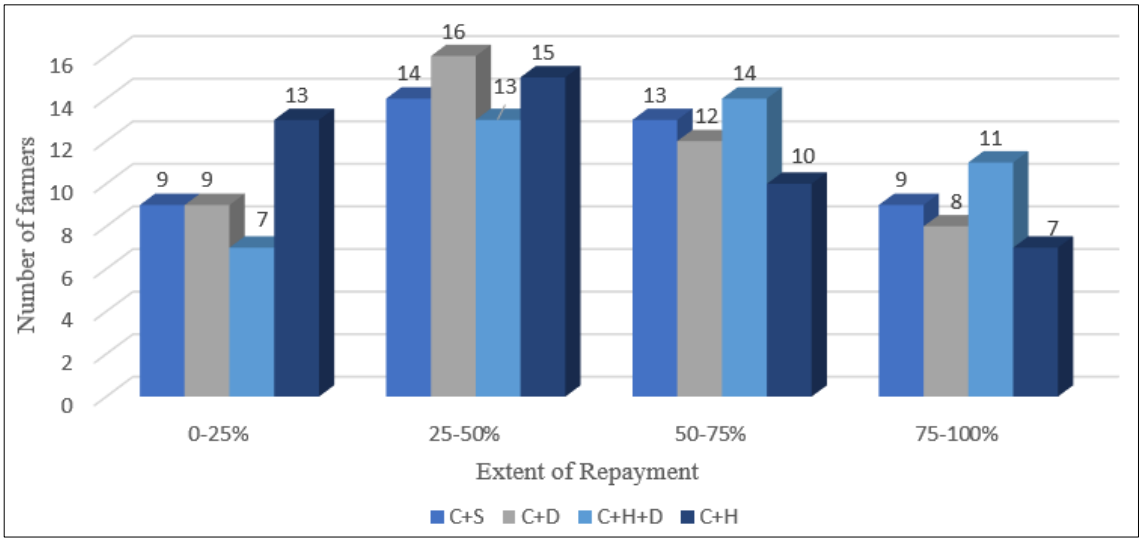
With respect to livestock loan, in the case of both the C+D farming system and C+H+D farming system, entire amount of livestock loan was utilized for livestock rearing but in C+S farming system the utilization was only 80 per cent and remaining amount was diverted to other purposes. In case of education loans, the expenditure was more than 100 per cent of their borrowing in C+S farming system, C+D farming system, C+H+D farming system and C+H farming system (120 %, 133.33%, 133.33 % and 114.29 %, respectively), this was due to the fact that some of the respondents diverted

loans borrowed for some other purposes towards educational expenses of their children. The respondents practicing C+S farming system and C+H farming systems utilized bore well loan completely in its intended purpose but in case of respondents practicing C+D farming system and C+H+D farming system, the actual expenditure was more than loan amount, as they have diverted the loan amount from other category loans for digging of bore well, which was due to under-financing or cost escalation of some of the items. This may be also due to the fact that the farmers practicing these farming systems with horticulture component which require more and regular water, since ground water being the main source of irrigation in the study area, hence diverted loans for creation of irrigation structures. Another reason for cent per cent and even more expenditure than sanctioned in the case of bore well credit is due to increasing demand for water in agriculture and allied enterprises due to lack of normal rainfall in recent years, cost escalation year after year and more intensive cultivation practices.

Repayment performance of farm households across major farming systems

Repayment of the borrowed loan is very important from the farmers' point of view to avoid the chance of paying penal rate of interest for delayed repayment and also important for recycling of credit, growth, development and smooth functioning of the banking sector. The farmers were categorized based on the extent of repayment across major farming systems. It could be observed from Fig. 2 that 20 per cent of respondents practicing C+S farming system, 17.78 per cent of C+D farming system, 24.44 per cent of C+H+D farming system and 15.56 per cent of C+H farming system practicing farmers fall under the category of higher repayment rate (75 to 100%). In C+S farming system, 31.11 per cent of the borrowers fall under low repayment category (25 to 50%), 28.89 per cent of them showed medium repayment (50 to 75 %) and 20 per cent of them with very poor repayment rate (0 to 25 %).

In the case of C+H+D farming system, 31.11 per cent of the borrowers fall under 50 to 75 per cent repayment category followed by 28.89 per cent of them in 25 to 50 per cent repayment category, nearly one-fourth showed high repayment (75-100%) rate and only 15.56 per cent belonged to poor (0 to 25%) repayment category. Whereas, in the case of in C+H farming system, relatively higher proportion cent of the sample farmers (33.33 %) falls under 25 to 50 per cent repayment category followed by poor repayment category (28.89 %), medium repayment category (22.22 %) and the high loan repayment category (15.56 %).



Note: C+S: Crop+Sheep, C+D: Crop+Dairy, C+D+H: Crop+Dairy Horticulture, C+H: Crop+Horticulture.

Fig 2: Distribution of farmers based on extent of repayment across different farming system

The repayment performance was very heartening with respect to C+H systems, as around 63 per cent of farmers were belong to less than 50 per cent repayment category because of crop losses, uncertain and low-price realization for their produce leading to lower net farm income. Thus, it can be inferred that the farmers with higher net income showed better repayment which is directly linked with the degree of diversification and resultant net income of the farm households.

Savings among farm households

It is evident from the Table 5 that, the savings with farmers those practicing C+H+D (₹ 1,98,703) farming system was relatively higher and was succeeded by savings of farmers practicing C+D (₹ 1,49,711) farming system, C+S (₹ 1,34,403) farming system and C+H (₹ 1,13,570) farming system. Compared to all other farming systems, in the case of C+H farming system, the savings were marginally lower due to lower income of the farm household. Income and consumption expenditure influences savings of a farm household.

Table 5: Savings among farm households (₹/annum)

Farming systems	Total Income	Consumption expenditure	Savings
C+S	3,18,023	1,83,620	1,34,403
C+D	3,36,045	1,86,334	1,49,711
C+H+D	4,44,421	2,45,718	1,98,703
C+H	2,95,850	1,82,280	1,13,570

Note: C+S: Crop+ Sheep, C+D: Crop+ Dairy, C+H+D: Crop+ Dairy Horticulture, C+H: Crop+ Horticulture.

Factors influencing the annual savings of the farm households

It is important to have an idea regarding the determinants of savings among the farm households in order to frame

strategies to enhance savings which in turn are one of the sources for investment and capital formation in agriculture. In C+S farming system the coefficient for variables like area under annual crops and number of sheep were found to be statistically significant. The chosen model was found to be good fit to the data set, as revealed by higher R^2 values for all the model of different farming situations. The results presented in table 6 indicated that one acre increase of area under annual crops would result in increase in savings by ₹ 10,400 per year. In the same way, if we add one more sheep to the existing herd, the savings would increase by ₹ 2,410 per year. Other variables like age, education were found to be positively contributing to household savings, but fail to exert any significant influence on savings. In C+D farming system, the annual savings were largely influenced by area under annual crops and number of milch animals. For every one acre increase in area under annual crops, the savings would increase by ₹ 8,350 per year and for every addition of one dairy animal to the existing herd, the savings would increase by ₹ 42,350 per year. In C+H+D farming system, number of dairy animals and area under horticulture were found to be the important variables influencing annual savings of the respondents as the coefficients for these inputs were statistically significant at one per cent probability as indicated by higher t-values of 4.21 and 2.78, respectively. For every additional dairy animal, the savings would increase by ₹ 49,760 per year while bringing additional acre of area under horticulture would boost savings by ₹ 32,530 per year. In C+H system every one acre increase in area under annual crops, the savings would increase by ₹ 7,670 per year and every one acre increase in area under horticulture crops, the savings by the respondents practicing C+H farming system would increase by ₹ 26,100 per year.

Table 6: Factors influencing savings among farm households

Sl. No.	Particulars	Para-meter	C+S	C+D	C+H+D	C+H
1	Number of observations	n	**45**	**45**	**45**	**45**
2	Dependent variable	Y	Annual farm household saving (in '000' Rupees)			
3	Intercept	A	-76.85 (-1.78)	-68.15 (-1.26)	-95.68** (-2.67)	-83.13 (-0.15)
4	Age of the respondent (years)	b_1	0.30 (0.41)	0.13 (0.28)	-0.86 (-0.43)	0.62 (1.09)
5	Area under annual crops (acres)	b_2	10.40*** (2.46)	8.35** (2.54)	1.46 (0.15)	7.67** (1.40)
6	Family size (No.)	b_3	-3.22* (-2.98)	0.18 (0.08)	-4.70 (-0.69)	-0.64 (-0.34)
7	Education level (Years)	b_4	0.68 (0.90)	2.02 (1.33)	-2.43 (-0.34)	-0.53 (-0.11)
8	Milch Animal (No.)	b_5		42.35*** (6.75)	49.76*** (4.21)	
9	Sheep (No.)	b_6	2.41*** (21.76)			
10	Area under Horticulture (Acre)	b_7			32.53** (2.78)	26.10** (2.56)
11	R^2		0.87	0.76	0.78	0.75
12	Adjusted R^2		0.85	0.72	0.71	0.72

Note: Figures in parentheses indicate t value.
***, ** and * indicate significant at one per cent, five per cent and ten per cent level of probability, respectively
C+S: Crop+ Sheep, C+D: Crop+ Dairy, C+H+D: Crop+ Horticulture+ Dairy, C+ H: Crop+ Horticulture.

The common variable influencing the savings among the farm households was the area under annual crops and the obtained results were on par with the results of the previous study by Mamman *et al.* (2018) [7] who found that farm size was positively and significantly influencing the savings among small farmers.

Conclusion

After thorough analysis of the four farming systems considered for the study, it was evident that the C+H+D system stands out as the most profitable and credible. It is crucial to promote such diversified farming approach within the agricultural community, taking into account factors such as resource availability, farmer knowledge and their preferences keeping in mind existing farm challenges. By embracing the highlighted profitable farming system, we have the potential to minimise the risk in farming and enhance their overall well-being.

Policy recommendations

- Promoting an ideal diversified farming system with all feasible components, among farmers residing in the Central Dry Zone of Karnataka and comparable regions is desirable through conduct of front-line demonstrations, training sessions, and on appropriate technologies. This strategic approach addresses the existing inefficiencies in resource allocation within current farming systems. By doing so, farmers can effectively mitigate farm-related challenges, leading to minimized distress. Additionally, this approach offers manifold advantages, including cost reduction, income augmentation, and decreased reliance on external borrowing.
- Greater focus needs to be directed towards prioritising quality production from livestock enterprises due to their land-saving nature and substantial contribution to farmers' income. These endeavours complement crop-based activities by optimizing resource utilization and also serving to stabilize overall farm earnings.

References

1. Anonymous. Annual Report (2021-22). MoSPI, National Sample Survey Office, Periodic Labour Force Survey, New Delhi, c2023. p. 58.
2. Anonymous. Annual Report (2022-23). Ministry of Finance, Department of Economic Affairs, Economic Division, New Delhi, c2023. p. 12.
3. Anwarul H, Prerna T. Credit policy for agriculture in India - An evaluation. Working Paper 302; c c2015. p. 1-31.
4. Bharath Kumar HE. Benefits of diversified farming systems: Evidences from a farm level study in Central Dry Zone of Karnataka. M.Sc. Thesis (Unpub.), Univ. Agric. Sci., Bengaluru; c2020.
5. Bhoi BK, Dadhich CL. Agrarian distress in India: Possible solutions. Indira Gandhi Institute of Development Research, Mumbai Working Papers 2019-017, Indira Gandhi Institute of Development Research, Mumbai, India; c2019.
6. Kavyashree PV. Economics of integrated farming system (IFS) in Tumkuru District, Central Dry Zone of

Karnataka. M.Sc. Thesis (Unpub.), Univ. Agric. Sci., Bengaluru; c2016
7. Mamman BY, Mustapha A, Sulumbe IM, Abdulhamid UM. Savings profile and its determinant among small-holder farmers in Jigwa state, Nigeria. J Agric. Econ. Ext. Sci. 2018;1(1):136-143.
8. Pavithra KN, Gaddi GM. Vegetable based farming systems In Koramangala - Challaghatta (KC) valley project area: An econometric analysis. Mysore J Agric. Sci. 2023;57(1):452.
9. Pavithra KN, Gaddi GM. Drivers of crop diversification: An empirical evidence from eternally drought prone area of Karnataka, Mysore J Agric. Sci. 2022;56(1):244-251.
10. Satyasai KJS, Mehrotra N. Enhancing Farmers' Income, Lead paper prepared for: Foundation Seminar in Vigyan Bhavan, New Delhi on Doubling Farmers' Income by NABARD; c2016. p. 16-20.
11. Saxena R, Singh NP, Choudhary BB, Balaji SJ, Paul RK, Ahuja U, *et al*. Can livestock sector be the game changer in enhancing the farmers' income? Reinvesting thrust with special focus on dairy sector. Agric. Econ. Res. Rev. 2017;30:59-76.
12. Singh RP, Sah AK. Repayment performance of borrowers with respect to agricultural loan of Ranchi Kshetriya Garmin Bank: A micro analysis. Indian J. Agric. Econ. 2004;60(3):396.
13. Udaykumar MS. Utilization and performance of formal and informal sources of credit by farm households across aural urban interface of Bengaluru. M.Sc. Thesis (Unpub.), Univ. Agric. Sci., Bengaluru; c2017.
14. Zainab N. Economic analysis of integrated farming systems in central dry zone of Karnataka. M.Sc. Thesis (Unpub.), Univ. Agric. Sci., Bengaluru; c2011.
15. Srivastava HM. Operators of basic (or q-) calculus and fractional q-calculus and their applications in geometric function theory of complex analysis. Iranian Journal of Science and Technology, Transactions A: Science. 2020 Feb;44(1):327-44.