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Agroecology and Sustainable Smallholder Agriculture: An Exploratory Analysis with Some Tentative Indications from the Recent Experience of 'Natural Farming in Andhra Pradesh'

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Abstract

This paper looks at the potential of agro-ecology for farming systems in India in order to achieve sustainable and inclusive development of agriculture in the country. It situates the potential of agro-ecology within the larger structural transformation context of the rural, agricultural and smallholder Indian economy, arguing that the preponderance of the smallholders in India is in contrast to the accepted view and past experiences of development. This calls for the exploration of alternative approaches to the development of agriculture in India. Using the case of 'Natural Farming' in Andhra Pradesh, the paper explores the impact and constraints of adopting agro-ecology on smallholder agriculture through the four indicators of impact of CNF on Quality of Soil, Crops, Food and Life, the impact of CNF on Diversification of Farming and Sources of Income Costs, yields and value of Crop Output in Comparative Perspective and farmers' Participation in and Practices of CNF. State support is imperative for the stable and gainful adoption of these initiatives at a large scale, which can provide livelihood security to the farmers of the country.

ABOUT THE AUTHOR

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CONTENTS

Agroecology and Sustainable Smallholder Agriculture: An Exploratory Analysis with Some Tentative Indications from the Recent Experience of 'Natural Farming in Andhra Pradesh'[1]

D Narasimha Reddy[2]

1. INTRODUCTION

The paper is divided into three parts. The first part is a brief overview of the broader structural transformation context of the rural, agricultural and smallholder Indian economy which is much in contrast with received academic wisdom. The second part is about the growing preponderance of the smallholders in agriculture in India which is in contrast to the expectations based on past experience of the paths of development, but much like the similar contrasting experiences of the countries with a comparable per capita income as of India. It is also about the policies, practices and proximate conditions that govern farming systems that have driven smallholder agriculture to life-threatening distress. This section also explores whether the growing interest in agro-ecology holds a potential for farming systems that could put the smallholder agriculture on a sustainable path? In the light of this question, the third part is an attempt at an appraisal of the recent experience of 'Natural Farming' in Andhra Pradesh.

1 *This paper is a revised version of the review delivered as the Professor* R. *Radhakrishna Memorial Lecture, 21st Annual Conference of the Indian Association of Social Science Institutions, Indira Gandhi Institute of Development Research, Mumbai 15 June, 2022. The choice of the theme for this lecture was driven by the consideration that in the last few years, Professor* R. *Radhakrishna evinced keen interest in 'Natural Farming' and was involved in guiding the assessment of the performance of the A.P. Community Managed Natural Farming (APCNF) by the AP Institute of Development Studies, Visakhapatnam.*

2 Professor of Economics (Rtd.), University of Hyderabad, Hyderabad. *I am grateful to the Rythu Sadhikara Samstha (RySS) especially Sri T. Vijaya Kumar, the Executive Vice Chairman, RySS, Sri C. Muralidhar, Senior Consultant and Dr. C.P. Nagi Reddy of RySS for encouraging me to review the work by providing access to all the available material. I also thank the present Chairman of APIDS, Prof. Mahendra Dev and Prof. S. Galab, Director, APIDS and his team for the cooperation. I am also grateful to Dr. P. Raghupathi and Dr. D. Siva Kumar for the last mile help.*

I. STRUCTURAL TRANSFORMATION PUZZLE

There have been several perspectives on the path of transformation from underdevelopment to development, based on the past experience of developed countries. These theories or perspectives have been the focus of extensive discussion in the debates on structural transformation as a part of explaining the development process, as someone would call it in desperation as a kind of 'cottage industry' (Timmer, 2009). A brief simplified stylized form of this debate is being presented in this section in order to provide a larger context to the theme of the present paper. The mainstream Marxist perspective envisions that the pre-capitalist feudal agrarian structures transform in the face of changing productive forces and production relations, facilitating the accumulation that propels development of capitalism in agriculture which also serves as the initial source of investment for industrial development. Fisher (1939), who was the first to visualize the economy into primary, secondary and tertiary sectors, Clark (1951) and Kuznets (1966) explained the structural transformation of growing economies as one of moving from the primacy of, first, agriculture to industry, and then from industry to services. The theory is premised on Engel's Law, which explains the change from the demand side, postulating that with the increase in income the demand for food and other agricultural products increase less than proportionately while the demand for industrial goods increase more than proportionately and with further growth and rise in incomes the demand for services out pace that of products of industry. Thus, structural transformation is seen as a progressive decline in the share of agriculture in the national income and employment, and the rise in the share of industry at the subsequent stage, and finally the decline of the share of industry as well, with the rise of the share of services.

Perhaps, there is no other contribution explaining structural transformation that has attracted as much attention as that of Lewis (1954), whether it is fifty years later (Krikpatrick and Barrientos 2004) or sixty years (Gollin 2014). Lewis (1954), characterizes the conditions in the less developed countries as 'economic dualism', with vast proportion of the economy marked by traditional low productive activities (mostly agriculture) that leave most of the workers as an underemployed reservoir of surplus labour, and a few islands of enclaves of modern high productive enterprises. Lewis, postulates that at a constant wage in the modern sector, high enough for those in traditional sector to move out, and low enough for the modern sector to accumulate profits for investment, development is a process of progressive structural shift of employment from traditional (predominantly agricultural) to modern (capitalist non-agricultural) activities. This process would continue up to the point that is popularly described as the, "Lewis Turning Point", a turning point from dualism to development. From the organizational perspective this could also be seen as a shift in employment from unorganized (informal) to organized (formal) activities. The spatial perspective of structural change is set out in Harris-Todaro (1970). The primary focus is on explaining the rationale of migration mediating the shift increasingly from the rural informal to the urban formal sectors. These theories are not exclusive but overlapping and yet largely linear perspectives of transformation.

Figure 1.1a

Structural Changes in GDP in India (%)

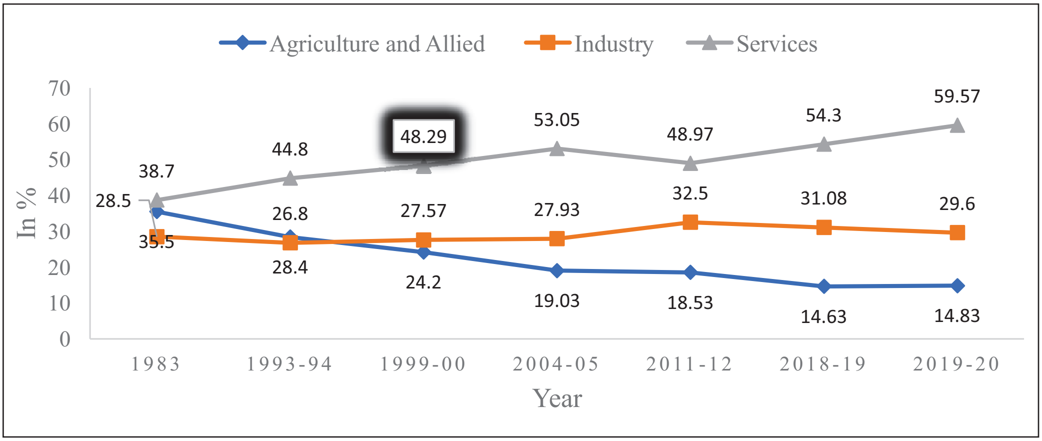
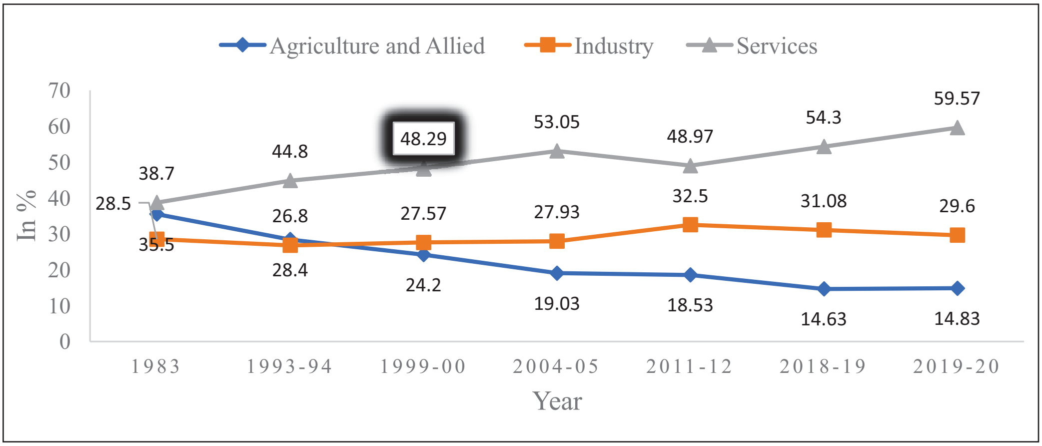


Figure 1.1b

Structural changes in Employment in India (%)



For a large number of post-colonial economies in the post World War - II era the experience has been largely a negation of all these perspectives with the exception of South-East Asia. For the imagination of development of the 'South' as increasingly becoming like the 'North', the structural processes that differ or defy the received wisdom, it may appear as "stunted" "distorted" or "retarded". But the fact is that there does not seem to be any path dependency in the transformation of the South. It is challenging to explore from the contextual historical perspective as to what holds for the future of economies like India, while the present still does not seem to reveal any clear hints of the nature of the transformation. For the 'Lewis Path' to pull the surplus labour from agriculture at a fast pace, the level of productivity in agriculture should be on par with that of non-agriculture (Timmer 2009). In India, on the contrary, the productivity gap between agriculture and non-agriculture has been on the increase. The ratio of non-agricultural productivity to that of agriculture increased from 3.91 in 2011-12 to 4.30 in 2018-19 (calculated from the data in Ghose and Kumar 2022). Structurally, the GDP growth in India has been led by services having a disproportionately low share in employment generation. The share of industry has been the lowest both in GDP and employment. While the GDP share of agriculture has been fast declining and reached a low level of about 15 per cent in 2018-19, it still retains the largest share of working population of about 42 per cent in the same year (Figures 1.a and 1.b), with creeping underemployment and low living standards.

What appeared to be an indicator of a net shift of excessive concentration of workforce from agriculture since 2004-05, witnessed a reversal with the share of agricultural employment rising from 42.39 per cent in 2018-19 to 45.53 per cent in 2019-20, forcing a characterisation as "stalled structural change" (Mehrotra and Parida 2021). Even the slow shift in employment from agriculture is more into informal non-agriculture than to high productivity formal activities (Basole 2022). Spatially, urbanization in India with about 35 per cent is one of the slowest processes in the world. As a result, it is not China, but India that is home for the largest proportion of the world's rural population and it is projected to remain so for a few more decades (Proctor and Lucchesi, 2012). Thus, the nature of the present trends in the growth and structure of the Indian economy reveals more puzzles than any clear path, especially for the agriculture sector that still remains predominantly a smallholder domain.

II. THE STATE OF SMALLHOLDER FARMING

The macro-structural challenge of the Indian economy seen from the fast-decreasing share of agriculture in the national product, even as almost half of the workforce holds on to it, is rooted in the agrarian structure. Going by the widely accepted classification of holdings with one hectare as ‘marginal’ and two hectares or less as ‘small’, small-marginal holders, together we refer here as ‘smallholders’. In the past six decades their share in total operational holdings and the area operated have almost doubled, bringing down the average size of the farm from about 2.2 hectares to 1.1 hectare. As a result, by 2015-16 more than two-thirds of Indian farms with an average size of 0.30ha are marginal holdings and small farms with an average size of 1.4ha come close to one-fifth of all holdings. Together marginal and small account for 86.1 per cent of all holdings, and almost half (46.9 per cent) of the area operated (Table: 2.1). While the proportion of holdings and the area operated in all other size classes have been on the decline, the small-marginal holdings are on the rise in number, and in the area operated. While their growing number is a cause for concern, there is some cause for relief that their average size, though tiny, has been stable for the last quarter of a century. The causes for the persistence of small-marginal holding are not far to seek. The contributing factors include demographic changes, the inheritance laws and the land mutation process, slow pace of industrialization, relatively low employment potential of the fast-expanding service sector, constraints on the rural-urban migration especially due to hostile urban housing and working conditions, and the poor education and skill formation among rural workers, and low and fast declining employment elasticity of the nature of the macro-economic growth process.

Of course, India is not alone in terms of agriculture with preponderance of smallholdings. A detailed analysis of 167 “countries and territories” based on the World Agricultural Census data estimates that there are 570 million holdings across the world. About 70 per cent of these farms are in Asia, with China (35 per cent) and India (25 per cent) accounting for more than half, followed by Sub-Saharan Africa (9 per cent), East and Central Asia (7 per cent), Latin America (4 per cent) and the Middle East and North Africa (3 per cent) (Lowder et.al. 2016). Marginal farms (<1ha) account for 410 million (72 per cent) and small farms (1-2ha) constitute 12 per cent. Together, small holders account for 84 per cent of the holdings, 12 per cent of the operated area, and 35 per cent of food production (Lowder, Sanchez, and Bertini 2021). While the average size of the already large holdings in the developed countries has been on the increase, the size of the small in the South is on the decline. A growing proportion of agricultural land across the global South is cultivated by smallholders (Hazell et.al 2010), and these are also becoming smaller by the decade to half the size they were in the 1960s and 1970s (Hazell and Rahman 2014).

Table 2.1

Farm Size and Distribution of Operational Holdings and the Area Operated in India (%)

Size Class	*1990-91*	*2000-01*	*2010-11*	*2015-16*	*% Change*		
					1990-91 to 2000-01	*2000-01 to 2010-11*	*2010-11 to 2015-16*
Marginal	59.4	62.9	67	68.5	19	23.1	8
	(15)	(18.7)	(22.2)	(24)	(20.2)	(20.4)	(5.6)
Small	18.8	18.9	17.9	17.6	13	9.2	4.2
	(17.4)	(20.2)	(22.1)	(22.9)	(11.5)	(9.7)	(2.6)
Semi-Medium	13.1	11.7	10	9.6	0.7	-0.9	-3.3
	(23.2)	(24)	(23.6)	(23.8)	(-0.5)	(-1.3)	(-0.2)
Medium	7.1	5.5	4.3	3.8	-13.2	-10.7	-5.3
	(27)	(24)	(21.2)	(20.2)	(-14.6)	(-11.5)	(-6)
Large	1.6	1	0.8	0.5	-25.6	-20.9	-13.8
	(17.3)	(13.2)	(11.8)	(9.1)	(-26.5)	(-19.8)	(-15.3)
All	100	100	100	100	12.5	15.4	5.9
					(-3.7)	(0.1)	(-1.1)
Average size (Ha)							
All	1.55	1.33	1.15	1.08			
Marginal	0.39	0.4	0.39	0.38			
Small	1.43	1.42	1.42	1.4			

Note: Figures in parentheses represent operated area

Source: Agricultural Census 2015-16, Agricultural Census Division Ministry of Agriculture and Farmers' Welfare, GOI, 2019

The persistence of smallholder agriculture often raises questions like whether small farms can generate the required food surpluses needed to feed a growing urban population? Can the present trend in the growth of small farms ensure sustainable livelihood for smallholders? What are the alternative paths to consolidate diversified smallholder livelihoods around secure and profitable agriculture? These questions are often addressed from the efficiency and equity dimensions, which are not exclusive of each other. The question of efficiency of smallholders is addressed from the productivity angle, and equity question often brings in political economy considerations of farmers' welfare and distributive justice.

On the efficiency of smallholder agriculture, there has been extensive debate and considerable empirical work on the size-productivity debate beginning in the early 1960s (Sen 1962) to recent work (Mishra and Singh 2021). These studies served as the evidence base in support of redistributive land reforms in India, which, of course, remain an unfinished agenda. There is a succinct summary of the work on the relationship between the farm size and productivity, (even with a footnote that hints at its historical vintage dating back to the father (James) and son (John Stuart Mill duo), that goes to show there is incontrovertible evidence, including authors' 2003 data, that small farmers are no less productive than the large (Gaurav and Mishra 2015). The latest evidence from the NSS 70th Round data for 2013 corroborates the trend (Mishra and Singh 2021). A multi-country evidence was shown as the basis for a strong case in favour of redistributive land reform that favoured small farms (Cornia 1985, Carter 1984). Earlier, Schultz (1964) added a rationality dimension by highlighting that 'traditional' small farmers were rational in the allocation of resources and hence more efficient.

Notwithstanding the proven efficiency of smallholder agriculture, smallholders in most of the countries are passing through severe sustainable crisis because of rising costs, declining returns and exposure to risks of market fluctuations with dwindling state support. Majority of marginal farmers lead a precarious life (Hazell and Rahman 2014). Therefore, the question to be raised is whether in the face of rising costs and lower returns, can a smallholder earn enough income from the farm to sustain their livelihood? The exception are the conditions of smallholder cultivation in East and South East Asia with strong state support systems – call it equity or political economy of public policy. "……State led rural and agricultural development leading to higher incomes for peasant farmers has been crucial to South-East Asia's success" (Henley and Donge 2013, Studwell 2013). From this follows the arguments that agriculture-led industrial growth has been the most effective way to achieve high growth, by making investments which enable smallholder farmers to raise their productivity and sell more of what they produce (Henley 2012). It was investment in smallholder farm productivity that was crucial in reducing absolute poverty in East Asia – because it is pro-poor and spatially and socially inclusive. Japan, South Korea and Taiwan provided sustained price support and input subsidy programmes to narrow the income gap between agriculture and non-agriculture (Otsuka 2012). Also, support and protection of rice crop, role of bureaucratic 'pilot organisation', the use of a whole range of more or less direct methods of guiding the market, and the mobilisation of the network of producers' organisations did provide the required succour to smallholder farmers (Franks 2002).

Paradoxically, when there is growing evidence that for smallholder based agrarian systems to achieve not only food security, but also to provide livelihood security to the farming community and to stimulate demand and incentivise investment in industry and drive overall development of the economy, there is a need for strong state investment and support systems for agriculture, there has been actually a deterioration in the role of state in most of the developing countries (Singh et.al. 2002). Beginning with the late 1980s most of the smallholder households have been experiencing severe distress not only in India (see for instance Haque 2016, Reddy and Mishra 2009, Reddy 2016) but across many countries in South Asia, Sub-Saharan Africa and Latin America. Broadly, there have been four major factors contributing to smallholder distress, about which much has been written, and therefore only a brief mention is made here. First is the adverse effect of the Green Revolution technologies inappropriately extended to all farms, crops and regions. The heavy doses of chemical fertilizers and pesticides, inappropriate use of irrigation water resulted in increased pest infiltration, mining of soil micronutrients, reduction in the nutrient-carrying capacity of the soil, build-up of soil toxicity and salinity and water logging (Pringati and Rosegrant, 1994). Some of these chemical inputs has led to considerable environmental harm. The quality of food carries these imprints and it is now known that food-related ill health will remain widespread for many people. It is estimated that approximately 30.80 per cent of nitrogen applied to farm land escapes and contaminates water systems and the atmosphere, increasing the incidence of disease vectors (Goulding et. al. 2008, Pretty et. al. 2003). The direct impact on the smallholders, besides the adverse health effects, takes the form of growing risks of failure of crops with heavy purchased inputs that had already drawn them into debt. The second major factor leading to distress among smallholders has been the unleashing of neoliberal reforms that saw progressive decline in state support and growing exposure to exploitative and volatile markets. The impact of the neoliberal reforms had an adverse effect, especially on smallholder agriculture across developing countries. "This orientation toward economic deregulation and privatization resulted in a 25-year downsizing of public services and disinvestment in agriculture systems" (De Schutter and Vanloqueren 2011). The adverse impact of neoliberal reforms on agriculture and especially on small-marginal farmers in

India is well documented (for example Reddy and Mishra 2009). There has been a drastic decline in the share of public investment in the Gross Fixed Capital (GFC) formation in agriculture from 44 per cent in 1981 to 17 per cent in 2017-18, and public investment in agriculture as a proportion of GDP declined from about 8 per cent in 1980s to about 4 per cent in 2017-18 (GoI, 2022). The increasing dependence on purchased inputs driven by the Green Revolution technologies on the one hand and declining public investment even in irrigation, often forced smallholders to make high risk investment like the ones in groundwater, pushing them not only into high-risk agriculture but also into a debt-trap. "Over the twenty-five year period since 1990-91, the aggregate cost of cultivation of the selected crops increased at a faster rate than the increase in output during 1990-91 to 2014-15" (Srivastava et. al, 2017).

There were also problems of market access to small farmers and "….access to both input and output markets has proved problematic for many smallholders, who remain at the margins of new agricultural economy" (FAO 2015). Public funded agricultural R & D in knowledge-intensive, cost reducing and affordable technologies that could be relevant and reach small farmers including those depending on dry lands are hard to come by. But, with the neoliberal regime in agriculture "…….technology spillovers from industrialized to developing countries are driven by research agendas that are oriented towards commercial projects rather than maximum public good", and not much has been done on the "huge, underutilized potential to link farmers' traditional knowledge with science-based innovations, through favourable institutional arrangements". (FAO 2011). On the top of all this, there have been extreme weather events resulting from looming climate change that have threatened not only the sustainability of agriculture and food security but also the livelihood security of the smallholders. It is under these conditions there has been a growing interest in 'agroecology' as an alternative system of agriculture.

2.1 Agroecology and Smallholder Agriculture

For the sake of simplicity, we could begin with a widely accepted definition of 'agroecology'. Agroecology is the "application of ecological principles to the design and management of agroecosystems through integration of traditional and scientific knowledge" (Altieri, 1995). It is not only a science and on farm practices but also a social and political movement that seeks to transform the dominant corporate food model by searching, implementing and advocating for socially just, economically fair and ecologically resilient models (Fernandez., et.al, 2018)[3]

It may also be necessary to have clarity whether agroecology is specific to smallholder agriculture? It is not. Agroecology is applicable to all farming contexts and scales. "Agroecology is not a niche for small-scale artisanal farmers in given sectors, nor is it a label to be attained on the basis of specific practices. Put simply, it is the opposite of monocultures and their reliance on chemical inputs. It is therefore a broad landing space that can be reached via variety of pathways and entry points, progressively or in more rapid shifts, as farmers free themselves from the structures of industrial agriculture and refocus their farming system around a new set of principles." (IPES-Food, 2016). Then why the association of agroecology with smallholder agriculture? It is simply because of resource efficiency as much as due to improved self-reliance. "Small farms using agroecological techniques may be two to four times more energy efficient than large conventional farms in terms of total energy input-output ratios" (Chappell and Larvolle, 2001). Further, "it is next to impossible to have ecologically sound farming at an extremely large scale…… Modest-sized family farms and cooperatives that use reasonable sized equipment can follow ecologically sound practices with increased labour productivity" (Rosset, 2000). There are certain food security pundits who fear that the misleading use of the term "small farms" may impede the efforts of agroecology to stimulate sustainable food production (Ebel 2020). But this is a convoluted argument. The proposition is that for smallholder agriculture shattered by Green Revolution technological practices, and the waning state support under neoliberal policies, agroecology holds the promise of sustainable livelihoods, and it certainly is not that agroecology practice is a monopoly of smallholders. It not only ensures a resilient environment but also more resilient livelihoods, which is the crux of the search for alternative agriculture (IPES-Food, 2016). Conventional agriculture, as is proved, demonstrates that smallholders are efficient but leaves them with unsustainable farm incomes.

Further, the "inverse relationship between farm size and output" has a much larger significance on the role of small farms not merely in obtaining a higher yield of a crop. There are a variety of explanations for the greater productivity

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3 The latter part of the above explanation is due to the concern for certain corporate penetration in the name of agroecology by stripping its social and political elements and to reduce it to technical science in the laboratories for the benefit of commercial interests.

of small farms in the Third World, that include multiple cropping, higher land use intensity, output diversity, efficient use of water, better quality of labour - generally family labour etc. The benefits of small farms extend beyond the economic sphere. Smallholder farming systems with multiple and cover cropping and with significant functional diversity within the farm which lead to better soil quality could provide valuable ecosystem services to the larger society. The growing recognition of the multi-functionality of small farms across the developed as well as the Third World as articulated for instance by the USDA Commission on Small Farms and the FAO, are succinctly summarised in Rosset (1999). Drawing upon the 'sustainable livelihoods' approach, it is argued that "sustainability of smallholder producers' livelihoods is integral to advancing the agenda of agroecological research" (Amekawa et.al.2010). Agroecology enables sustainability of smallholders through the articulation and materialisation of the multi-functionality of their agriculture that incorporates various commodities and non-commodities produced through agroecological practices (Amekawa et.al.2010).

Agroecology has been mischaracterised as a return to the past and as incompatible with mechanisation of agriculture. "Agroecology is not about a return to a model of agriculture that relies solely on human power for tilling and harvesting. Agroecological approaches are perfectly compatible with a gradual and adequate mechanization of farming," (De Schutter and Vanloqueren 2011). Agroecology has gained world-wide attention since the 1980s in the face of the unravelling of negative effects of the Green Revolution and the neoliberal structural adjustment policies which expose farmers to more risks, high costs and uncertain returns (Amekawa, 2011). It started as and continues to be a part of farmers' movement in Latin America with the coordination of La Via Campensina (LVC) and has spread across the Third World from Maputo to Jakarta (LVC, 2013). The social mobilisation as the driving force in the adoption of agroecological practices in Latin America is well illustrated by the Nicaraguan experience led by the Rural Workers Association (ATC). It is seen as a counter hegemonic construction and reaction against neoliberal reforms which have led to the devastation of education, health and human development (McCune et.al. 2016). State driven Cuban experience of Cuba adds an additional dimension to the spread of agroecology in Latin America. Otherwise, most of the agricultural sustainability improvements occurring in the 1990s and early 2000s appear to have arisen despite existing national and institutional policies rather than because of them (Dasgupta 1998, referred to in De Schutter 2011).

One of the largest studies done on 'sustainable agriculture' is reported in Pretty (2008). This study was about the adoption and impact of agricultural sustainable technologies and practices on 286 projects in 57 countries. "In all, some 2.6 million farmers on 37 million hectares were engaged in transition towards agricultural sustainability in these 286 projects. This is just over 3 per cent of the total cultivated area in developing countries. The largest number of farmers was in wetland rice-based systems, mainly in Asia, and the largest area was in dualistic mixed systems, mainly in Southern Latin America. This study showed that agricultural sustainability was spreading to more farmers and hectares" (Pretty, 2008). Out of this, "for the 360 reliable yield comparisons from 198 projects, the mean relative yield increase was 79 per cent across the very wide variety of systems and crop types. However, there was a widespread variation in these results. While 25 per cent projects reported relative yield greater than 2.0 (i.e. 100 per cent increases), half of all projects had yield increases between 18 per cent and 100 per cent. The geometric mean also shows a 64 per cent increase in yield. Yet the average hides large and statistically significant differences between the main crops. However, in nearly all cases there was an increase in the yield with the project, only in rice there were three reports where yields decreased, and the increase in rice was the lowest (mean 1.35), although it constituted a third of all the crop data. Cotton showed a similarly small mean yield increase." (Pretty 2008). These sustainable agroecosystems also have positive side effects, helping to build natural capital, strengthen communities (social capital) and develop human capacities.

Globally these success stories still remain far and few. There are not many countries with definite policy perspective on the promotion of sustainable agriculture. "Only three countries have given explicit national support for sustainable agriculture. Cuba has a national policy for alternative agriculture; Switzerland has three tiers of support to encourage environmental services from agriculture and rural development, and Bhutan has a national environmental policy coordination across all sectors" (Pretty 2008).

However, Li Wenhna (2001) reports a good example of a carefully designed and integrated programme of ecological farming from China. Pretty (2008) also refers to a white paper as early as in 1994 coming from China to set out implementation of Agenda 21 which put forward ecological farming known as 'Shen gtai Novgye' or agroecological engineering as the approach to achieve sustainability in agriculture and reports pilots in 2000 townships and villages across 150 countries with incentives for adoption of diverse farming systems [4]. Here it

4 The details on the progress of the programme is not accessible.

may be useful to pay attention to some of the major obstacles to the spread of agroecological practices as identified by De Schutter and Vanloqueren (2011). First, small-scale farmers, the primary practitioners of agroecology, are marginalised in policy decisions (Vanloqueren and Baret 2009). Decentralised small farmers experience agency problems and transaction costs. Second, agroecology has rarely been supported by mainstream trade and agricultural policies. The development of agroecology requires a strong state to empower small-scale farmers, and invest in agriculture. But neoliberal orientation toward economic deregulations and privatisation resulted in "a 25-year downsizing of public services and investment in agricultural systems." (De Schutter and Vanloqueren 2011). Third, because of the common belief that a Green Revolution complemented by a "gene revolution" could solve global hunger, there is hardly any support for agroecological research. To overcome these obstacles and many more, there is a necessity to pay attention to the needs of smallholders. Further programmes and policies must ensure meaningful participation of smallholders.

III. AGROECOLOGY AND ALTERNATIVE AGRICULTURE IN INDIA: THE CASE OF ANDHRA PRADESH COMMUNITY MANAGED NATURAL FARMING

3.1 Introduction

This section is divided into three parts. The first part (3.1) is a brief description of the initiatives in alternative agriculture in India that come close to the broad agroecological approaches. The second part (3,2) a brief account of the Andhra Pradesh Community Based Natural Farming (APCNF) as it evolved. The third part (3.3) attempts to assess the performance of the APCNF by utilising the available seasonal and annual socio-economic assessment reports based on regular field surveys in the past four years by the AP Institute of Development Studies, Visakhapatnam, in terms of five broad criteria viz. i. the extent of participation, the characteristics of the participants and the number of practices followed; ii. A comparative analysis of the differences between the 'CNF farmers' and 'Non-CNF farmers' in terms of costs of cultivation, yields, and the 'gross' and 'net' value of select crops; iii. The differences in the sources of household incomes of CNF and Non-CNF farmers with special focus on the crop-diversification effect; iv. CNF farmers; perceptions about impact of the alternative farming practices on the quality of crops and the output, their own family and soil health, and overall well-being; and v. the nature of persisting constraints to CNF.

There have been a number of initiatives by individuals and other civil society organisations towards alternative agriculture as a reaction to the adverse and unsustainable practices of chemical agriculture or the so called 'industrial agriculture'. One such momentous drive in India came from Subhash Palekar from Maharashtra. Palekar's chemical free principles of agriculture gained the attention of some farmers' organisations, other civil society organisations and even several state governments under the name of Zero Budget Natural Farming (ZBNF). It was called 'zero budget' because in Palekar's conception, if a farmer possesses a desi-cow, the urine and dung become sources of preparation of biologicals for stimulating soil fertility and crop protection, and combined with the family labour there will be no external inputs and therefore, zero 'costs'. But in the present pervasive neoliberal capitalist world there is hardly any farming, marginal or large, that could exclusively be external-input free. Palekar soon realised that the epithet 'zero' was misleading, but his effort to change it did not register well with those who were carried away by his "spiritual" lectures (Khadse et.al. 2017). The name 'Zero Budget' got stuck to natural farming at all levels, even with the Government of India, which is showing interest in its version of 'Paramparagat Krishi' (traditional farming). But those who are involved in the promotion of ZBNF, like the Karnataka Rashtriya Rythu Sangha (KRRS), get carried away when the practice is seen as nothing but agroecological. The Karnataka proponents draw attention to the La Via Campesina' (LVC) observation (Khadse et.al 2017): "….a number of names exist round the world for farming practices based on similar principles. Instead of labels, we are concerned with the key ecological and political principles that of the ZBNF, and we find those to be consonant with agroecology" (LVC, 2013 quoted in Khadse et.al 2017). Karnataka, not the state, but the Karnataka Rashtriya Ryuthu Sangha (KRRS) is the first major adopter of ZBNF. But, it is through the AP Community Managed Natural Farming (APCNF) in Andhra Pradesh that practices of agroecological principles are expanding in the fastest and largest manner. It is in this context, an attempt has been made here to assess the APCNF, as one of the progenies of agroecology, from the perspective of smallholder farm sustainability, and to identify the positive signals and conditions under which these could be realised.

3.2 Andhra Pradesh Community Managed Natural Farming (APCNF)

Andhra Pradesh Community Managed Natural Farming (APCNF) is a unique initiative. It is neither an organisation promoted by the civil society (NGO) or farmers' movement as in Karnataka (Khadse et. al. 2017) or a social movement as especially in Latin America (Cacho et.al. 2010), nor it is directly a state initiative as in Sikkim (Meek and Anderson 2019). APCNF is under Rythu Sadhikara Samstha (RySS), a special corporation created by the government of Andhra Pradesh for the specific purpose of promotion of natural farming, but works within the purview of the legal and administrative framework of the state. Though the immediate context was the influence of Subhash Palekar's alternative agricultural paradigm of Zero Budget Natural Farming (ZBNF), the antecedents that have acted as a strong motivation and driving force, go back to the Community Managed Sustainable Agriculture (CMSA) of the erstwhile combined state of Andhra Pradesh (Kumar et. al. 2007). Encouraged by the enthusiastic response of farmers towards Non-Pestical Management (NPM) of crops, CMSA was setup in 2004 by the Society for the Elimination of Poverty (SERP) [5] under the poverty reduction programme, viz. Indira Kranthi Patham (IKP). Starting with 4000 acres of land in 12 villages in 2004, CMSA promoted NPM practices involving replacement of chemical pesticides with a combination of physical and biological measures including bio-pesticides and it soon spread to over 3 lakh farmers cultivating 1.36 million acres of farm land in the erstwhile combined state of Andhra Pradesh (Kumar et.al.2009). The pace of progress waned by 2014 due to the lack of ownership of the programme by the Agriculture Department of the State Government and it ended with the conclusion of certain financial inducement built into it.

The lessons learnt from CMSA experience have been addressed in the new initiative in the newly formed state of Andhra Pradesh through the following measures while launching the Zero Budget Natural Farming (which was later changed as AP Community Managed Natural Farming – APCNF). First, men and women farmers of the villages, instead of women only approach; second, full saturation approach covering the entire Gram Panchayat; third, making sure that the Agriculture Department owns the project with the full commitment of the government as another big cornerstone. The AP ZBNF was launched as a pilot project in 2016 across 704 villages covering 48,565 farmers, with the initial financial support by the Government of India through Rashtriya Krishi Vikas

5 SERP, a non-profit entity set up by the Department of Rural Development, of the Government of (the then combined) Andhra Pradesh to implement the poverty alleviation programme called Indira Kranti Patham (IKP). The Ryuthu Sadhikara Samstha (RySS) the institution directing APCNF, is a replica of the SERP. The umbilical link that could be seen between the two institutions is Sri T.Vijayakumar I.A.S, the then CEO of the SERP and the present Vice Chairman of the RySS. There is no exaggeration in some one calling him as the 'conductor of the orchestra' (Dorin 2021), and that he has been the inspiration and driving force behind APCNF.

Yojana (RKVY) and Paramparagat Krishi Vikas Yojana (PKVY) and Azim Premji Philanthropic Initiatives (APPI). The pilot was successful with around 10,000 farmers called as "CNF farmers" adopting the ZBNF practices seed-to-seed (S2S), and the remaining adopting partially, called as 'partial farmers', a classification that continues later. Following the success of the pilot, in addition to the RKVY, PKVY and APPI, the Government of A.P. also joined in supporting the project by meeting the salary expenses of the district and state level personnel. The full-fledged ZBNF was launched in 2015 with an ambitious target of covering all the 13 districts of the state by 2022.

The Ryuthu Sadhikara Samstha (RySS) which is steering the ZBNF (here after APCNF) has been an initiative in response to the deteriorating conditions of agriculture and its impact, especially on the poor farmers. The organisation set out by clearly spelling out the major challenges facing agriculture and the food system, like the ever-increasing farmer distress, the threat of emerging food scarcity in the face of rising population; the adverse impact of soil degradation, water stress and loss of biodiversity; global warming and climate change. The APCNF was visualised as a climate resilient transformation solution[6] by promoting farming in harmony with nature. Accordingly, the objectives set for APCNF are:

i. Reducing cost of cultivation and risks, and increasing yields. It is climate change resilient, thereby lesser risks in farming, generation of regular as well as higher net incomes,
ii. Producing more food, safe and nutritious and free of chemicals;
iii. Reducing the distress migration of youth from villages and creating reverse immigration to villages; and
iv. Enhancing soil health, water conservation, regeneration of coastal ecosystems and biodiversity. (for more details see: Concept Note of APCNF, apzbnf.in).

Like that of ZBNF promoted by Subhash Palekar, the APCNF practices are based on the following four natural principles:

1. **Jeevanamrutha:** a fermented microbial culture that provides stimulus and promotes the activity of the microorganisms in the soil, and increases the population of earthworms.

6 In fact initially the programme was conceived as climate Resilient ZBNF (CRZBNF) to improve farmers' livelihood in the drought-prone region of Rayalaseema in the state (Ranjit Kumar et. al. 2020)

2. **Beejamrutha** is for seed treatment that protects seedlings from fungus as well as from soil-borne diseases.
3. **Acchadana** or Mulching, which protects the soil, moisture and promotes microorganisms
4. **Whapasa** is aeration, a condition where both air molecules and water molecules are present in the soil, reducing the need for frequency of irrigation.

The other practices under CNF include polycropping, a system of 5-layer cropping, with different levels of canopies consisting of trees, fruits, vegetables, pulses and cereals. For pest control, **Neemastea, Brahmastra** and **Agniastra – Kashayams** with different plant and organics are used. Since 2018, APCNF also introduced pre-monsoon dry sowing (PMDS), which is a recommended practice for rain-fed and unirrigated regions and involves broadcasting the treated seeds before the onset of monsoon. The seeds germinate with the first flush of rain and helps avoid repeat sowing.

These practices are broadly in consonance with the following key principles of agroecology (Altieri 1989):

i. enhanced biomass recycling,

ii. enhanced functional biodiversity,

iii. enhanced soil conditioning,

iv. minimum loss of energy, water and nutrients,

v. diversification of genetic resources, and

vi. enhanced beneficial biological interactions.

The implementation process of APCNF is based on what is referred to as the 'three pillars of the model', which are derived from three 'theories': First, transformation should happen in a democratic way with the participation of women collectives (Self Help Groups [SHGs]) and their federations, and other collections of farmers. These farmer institutions are involved in programme planning, implementation and monitoring. Second, knowledge dissemination and landholding support should happen through farmer-driven extension architecture led by Community Resource Persons (CRPs). Third, saturation of entire village, cluster, mandal and state, in that order, should happen - a vision of total transformation towards natural farming. The implementation plan calls for a 5-7 year support to the Gram Panchayat and support to each farmer for about 3-5 years of support and landholding. The emphasis is on mainstreaming the 'poorest of the poor'. These include landless agricultural labourers, tenant farmers, SC and ST farmers with less than two acres of land. For the landless, special efforts are to be made to provide land on lease which is to be facilitated through Community Resource Persons (CRPs) and SHGs. Besides, it involves promotion of kitchen gardens for securing food and nutrition, development of assigned lands through CNF practices, and non-farm enterprises, including NF input shops, seed supply etc. and off-farm livelihoods such as backyard poultry and fishponds. Apart from the central expert committee and the state and district level personnel, about five thousand personnel consisting of master Community Resource Persons (908), village level Community Resource Persons (3518) and Natural Farming Fellows (257) were in place by 2018 as part of the implementation system.

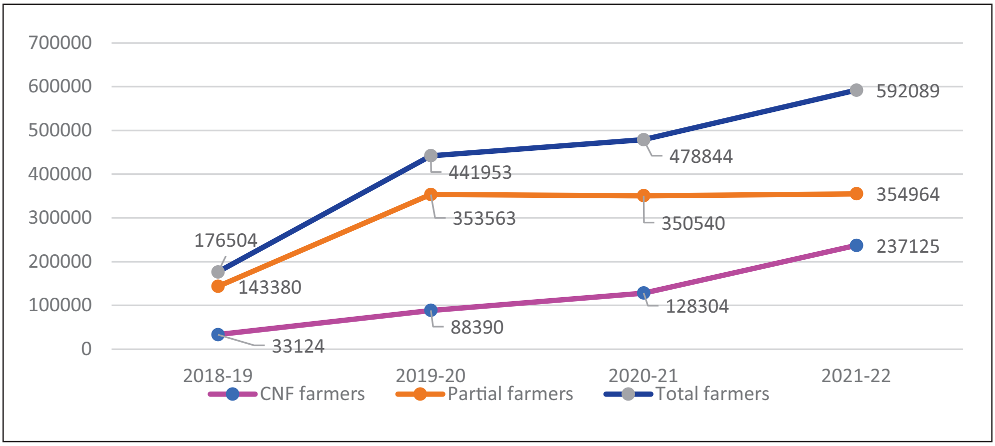
Since the beginning, RySS initiated a number of studies for the assessment of the APCNF. There are two types of studies assessing the impact of the CNF programme. One set of studies that involve scientific evaluation of the issues like the impact on water use efficiency, soil quality etc. which are done by experts from national and international institutions. The second type of studies address the assessment of the socioeconomic impact of the programme for every agricultural season, reported separately (Kharif and Rabi), followed by a consolidated report annually. The latter studies on the socio-economic impact were conducted first by CESS, Hyderabad for the year 2017-18, and thereafter these are being done by the A.P. Institute of Development Studies, Visakhapatnam. So far, ten reports have been submitted to RySS which form the basis of the highlights of the achievement of the APCNF presented briefly here.

3.3 Towards Understanding the Impact of the APCNF

(i) Farmers' Participation in and Practices of CNF

CNF is not only seen as a mere programme in the conventional sense but is designed as a transformative process aimed at a fundamental change in the way farming is practiced. Therefore, the first criterion for an assessment of the extent of movement along the transformative path is through participation. The available data could be used to examine the extent of the willingness of farmers to participate and practice NF. At least **four** indicators could be considered for assessing farmer participation. One is the expression of one's willingness to be a part of the practice by joining as a CNF farmer. Here we have two types of farmers, one who goes the whole hog with all the practices, called seed-to-seed (S2S) practices and the other is a farmer who takes up some of the practices. The former is designated as 'CNF farmer', and the latter as a 'partial farmer'. The **second** indicator is the extent of taking up of CNF practices, the **third** is the extent of one's own farm that is brought under NF, and the **fourth** is the proportion (%) of one's cultivated area turned into NF. APCNF has shown very positive results in all the above mentioned indicators. Figure 3.1 shows that there has been a substantial increase in the total number of CNF farmers over the years. Starting with about 10,000 S2S CNF farmers and about 40,000 'partial' CNF farmers in 2017, APCNF had registered an increase in S2S CNF farmers to 33,124, and the latter to 1.43 lakhs, together accounting for a total participation number of 1.77 lakh. The total practitioners of CNF reached 5.92 lakhs by 2021-22. What is more impressive is the increase in the number and share of S2S farmers, which has almost doubled in the last one year between 2020-21 and 2021-22 from 1.28 lakhs (27 per cent) to 2.37 lakhs (40 per cent).

Figure 3.1
Farmers Participation in CNF



Source: IDS-AP

In tune with the emphasis of the APCNF to focus more on the 'poorest of the poor', the social composition of CNF farmers shows that ST and SC constitute 34 per cent of the total CNF farmers, substantially higher than their share in the population as well as among the farming community (Fig.3.2a). Similarly, 86.6 per cent belong to small-marginal classes, and another 8.2 per cent are pure tenants (Fig.3.2b). There is a widely shared view that agriculture as an occupation has not been able to attract the young and educated (White, 2012). A close look at the age and educational differences between the CNF farmers and the Non-CNF farmers reveals that there is a higher percentage of farmers in the age-group of less than 40 years and with an education level of secondary and more, in the CNF group when compared to the Non-CNF group. About 30 per cent of CNF farmers are in the age group of less than 40 years, wherein the case of Non-CNF farmers it is only 19 per cent (Fig.3.4), and 45.5 per cent of them are with an education level of secondary and above, where it is only 30 per cent among Non-CNF farmers (Fig.3.2d).

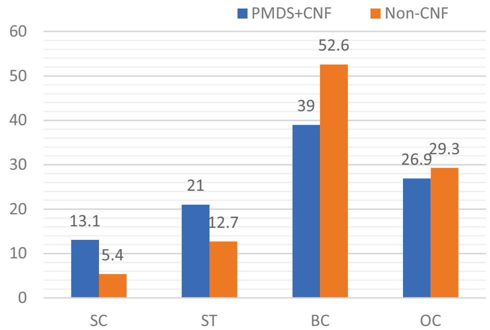


Figure 3.2a: Social Group-Wise Composition of PMDA+CNF and Non-CNF Farmers (In Percentages)

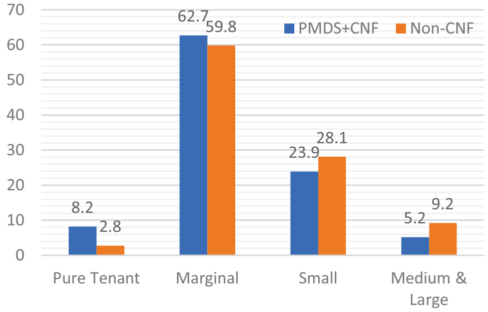


Figure 3.2b: Farm-category wise Distribution of PMDS+CNF and Non-CNF Farmers (%)

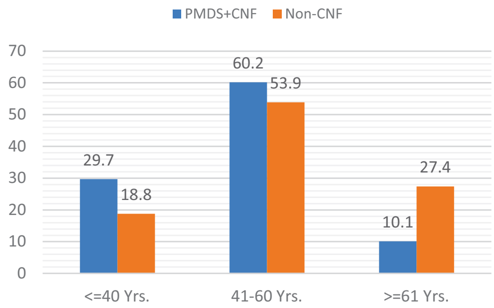


Figure 3.2c: Composition of PMDS+CNF and Non-CNF Farmers according to Age of Head (%)

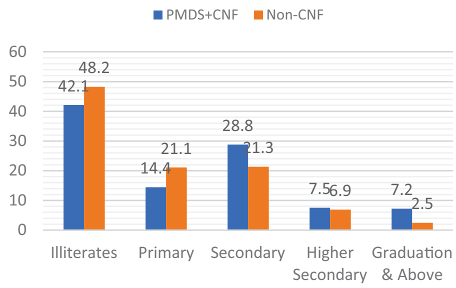


Figure 3.2d: Compostion of PMDS+CNF and Non-CNF Farmers according to Education Level of Household Head (%)

There are also interesting geographical and social intersections in CNF participation. "Almost all tribal farmers have adopted CNF in the CNF Gram Panchayats of High Attitude Zone. The participation of tribal farmers in CNF is higher by 30 percentage points over Non-CNF. The conversion into CNF from Non-CNF of these communities is faster due to the benefits from CNF that alleviate their distress conditions. Moreover, natural farming is close to their hearts down the ages. The social profile of farmers seems to be broad based in 'Scarce Rainfall' and Southern and North Coastal Zones [considered as the backward regions of the state] due to more distress conditions in Non-CNF agriculture. Preference of SCs and STs across all categories of farmers in CNF compared to Non-CNF indicates the fact that the marginalized sections of farmers are shifting to CNF from Non-CNF." (IDS, 2021).

Figure 3.3

Number of CNF Practices, on average, adopted by PMDS+CNF Farmers

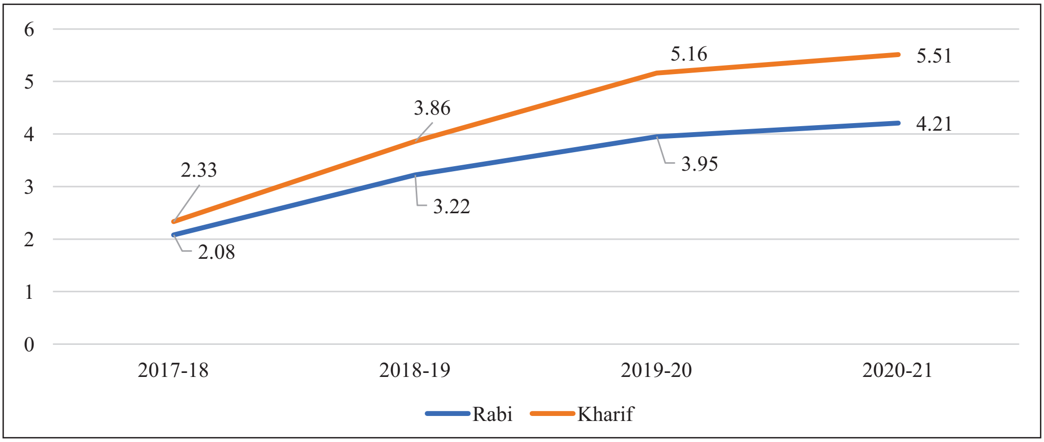


Figure 3.4

Cultivated area under CNF - Rabi (in hectare)

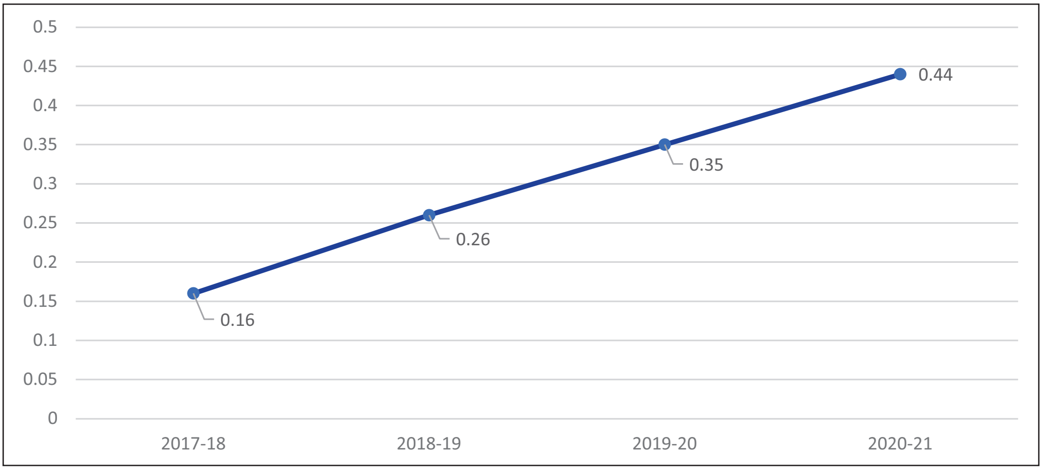
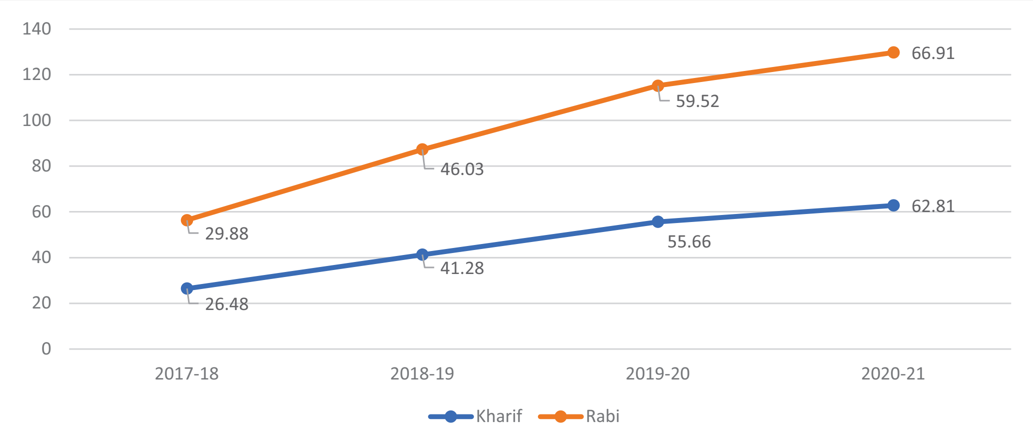


Figure 3.5

Percentage of Area Allocated to CNF in the Total Cultivated Area



The second important indicator of the intensity of participation is seen in terms of the number of CNF practices adopted. Figure 3.3 shows the average number of CNF practices adopted by each participant (data relates to only S2S farmers) has been on the increase gradually. Since it is well known that adoption to natural farming takes at least 3 to 4 years, the progress in this regard is very positive. The other two indicators of the extent to which the farmer is willing to transit to CNF are the actual area of one's farm changed to CNF, and its extent in one's own over all holding. Figures 3.4 and 3.5 show slow but consistent increase in the land allotted to NF both in terms of actual extent and as a share of one's own operational holding. Table 3.1 shows the size-class -wise progress in the area allocated to CNF between 2017-18 and 2020-21. In all categories there has been a progressive shift in the area allotted towards CNF. By 2020-21 rabi season, the proportion of cultivated area of one's own farm to CNF, is the highest among marginal farmers (72 per cent]) followed by small (57 per cent) and the medium and large farmers (53 per cent). It is a clear reflection that CNF as per its mandate is bringing into its fold more poor and marginal farmers.

Table 3.1

Progress in Size-Class-Wise Area Allocated to CNF Between 2017-18 and 2020-21 (in Ha)

Year	*Marginal Farmers*	*Small Farmers*	*Medium and Large Farmers*
2017-18	0.33	0.54	0.72
2018-19	0.54	0.79	1.09
2019-20	0.77	1.11	1.35
2020-21	0.88	1.40	2.35
% Shift to CNF out of total cultivated area by 2020-21 Rabi	72	57	53

Source: IDS October 2020-21.

ii. Costs, Yields and Value of Crop Output in Comparative Perspective

The second set of indicators for the assessment of the CNF performance is in terms of 'cost reducing effect', 'yield augmenting effect' and the increase in the net nature of crops. The reports of Centre for Economic and Social Studies (CESS), Hyderabad for 2018-19 and the Institute for Development Studies (IDS), A.P. have covered as many as 13 crops and provide data on the costs of cultivation, yields and value of output. But not all crops are included in each season, since some crops are season specific, like for example cotton, chillies and red gram are kharif specific while crops like Bengal gram and red gram are rabi crops. Usually, the reports cover 9 crops during kharif and 6 during rabi. However, since the purpose of the present analysis is to get a broad picture of the differential impact of CNF on costs of cultivation, yield levels and value of the output, it is unwieldy to cover all the crops reported and hence, the choice is limited to two crops, viz. Paddy and Groundnut. The choice of these two crops is made based on the following considerations. First, these two crops are grown in both kharif and rabi seasons and together cover about 45 per cent of the gross cropped area in the state. Second, more than 50 per cent of the CNF and Non-CNF crop sample in each of the seasons belong to these two crops. The yield estimates of these two crops are made based on adequate number of Crop-Cutting Experiments (CCEs).

Here, costs of cultivation is broadly divided into two types viz., 'plant nutrient and protection inputs' (PNPI) and 'other paid-out costs'. The PNPI refer to 'biological' preparative used under CNF, while in the case of Non-CNF these refer to chemical fertilizers and pesticides. The 'other paid out costs' are common to both CNF and Non-CNF practices and include costs of seed, human labour, bullock labour, machine labour, water fees, farmyard manure (FYM) etc. in the case of 'other paid out costs' there may not be any difference between the CNF and Non-CNF practices, and there are instances where on some of these costs CNF actually incurs more expenditure than Non-CNF. But the critical "cost reducing effect' of CNF is in the substitution of 'biologicals' for the chemical fertilizers and pesticides involved in Non-CNF.

Before analysing in more detail the impact that the PNPI cost differences make to the overall cost advantage of the CNF, let us look at the nature of differences between the CNF and Non-CNF in "other paid-out costs" as well. Table 3.2 which refers to PNPI and all other paid-out costs of paddy during the four seasons of 2018-19 and 2019-20 is being used as an illustration from which we can obtain certain broad abstraction on the cost differences and commonalities in CNF and Non-CNF. For both CNF and Non-CNF, 'human labour' cost is the highest component of cost of cultivation, followed by 'machine labour' cost for CNF and chemical PNPIs for Non-CNF. In some seasons costs of human labour 'bullock labour', 'machine labour', seeds etc., could be higher for CNF than Non-CNF. But invariably the total paid-out costs of CNF is less than that of Non-CNF, basically due to 'cost reducing effect' of the biological PNPIs.

Table 3.2

Cost Differences in Inputs of PADDY under CNF and Non-CNF (per hectare in Rs.)

Year	*Khariff*										
	CNF / Non-CNF	*PNPIs*	*Seed*	*Human Labour*	*Bullock Labour*	*Machine Labour*	*Imple-ments*	*Water Fees*	*FYM*	*Others*	*Total Cost*
2018-19	CNF	4215	2175	14589	1237	10886	0	0	0	2908	36009
		(11.71)	(6.04)	(40.52)	(3.43)	(30.23)	(0)	(0)	(0)	(8.07)	(100)
	Non-CNF	13248	2125	13527	270	11066	0	0	0	1501	41736
		(31.74)	(5.09)	(32.41)	(0.65)	(26.51)	(0)	(0)	(0)	(3.6)	(100)
2019-20	CNF	5035	2413	17492	367	12259	624	695	1848	0	35698
		(12.36)	(5.92)	(42.94)	(0.90)	(30.10)	(1.53)	(1.71)	(4.54)	(0)	(100)
	Non-CNF	14330	2570	18080	430	12563	822	377	1256	0	36098
		(28.42)	(5.10)	(35.85)	(0.85)	(24.91)	(1.63)	(0.75)	(2.49)	(0)	(100)
Rabi											
2018-19	CNF	2510	1538	20374	1012	7752	255	0	161	742	34346
		(7.31)	(4.48)	(59.32)	(2.95)	(22.57)	(0.74)	(0)	(0.47)	(2.16)	(100)
	Non-CNF	19040	1872	16442	730	8863	765	0	136	361	48209
		(39.49)	(3.88)	(34.11)	(1.51)	(18.38)	(1.59)	(0)	(0.28)	(0.75)	(100)
2019-20	CNF	8660	2641	14687	368	13117	514	582	836	0	41405
		(20.92)	(6.38)	(35.4)7	(0.89)	(31.68)	(1.24)	(1.41)	(2.02)	(0)	(100)
	Non-CNF	14508	2876	17040	354	12181	551	570	908	0	48988
		(29.62)	(5.87)	(34.78)	(0.72)	(24.87)	(1.12)	(1.16)	(1.85)	(0)	(100)

**Note:* Figures in parenthesis are percentages to the total cost.
Source: IDSAP Field Surveys.

Table 3.3a

PNPI Costs, Other Paid-out Costs and Total Paid-out Costs of Paddy in Comparative Perspective: CNF and Non-CNF

Seasons & Year	*PNPI Costs (Rs/Ha)*			*Other Paid out costs (Rs/Ha)*			*Total Paid out costs (Rs/Ha)*		
	CNF	*Non-CNF*	*Difference (%)*	*CNF*	*Non-CNF*	*Difference (%)*	*CNF*	*Non-CNF*	*Difference (%)*
2018-19									
Kharif	4215	13248	-68.2	31794	28489	11.6	36009	41737	-13.7
Rabi	2510	19060	-86.8	31836	29169	9.1	34346	48229	-28.8
2019-20									
Kharif	5035	14330	-64.9	30663	21768	40.9	35698	36098	-1.1
Rabi	8660	14508	-40.3	32745	34480	-5.0	41405	48988	-15.5
2020-21									
Kharif	5132	12948	-60.4	40993	48353	-15.2	46125	61301	-24.8
Rabi	4589	11516	-60.2	39171	40513	-3.3	43760	52029	-15.9

Table 3.3b

Yields and Value of Output of Paddy in Comparative Perspective: CNF and Non-CNF

Seasons & Year	*Yield (Qtl/Ha)*			*Gross Value (Rs/Ha)*			*Net Value (Rs/Ha)*		
	CNF	*Non-CNF*	*Difference (%)*	*CNF*	*Non-CNF*	*Difference (%)*	*CNF*	*Non-CNF*	*Difference (%)*
2018-19									
Kharif	48.9	51.6	-5.2	87461	91960	-4.9	17779	18406	-3.4
Rabi	49.7	48.5	2.5	NA	NA	NA	NA	NA	NA
2019-20									
Kharif	50.87	48.06	5.8	92161	81460	13.1	51426	31031	65.7
Rabi	63.67	48.48	31.3	119863	117450	2.1	78457	68461	14.6
2020-21									
Kharif	53.95	51.75	4.3	99293	94693	4.9	53168	33392	59.2
Rabi	62.56	57.11	9.5	104967	90811	15.6	61207	38782	57.8

Source: CESS and IDS (Six Seasonal Reports for 2018-19 (CESS), 2019-20 and 2020-21 (IDS).

Let us now turn to the transmission process of the 'cost reducing effect' of CNF practices that make a positive difference to the 'net value of output'. This is done by focusing, as mentioned earlier, on two crops viz. paddy and groundnut. Tables 3.3a and 3.3b list the results of the analysis of the comparative perspective on the differences between CNF and Non-CNF in terms of costs which are broadly grouped into PNPI costs, 'other paid-out costs' and total costs, along with differences in yields, and gross and net value of output of paddy crop during six seasons of the three years - 2018-19, 2019-20 and 2020-21. There has been a substantial cost reduction ranging from 40.3 per cent to 86.8 per cent under CNF when compared to Non-CNF in paddy because of the substitution of biological PNPIs for the chemicals. There has been a consistent overall net total cost reduction effect in all seasons, even when CNF 'other costs' are more than Non-CNF, because of the costs saved due to the use of biologicals in place of chemicals as PNPI. In contrast there was no "yield augmenting effect" of CNF in Paddy in the kharif season of 2018-19, with CNF per hectare paddy yield falling 5.5 per cent below Non-CNF yield. The result is lower "gross" as well as "net value" of paddy under CNF. But the situation has changed from 2019-20, partly due to, as observed earlier, the increase in the number of CNF practices adopted and partly because of the fact that a certain period of time, progressively about three years, is needed to get the full benefits of soil microbial activities of the biologicals and with it the improved nutrients from the soil. The "yield augment effect" of CNF in paddy is evident from the kharif season. What is significant to note is that the 'net value of output' under CNF has been consistently higher than that of "gross value" gain. It is because the costs saved under PNPIs in CNF do not get reflected in gross value but in the net value.

Tables 3.4a and 3.4b present a similar analysis of costs, yields and values of output in the case of groundnut. The CNF's 'cost reduction effect' in the case of PNPIs ranges from 12.6 per cent to 82 per cent. Though in the case of three seasons, the CNF 'other paid-out casts' are more than Non-CNF, the CNF 'total paid-out costs are less than that of Non-CNF in all seasons because of its lower PNPI costs, as observed in paddy as well. The 'yield augmenting effect' of CNF is positive in all seasons, though it varies from a low of 0.9 per cent in kharif 2019 to an all-time high of 41.5 per cent in rabi 2020-21. Further the percentage difference 'net value of output' per hectare is higher than 'gross value' in all seasons. Broadly, similar trends of substantial 'cost reduction effect', driven by the use of biologicals in CNF and the transmission of the same through the additional yield augment effect and finally to higher net value of output per hectares are observed in most of crops reported in IDS reports. There certainly are differences due to the degree of adoption of CNF practices for a full season cycle or part of the season as well as the regional and seasonal exception in certain crops but there is no room for a general conclusion that "NF is not able to achieve higher yield than conventional farming" as observed by the 'Collaborative Research Project' sponsored by the NITI Aayog (Ranjit Kumar et.al.2020) which studied 'natural farming' in three states including the CNF in Andhra Pradesh.

The almost universal cost reduction among all CNF crops compared to the Non-CNF due to the substitution of biological PNPIs in the place of chemical fertilizers and pesticides tells only one part of the story, and hides two other equally critical and significant parts of the story of the effect of the switch from traditional to NE. One is that the substitution not only reduces the paid-out costs of the CNF farmers, but also reduces the extent of fertilizer use, and to that extent the fertilizer subsidy cost to the exchequer of both the state and the their governments. IDS (2021c) provides a very thoughtful estimate of the CNF project's contribution to the benefits in the form of the value of the chemical fertilizers and pesticides per participating farmer as well as the total for all participants; sowings in paid-out costs per farmer as well as total savings for all; and the Gross and Net-Values of output per farmer and for all farmers (Table 3.4).

Table 3.4a

PNPI Costs, Other Paid-out Costs and Total Paid-out Costs of Groundnut in Comparative Perspective: CNF and Non-CNF

Seasons & Year	*PNPI Costs (Rs/Ha)*			*Other Paid out costs (Rs/Ha)*			*Total Paid out costs (Rs/Ha)*		
	CNF	*Non-CNF*	*Differ-ence (%)*	*CNF*	*Non-CNF*	*Diffe-rence (%)*	*CNF*	*Non-CNF*	*Differ-ence (%)*
2018-19									
Kharif	2759	3732	-26.1	26460	26225	0.9	29219	29957	-2.5
Rabi	1587	8846	-82.1	35369	29442	20.1	36956	38288	-3.5
2019-20									
Kharif	6994	8001	-12.6	40054	43745	-8.4	47048	51746	-9.1
Rabi	6566	14064	-53.3	49084	52339	-6.2	55650	66403	-16.2
2020-21									
Kharif	4027	7101	-43.3	42513	41347	2.8	46540	48448	-3.9
Rabi	3608	8982	-59.8	36319	48168	-24.6	39927	57150	-30.1

Table 3.4b

Yields and Value of Output of Groundnut in Comparative Perspective: CNF and Non-CNF

Seasons & Year	*Yield (Qtl/Ha)*			*Gross Value (Rs/Ha)*			*Net Value (Rs/Ha)*		
	CNF	*Non-CNF*	*Difference (%)*	*CNF*	*Non-CNF*	*Difference (%)*	*CNF*	*Non-CNF*	*Difference (%)*
2018-19									
Kharif	15.3	12.4	23.4	29264	23796	23.0	13264	-12958	-202.4
Rabi	16.3	15.4	5.8	NA	NA	NA	47489	35695	33.0
2019-20									
Kharif	16.5	16.4	0.6	98236	93091	5.5	51190	41346	23.8
Rabi	28.2	26.9	4.8	174272	163895	6.3	118623	97492	21.7
2020-21									
Kharif	21.1	19.6	7.7	96439	69051	39.7	49899	20602	142.2
Rabi	36.2	25.6	41.4	208215	130637	59.4	168286	73494	129.0

Source: CESS and IDS (Seasonal Reports for 2018-19 (CESS), 2019-20 and 2020-21 (IDS).

Table 3.5

Project Level Benefits, due to CNF in 2020-21

Indicator	*Per CNF Farmer in Rs.*	*Per Partial Farmer in Rs.*	*For all CNF Farmer in Rs. Crores*	*For a all Partial Farmers Rs. Crores*	*For all Farmers Rs. Crores*
Savings in Agrichemicals	11944	5972	153.25	209.34	362.59
Savings in Paid-out Costs	12177	6088	156.23	213.42	369.65
Gross Value of Output	15493	7746	198.78	271.55	470.33
Net Value of Output	27670	13835	355.01	484.97	839.98

Source: IDSAP Field Surveys.

According to these estimates, in 2020-21 an amount of Rs.363 crore worth of chemical fertilizers and pesticides were not used (saved) by CNF farmers by turning to biological PNPIs instead. In addition, Rs.200 crores worth of fertilizer subsidy was saved for the public exchequer. Further, Table 3.5 shows that the net value of CNF farm output increases over gross value by the amount of the hidden value that is in the form of saved paid-out cost.

The second hidden part of the story of the switch to CNF and the chemical PNPIs saved is in the positive internalisation of the negative externalities of the use of chemicals. It has two dimensions. One is that the reduction in fertilizer and pesticide use has the "soil damage, water and output contamination reduction effect" and the second is the substitution with biologicals has the "soil and human health augmentation effect". There are still trying to be estimated and compensated to the CNF farmers as the "ecological services" rendered, which will go a long way in the sustainability of not only farming but also the small farmer livelihoods. There has been a growing demand for such compensation across the world. "….. farmers adopting more sustainable agroecosystems are internalizing many of the agricultural externalities associated with the intensive farming and hence could be compensated for effectively providing environmental goods and services. Providing such compensation or incentives would be likely to increase the adoption of resource serving technologies" (Dobbs and Pretty 2004). Nearer home there are voices suggesting payments to farmers for ecosystem services that they provide "which could be a novel way to achieve multiple goals of doubling the farm incomes, reduce rural-urban migration, reduce pressure on urban infrastructure, and at the same time, incentivize sustainable agrarian practices in India" (Devi et. al. 2017).

(iii) The Impact of CNF on Diversification of Farming and Sources of Income

The above analysis of the costs, yields and value of earnings are confined to each crop for which filled data was collected and presented in per hectare terms. But the more crucial question is as to what difference CNF has made to households - earnings from agriculture and non-agricultural sources? At the household level what type of diversification could be discussed within agriculture and beyond? To answer these questions farm category-wise and source-wise household data become essential. From the IDS reports such data are available for only 2020-21 (IDS, 2021b). Table 3.6 shows the average household income of CNF and Non-CNF farming households from different sources during the entire year 2020-21 including both kharif and rabi seasons. A word of clarification on the details presented in Table 3.6 may be in order. Regarding the CNF households, Table 3.6 provides details of average income from each source to each of the category of households as well as the average of all the households and all the sources. But for Non-CNF, source-wise information is confined to only average of all households and not for each category of household. This is done to reduce the load on the table but without harming the focus on the differences between the CNF and Non-CNF in the overall average household income source-wise and category-wise. The CNF and Non-CNF differences for each source is given in col.8 (col.6 – col.7), and for each farm class/category in the last row of the table.

Table 3.6

Farm Category-wise Household Income of CNF from Different Sources in Comparison with non-CNF Farmers during 2020-21 (in Rs.)

Income from	*Kharif & Rabi*						
	PMDS+CNF				*CNF*	*Non-CNF*	*Difference*
	Pure Tenant	*Marginal*	*Small*	*Medium & Large*	*Total*	*Total*	*CNF – Non-CNF*
1.1 Income from major crops	56,545	50,578	56,754	48,571	52,438	51,528	910
	(30)	(29)	(27)	(16)	(27)	(31)	(2)
1.2. Other Crops	64,197	24,227	48,024	1,18,359	38,125	9,737	28388
	(35)	(14)	(23)	(38)	(20)	(6)	(29.2)
2. Animal Husbandry and Fishery	20,274	29,071	40,886	36,607	31,579	29,074	2505
	(11)	(17)	(19)	(12)	(17)	(18)	(9)
3. Forestry	424	1,372	2,226	266	1,441	835	606
	(0)	(1)	(1)	(0)	(1)	(1)	(73)
4. Wage from Agriculture	24,663	18,528	14,185	12,199	17,656	19,749	-2093
	(13)	(11)	(7)	(4)	(9)	(12)	(-11)
5. Self-employed in non-agriculture	1,528	2,726	2,565	12,814	3,119	3,100	19
	(1)	(2)	(1)	(4)	(2)	(2)	(0.6)
6. Non-agricultural wage and salary	9,771	22,508	16,703	53,338	21,698	23,462	-1764
	(5)	(13)	(8)	(17)	(11)	(14)	(-2)
7. Rent	115	1,525	4,007	3,532	2,109	1,150	959
	(0)	(1)	(2)	(1)	(1)	(1)	(83)
8. Other Sources	8,175	23,225	25,896	23,091	22,631	25,463	-2832
	(4)	(13)	(12)	(7)	(12)	(16)	(-11)
Total income - CNF	1,85,691	1,73,760	2,11,246	3,08,777	1,90,796		
	(100)	(100)	(100)	(100)	(100)		
Total income – Non-CNF	1,62,731	1,38,389	2,09,897	1,91,310		1,64,098	
	(100)	(100)	(100)	(100)		(100)	
Difference: CNF – Non-CNF	22960	35371	1349	17467			26698
	(14)	(26)	(0.6)	(61)			(16)

Note: Figures in parentheses are percentages.

Source: IDSAP Field Survey, 2020-21 (IDS, 2021b)

On the whole the incomes of the CNF farmers are higher than that of Non-CNF farmers across each of the classes ranging from marginally more (0.6 per cent) in the case of small farmers, to 14 per cent more in the case of pure tenants, 26 per cent more for marginal to the highest difference (61 per cent) in medium and large class. First, this is due to the CNF farmers' cost advantage, driven by the shift to biologicals as discussed earlier, and also yield gains in many main crops. Second, "other crops" forms the second most important and substantial (20 per cent) source of income for CNF farmers, while for Non-CNF "other crops" is an insignificant (6 per cent) source (see 2nd row 2 cols. 6&7). In fact, the entire difference of Rs.26698 (16 per cent) in the incomes between the CNF and Non-CNF farmers is explained by the difference in the incomes from "other crops". What is more revealing is that the income from "other crops" constitutes 35 per cent of the total income for "pure tenants" and 38 per cent for "medium and large" farmers. This is more than the share of income of 30% and 16% from the major crops, for both categories respectively. This clearly shows the impact of crop diversification and crop intensity with a variety of crops spread over the year on earnings. It is reflected in each one of the CNF classes. It draws attention towards the positive environmental effect of diverse crop cover of the soil.

Further, the third contributing factor to the difference in incomes in favour of CNF farmers is the role of animal husbandry. About 64 per cent of CNF farmers have dairy animals compared to 49 per cent in the case Non-CNF farmers (IDS, 2022). The combined additional income from "other crops" and "animal husbandry", which may be called the "diversification effect", are much more than the combined "cost reduction effect" and "yield enhancing effect".

The phenomenon of "other crops" and its relatively phenomenal contribution to CNF farmers' household income has to be seen in the light of some of the following practices, other than the main components earlier promoted under APCNF. These include 365 Day Green Cover (365 DGC); treating each holding as a watershed; adopting diversified crop models such as 5-layer models-multiple layers of crops grown on a piece of land simultaneously; 36 by 36 models – a piece of 36 meter by 36-metre land developed with diversified crops to yield sustainable and continuous income to farmers' households throughout the year; system root intensification (SRI); and micro-irrigation promoted to improve water usage efficiency. Further, from 2019-20, the APCNF introduced an innovative method of farming called Pre-Monsoon Dry Sowing (PMDS) to enable sowing of crops in the dry season before the onset of monsoons. The diverse crop cover under CNF creates special conditions which enable seed germination with very little water through the water vapour harnessed from the air in the atmosphere. Once the monsoon sets in the seedlings start growing. There is hardly any doubt that these practices are at the root of the income reported under "other crops". But as long the contribution of the practices listed above are not identified, the income under 'other crops' will remain vague and for some puzzling.

This brings-in the question of the need for measuring the performance of diversified farming systems differently. For crops in agroecological systems, "……measuring the production of a single crop (yield) makes no sense, as their true productivity is the sum of all they produce on each hectare…." Integrated faming systems in which the small-scale farmer produce gains, fruits, vegetables, fodder and animal products out-produce yield per unit of single crop" under monocropping (Rosset and Altieri 2017). It is suggested that an important tool to assess yield advantages is the 'land equivalent ratio' (LER). The LER measures the yield advantage obtained by growing two or more crops as an intercrop compared to growing the same crops as separate monocultures. The LER is calculated using the formula $LER=\sum(Ypi/Ymi)$, where Yp is the yield of each crop in monoculture. For each crop (i) a ratio is calculated to determine the partial LER for that crop, then the partial LERs are summed up to give the total LER of the intercrop. A LER value of 1.0, indicates no difference in total productivity between intercrop and monocrop. A value greater than 1.0 indicates a production advantage for the intercrop (Rosset and Altieri, 2017).

Returning to Table 3.6, while CNF contribution to improvement in household earnings is quite positive, still the question is whether the improved earnings assure sustainable livelihood to smallholders? The improved incomes of CNF farmers from all the sources works out to monthly earnings of Rs. 14,480 for the marginal, Rs.17604 for the small, Rs.15474 for 'pure tenants', and only Rs.25,731 (even) for medium and large categories, which by themselves are far from adequate for smallholder sustainable livelihoods. But by reducing costs and risks, CNF has laid a stable foundation for a better livelihood which needs to be built up through building institutional support systems. This can be done through strong involvement of the state in securing premium market process for their produce, better public health, educational and skill development facilities that would enable them to diversify their sources of earnings further and compensating appropriately for the ecological services.

(iv) Impact of CNF on Quality of Soil, Crops, Food and Life

The shift to natural farming is much more than cost reduction and yield augmentation on productivity gains in terms of commodities produced but it also involves the qualitative non-commodity values generated. Table 3.7 and figure 3.4 record some of these values generated in the farm for improved soil quality, improved soil moisture though reduced water use, better plant resilience to extremes of weather, better taste and quality of food, improved health and reduced out of pocket health expenses, reduced tension due to less external financial dependence and above all, increased 'happiness', an index which is now globally more sought after than the 'GDP' index. These highlight, as never before, the clear positive multi-functionality of agriculture (Amekawa 1999, Amekawa et. al. 2010, and Rosset and Altieri 2017). Thus, CNF shows how agriculture which accumulated life threatening negative externalities under chemical agriculture can transform towards a positive that adds to welfare.

Table 3.7

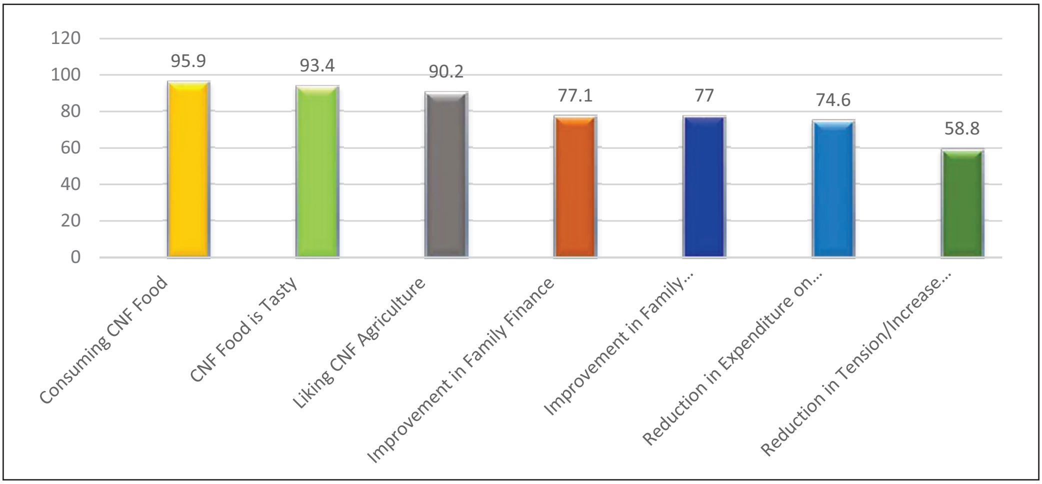
Impact on Soil and Crop Resilience: CNF Farmers' Response (%)

Indicator	*2018-19*		*2019-20*		*2020-21*	
	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
Improvement in soil quality	83		94		97	85
Soil softened	83	52	92	37	97	80
Now see more earth worms	82	43	76	3	76	66
Increased green cover	56	36	64	30	77.	72
More resistance towards dry spells	42	20	42		78	69
Stronger Stems	60	33	47		91	77
Grain weight increased	53	35	64		90	75
Soil Moisture increased					65	59
Withstand heavy rains					77	69
Withstand strong winds					61	60

Source: *IDSAP Field Survey, 2020-21*

Figure 3.4

Farmers Response in Increasing Human Well-being due to APCNF Farming (%)



(v) Constraints Faced by CNF Farmers

The last set of indicators of the performance of CNF relates to the constraints that persist even at the end of the third year of reporting. Table 3.8 lists the extent of these constraints as perceived by the CNF farmers. While most of these constraints like 'scarcity of Desi Cow', 'knowledge gap', 'procurement of inputs' etc., could be resolved at the local level as the project gets entrenched, the biggest challenge that is likely to persist unless there is concerted effort towards marketing of variety of CNF produce which is produced in small quantities throughout the year. It is a question of aggregation at one level, and ensuring better or premium price at the other. Small farm-based 'natural farming' has faced this problem in developing countries across all three continents. This has been recognised by those who report to the UN on food security and small farms: "The reality is that small food producers face a number of problems…….(for them) improving market conditions is a greater priority than – and a condition for – improving crop productivity…." (DeSchutter and Vanloqueren 2011). Those with rich experience in development natural farming caution: "The demand for agroecological products and opportunities for farmers to sell their produce grown ecologically at a profit can be key driving force in successful cases of bringing agroecology to scale…" (Rosset and Altieri 2017).

Table 3.8

CNF Farmers Reporting Constraints of Different Types in Practicing NF (%)

Constraints	*2018-19*	*2019-20*	*2020-21*
Lack of Marketing Support	44	77	78
Scarcity of Desi Cow	37	69	66
Knowledge Gap	24	7	63
Procuring Inputs	31	31	55
Scarcity of Labour	35	39	60
Scarcity of Family Labour	24	25	52
Transplanting	6	3	
Preparing Seedling bed	13	5	
Others	2	8	

Source: IDSAP Field Surveys.

IV. SCALING UP APCNF

There are eulogies in praise of the progress of alternative agriculture. For instance in the case of ZBNF in Karnataka: "The level of participation has been achieved without any formal organization, paid staff, or even a bank account. The movement benefits from the spirit of voluntarism among its peasant farmer protagonists. Part of the appeal to farmers comes from Palekar's charisma and powerful mix of Hindu cosmology and resistance to both international corporations and the green revolution"(Mateo Mier et. al. 2018). Very elating indeed! But, in the face of the high profile that has been built around the Green Revolution, a phenomenon that brought about a historically unprecedented breakthrough in agricultural productivity, that is at the base of the food security of the present and as the only promise for the future and with all the corporate, political interests and equally significant agricultural scientific community entrenched around it, change from the conventional so called industrial agriculture is not an easy task. The APCNF story is one that seems to have worked with the principle that if the small-marginal farmer whose livelihood has taken a beating under 'chemical agriculture' are made to regain their confidence that their own knowledge and locally accessible resources could bring stability to their farming and with improvements in how and what they produce and consume the success of natural farming is ensured.

As mentioned earlier, the APCNF was launched in 2016 by the Rythu Sadhikara Samstha (RySS), started as a special corporation under the Department of Agriculture of the Government of Andhra Pradesh (GoAP). The cautious encouragement by the GoAP is obvious from the fact that there was no direct funding for the project. Though APCNF is a part of the Agriculture Department, there was no share in the budget allocation, except salary payments for the district and state level personnel of the project. When the ZBNF was launched in 2016, there was widespread bureaucratic scepticism and more importantly, near hostility from the agriculture science community. Even as the Union government softened towards ZBNF and showed willingness to make it part of its promotion programmes, there was resistance from the agricultural science establishment. Responding to the fervent appeal in the Economic Survey 2018-19 and an endorsement by the finance minister while presenting the union budget 2019-20 for the adoption of ZBNF, the National Academy of Agricultural Scientists (NAAS) called for a day-long Brainstorming Session on August 21, 2019. About 75 scientists participated in the session, referring to a few field studies which indicated that "yield levels were drastically reduced in several cropping systems" where natural farming is followed. They concluded that widespread adoption of ZBNF "may lead to massive damage to the hard-earned knowledge and benefits of agricultural R & D over the last 70 years. and ZBNF cannot provide adequate quantity of nutrients required for higher crop productivity as soil has a limited nutrient supplying capacity" (NAAS, 2019). This conclusion, that reminds the proverbial saying of "throwing the baby with the bathwater", is obviously more prejudiced than based on any 'scientific' knowledge of what is emerging on the other side of agricultural science viz. agroecology, the awareness of which would have informed more nuanced and balanced conclusion. However, there are clear indications that the NAAS rushed response is not the last word on behalf of agricultural science and there are other reasonable voices of science.

A team of scientists concerned with the challenges that India faced in terms of loss of agrobiodiversity due to chemically intensified agricultural farming, the increasing replacement of locally adopted and traditionally grown cultivators by high-yielding modern cultivators, soil degradation, fragmentation and excessive tillage, inappropriate crop rotation, water scarcity, post-harvest losses, national disasters and climate change impacts, after policy analysis of various schemes, missions and programmes of the Ministry of Agriculture and Farmers' Welfare put forth recommendations towards promoting ecologically intensified agricultural farming practices by ecological principles (Jacob, Parida and Kumar 2020). There were similar strong voices from some of those who have been a well-established part of agricultural science: "The biodiverse, predominantly crop-livestock mixed farming in India is the key to ensure resilience to climate change and sustainability of smallholder farming ecologies", and they went on to suggest: "Recognizing that access of smallholders to technology, land, and other production resources, credit, and capital is limited, a holistic pro-smallholder approach and robust policy initiatives are called for" (Singh, Parada and Sudhami, 2021). Further, a recent scientific evaluation of ZBNF projects in three states viz. Andhra Pradesh, Karnataka, and Maharashtra by a team of agricultural scientist sponsored by the NITI Aayog came out with a categorical conclusion, though they have some doubts about yields, that "the Natural Farming Practice has established itself as sustainable agricultural production system" (Kumar et. al. 2020)

It is in this changing atmosphere of scientific opinion in favour of alternative agriculture to overcome the challenges faced by the smallholder agriculture, deteriorating agrobiodiversity and climate change, that there has been a positive response by the Government of India (GoI). In 2015-16, GoI launched Paramparagat Krishi Vikas Yojana (PKVY) with financial assistance to natural farming practices at the rate of Rs.50,000 per hectare for three years of which Rs.31,000 (61 per cent) would be direct benefit transfer (DBT) for inputs like bio-fertilizers, bio-pesticides, organic manure, compost, vermicompost, botanical extracts etc. Another initiative towards natural farming is the launch of the Bharatiya Prakritika Krishi Padhati

(BPKP) in 2020-21 with an outlay of Rs.4645.69 crore for a period of six years from 2019-20 to 2025-25 (MoAFW, 2022). This is conceived as a sub-programme of the PKVY for the promotion of traditional indigenous practices including Natural Farming to bring down input costs, promotion of on farm bio-mass recycling, with stress on biomass mulching, use of cow dung and urine formulations, and plant-based preparations. Initially, BPKP assistance to cover about 4 lakh hectares over eight states was launched, with the largest area of one lakh hectares in Andhra Pradesh. Though still a meagre existence compared to the scale of APCNF, the Centre's initiatives are reflected in the resources available to APCNF (Table 3.9).

Table 3.9
Sources of Finance for APCNF (Rs. Lakh)

Year	*RKVY*	*PKVY*	*BPKP*	*APPI*	*Total*
2015-16	3404				3404
2016-17	4591				4591
2017-18	3838	3163.89		1200	8201.89
2018-19	6300	6760.09		614.16	13674.3
2019-20		12496.6		839.93	13336.5
2020-21		13773.9		0	13773.9
2021-22		15399.5	1250	1252.17	17901.6
Total	18133	51593.9	1250	3906.26	74883.2

Source: RySS, AP

The RKVY funding could be seen as initial seed money for the first two years of the programme, while the launching of PKVY has helped in scaling up during the last five years. The initial promise of the project helped in encouraging Azim Premji Philanthropic Initiatives (APPI) to chip in resources towards studies to assess the impact of the APCNF. Though one of the largest of its kind across the world, if APCNF has to be scaled up to reach at least half of the villages in the state, resources are required not only to help the farming community to shift to CNF but also to assist small-marginal farmers to move on to reasonably stable diversified earnings. This would make a considerable enhancement of Centre's financial and infrastructure support an essential condition. A clearly laid down public policy towards scaling up of the CNF as a part of the overall National Agricultural Policy would help provide a clear direction. The expanded BPKP and the repurposing of the present agricultural subsidies could be a first step in that direction. The positive attitude of GoI towards natural farming could be seen in the expanded BPKP and in NITI Aayog's sponsoring of consultations and conferences on natural farming with the commissioning of a working paper on the theme (Patel et. al. 2022). The CNF, with its several advantages, has unequivocally proved as a practice of substantial cost saving to farmers in general. But as far as the government is concerned it cannot be seen as a method of reduced fiscal commitment. At this stage it is necessary to caution that if the growing interest of the Union government in natural farming is because of the consideration of it as an agricultural subsidy and investment sowing machinery, it would be disastrous for Indian agriculture, especially for the small-marginal farmers. What is needed is more help to small farmers through repurposed and restructured subsidies and investment in building up of infrastructure both institutional and physical, at least for a decade until this alternative system acquires stable and gainful adoption. Given the present condition of the smallholder agriculture it could mean more of the state to turn their livelihoods towards the sustainable path. There is a clear message from Peter Hazell (2005) referring to the role of the state in smallholder agriculture: "How much one judges that ways can be found for the public sector to play a useful role is one of the differences between those who believe that small farmers have a future and those who do not".

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