AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Agricultural Economics Research Review
Vol. 28 (Conference Number) 2015 pp 25-34
DOI: 10.5958/0974-0279.2015.00019.1

Misplaced Priorities and Lopsided Investments: A Macroscan of Agriculture, Livestock and Fisheries Sectors in India

Neha W. Qureshi[a*], Lalith Achoth[b], M. Krishnan[a], Swadesh Prakash[a], Ananthan P.S.[a], N.R. Kumar[a] and S.K. Pandey[a]

[a]ICAR-Central Institute of Fisheries Education, Mumbai- 400 061, Maharashtra
[b]College of Dairy Science, KVAFSU, Hebbal, Bengaluru- 560 024, Karnataka

Abstract

This paper captures the performance of the agriculture, livestock and fisheries sub-sectors in terms of capital formation, incremental capital output ratio and relative contribution of these sub-sectors to gross domestic product during the period 2004-05 to 2010-11. The Gross Fixed Capital Formation (GFCF) in fisheries took off at around 6 per cent in 1990, peaked at around 16 per cent in 1999 and has been hovering around 10 per cent for the past 5-6 years. But, the GFCF in agriculture turned positive after 1999, and reached a maximum of 5 per cent, while GFCF in livestock, turned positive only in the Xth Plan period and still remains below the 5 per cent mark. The investment elasticity of growth (IEG) in agriculture has been found fluctuating during 1981-2011, while that of the livestock and fisheries sub-sectors has been found improving. In all the three sub-sectors, when the investment elasticity is higher, the Incremental Capital Output Ratio (ICOR) is lower and vice-a-versa. The investment efficiency ratio (IER) has been found increasing in agriculture and fisheries, and reducing in the livestock sub-sector. Despite the fact that agriculture is the largest private investment sector in India, the investment elasticity is low and the ICOR is high, indicating the need for a relook at the composition and direction of investment in agriculture and livestock sub-sectors. The estimates of IEG in the fisheries have been found positive but, the ICOR is declining, indicating an increased output resulting from the increasing capital formation. The co-integration analysis has revealed a long-run equilibrium of time series with a common ground in the values of agriculture, livestock and fisheries GDP and GFCF. The ICOR in livestock has been found declining, indicating an excess capacity of capital in this sub-sector despite the fact that the IER has been marginally positive. The excess capacity could also arise because of misdirected investments in areas within the livestock sub-sector. Some broad leads have been derived from the results.

Key words: Gross fixed capital formation (GFCF), investment elasticity of growth, ICOR, investment efficiency ratio, agriculture, livestock, fisheries

JEL Classification: Q22, Q13, E6, O210

Introduction

Although agriculture accounts for only 14 per cent of gross domestic product (GDP) presently, it is still the main source of livelihood for the majority of rural population in India. Several significant structural changes are taking place within the sector and there are definite signs of improved performance. The average of annual growth rates of GDP in agriculture and allied sectors during the XI Five-Year Plan is placed at 3.3 per cent. This is, though short of the target of 4 per cent, is significantly better than the achievement of 2.4 per cent in the X Plan. Failure to reach the target growth is one reason for the high inflation in prices of

* Author for correspondence
Email: nihaqureshi01@gmail.com

food and other primary commodities that persists despite recent slowdown in overall GDP growth. Consequently, although the overall GDP growth target of the XII Plan has been revised, the growth target for agriculture is maintained at 4 per cent (GoI, 2013)

Small farms dominate the Indian agriculture and the Agriculture Census 2005–06 had reported the average size of an operational holding at only 1.23 ha, with farms less than 2 ha comprising 83 per cent of all holdings and 41 per cent of area. It may be noted that 12 per cent of the rural households are now headed by females and are with even smaller holdings. For achieving the growth rate of 5–6 per cent per annum, the livestock sector would have to address important challenges during the XII Plan. Compared to its contribution to the economy, the livestock sector has received much less resources and institutional support. The potential of fisheries sector in providing quality food and nutrition, creating rural livelihoods, advancing socio-economic development in the rural and far flung areas is recognized as a powerful tool for poverty reduction and fostering rural development. With a perspective on the outcome of the XII Five-Year Plan, this paper has studied :

(i) Performance of agriculture , livestock and fisheries sectors over time, and

(ii) Capital formation, incremental capital output ratio (ICOR), investment efficiency, and relative contribution of these sub-sectors to the gross domestic product

Data and Methodology

The secondary data on output values from agricultural crops, livestock and fisheries sub-sectors were taken from the National Accounts Statistics. All values are based on 2004-05 prices. To examine the change in output values, the following index was used (Singh and Lal, 1990)

$$Index = I_{YX} = \frac{Yi}{Xi} \times 100 \quad \ldots(1)$$

where,

Y_i = Output value of the i^{th} year

X_j = Output value of the j^{th} year, - $i > j$

and i , j = 1,2,3,4,5, i.e. 2004-05 to 2010-11

Incremental Capital Output Ratio

The incremental capital output ratio (ICOR) assesses the marginal amount of investment capital required for an entity to generate the next unit of production and is used in determining a country's level of production efficiency. It is calculated as:

$$ICOR = \frac{Annual\ investment}{Annual\ increase\ in\ GDP} \times 100 \quad \ldots(2)$$

World Bank's incremental capital output ratio (ICOR) tool has been used to analyse the impact of the GFCF of agriculture/fisheries on the GDP of agriculture/fisheries. In this study we have used the formula (3)

$$ICOR = \frac{GFCF\,(AGRI)\,t-1}{GDP\,(Agri)\,t - GDP\,(Agri)\,t-1} \quad \ldots(3)$$

where, GCF is the gross capital formation, t is the present year and t-1 is the previous year of analysis period. Higher the ICOR, lower the productivity (Sivakumar, 2013).

The other tools used in the study were investment elasticity of growth (IEG) and investment efficiency ratio (IER).

Investment Elasticity of Growth (IEG)

The investment elasticity of growth (IEG) gives the percentage change in GDP with respect to the percentage change in the gross capital formation (GCF). The elasticity concept has been utilized in this study to analyse the sensitivity of GDP in agriculture, livestock and fisheries for the change in GCF in these sub sectors, respectively.

$$Inv\,Ed = \frac{\delta\,GDP}{\delta\,GCF} * \frac{GCF}{GDP} \quad \ldots(4)$$

where, *Inv Ed* is the investment elasticity of growth and δ denotes the change.

Investment Efficiency Ratio (IER)

This is the ratio between gross fixed capital formation and GDP and a higher value indicates higher rate of capital formation.

$$IER = \frac{GFCF}{GDP}$$

Results and Discussion

Table 1 shows the shares of fisheries GDP and livestock GDP in agricultural GDP and total GDP for the period 2005-06 to 2012-13. The contribution of fisheries GDP to the total GDP has marginally increased, from 0.93 per cent to 1.10 per cent in 2012-13, while the subsector's share in agricultural GDP has made it past the 5 per cent mark to 5.45 per cent in 2012-13. Relatively, the contribution of livestock to total GDP has ranged from 4.39 per cent to 5.45 per cent and to agricultural GDP from 23.60 per cent to 27.25 per cent. Therefore, the performance of both livestock and fisheries has remained relatively constant during the X and the XI Plan periods.

The values of output in sub-sectors and agricultural crop sector presented in Table 2 reveal a steady increase. For the overall agriculture and allied sectors, it ranged from 2.30 per cent during pre-green revolution period to 3.60 per cent during XI Five-Year Plan (2007-08 to 2011-12). The growth in the value of output from livestock sub-sector ranged from a low of 1.00 per cent to a high of 4.80 per cent, and from fisheries, it ranged from 2.70 per cent to 4.70 per cent for the same period. The livestock sub-sector contributed 25 per cent to the gross value added in the agriculture sector and it provides employment to about 21 million people. A rapid growth of this sector would be even more egalitarian and inclusive than the growth of crop sector because those engaged in it are largely smallholders and landless. The growth of livestock output averaged 4.8 per cent per annum during the XI Plan, recovering from an average of 3.6 per cent in the IX and the X Plans.

Table 1. Contribution of fisheries GDP and livestock GDP to total GDP and agricultural GDP, 2005-06 to 2012-13

(per cent)

Year	Share of fisheries GDP in		Share of livestock GDP in	
	Total GDP	Agri-GDP	Total GDP	Agri-GDP
2005-06	0.93	4.97	3.76	23.75
2006-07	0.89	4.87	3.61	23.60
2007-08	0.85	4.65	3.69	23.64
2008-09	0.83	4.67	3.78	24.85
2009-10	0.82	4.65	3.88	25.53
2010-11	0.79	4.39	3.80	24.99
2011-12	0.78	4.47	3.92	26.55
2012-13	1.10	5.45	3.93	27.25

Table 2. Growth in value of output in agricultural crops, livestock and fisheries sub-sectors, (1951-2012)

(per cent)

Sector	Pre-green revolution period 1951-52 to 1967-68	Green revolution period 1968-69 to 1980-81	Wider coverage 1981-81 to 1990-91	Early liberalization 1991-92 to 1996-97	IX Plan 1997-98 to 2001-02	X Plan 2002-03 to 2006-07	XI Plan 2007-08 to 2011-12
Value of output at 2004-05 prices							
Agricultural crops	3.0	3.00	3.00	3.10	2.30	2.10	3.40
Livestock	1.00	3.30	4.80	4.00	3.60	3.60	4.80
Fisheries	4.70	3.10	5.70	7.10	2.70	3.30	3.60
Agriculture & allied	2.30	2.40	3.0	3.10	2.60	2.40	3.60

Source: GoI (2013)

The performance of fisheries sub-sector has been impressive registering a growth of more than 5 per cent per annum during the 1980s and 1990s, but this growth has been decelerating since mid-1990s. This deceleration maybe attributed to the stagnant marine fish landings, a phenomenon which is expected to continue. Inland fisheries have been contributing to this growth in a substantial way, the brackish water aquaculture with its high-value species being in the lead. Fish prices more than doubled during the XI Plan, at a higher rate than the rise in prices of other agricultural and livestock commodities, despite increased growth in production, *albeit* small, compared to the X Plan.

There is a need to integrate the roles of the National Fisheries Development Board (NFDB), Marine Products Exports Development Authority (MPEDA) and the Department of Fisheries (DoF) in various states. The DoF in the states needs to become growth-oriented. It is also necessary that the priority of welfare of fishers and fish farmers is taken up by the administrators and the technical people should concentrate on growth. These priorities, misplaced presently, have in particular meant an inability to realize the vast potential of inland freshwater fishery. Fish production can be enhanced 2 to 4 times in the rainfed water bodies, including irrigation reservoirs, natural wetlands or ponds and tanks built under watershed development or Mahatma Gandhi National Rural Employment Guarantee schemes. If fully harnessed, the sub-sector has the potential to register 6 per cent growth in the XII Plan (GoI, 2013).

The movement of the real price of agricultural commodities (2004-05 base) has indicated that the real prices have increased for all agricultural commodities (consisting of both food and non-food primary commodities by 22 per cent, while of eggs, fish and meat (EFM) have increased by 37 per cent. The contribution of EFM to food inflation was nil during 2004-2009, but went up significantly during the XII Plan. This has been ascribed to the shortage of feed and forage following the 2009 drought (GoI, 2013). The projected demand for fish for 2016-17 is 11 Mt and 14 Mt by 2020-21 against the current production of 9.6 Mt (XII Plan WG, Fisheries, 2013).

Table 3 depicts the increase in output values from agriculture during the period 2004 to 2012. The maximum increase in output values over the previous year value was 12.83 per cent in 2006 over 2005. The fall in value over the preceding year ranged from -0.38 per cent to -8.35 per cent. The output values fluctuated in real terms irregularly during the period considered.

Changes in output values from livestock for the period 2004-2011 are presented in Table 3. The positive percentage changes in output values ranged from 100 to 118.79, indicating an 18 per cent increase in value of output of livestock products during 2004-2011. The fall in value over the preceding year value ranged from -2.66 per cent to -3.34 per cent.

The positive changes in output values from fisheries for the period 2004-2011, based on the preceding year value ranged from 0.33 per cent to 40.37 per cent (Table 3). Therefore, a substantial increase in value of output of fisheries can be discerned over 2004-2011. The range of negative movement of output values in fisheries was from -0.33 per cent to -2.42 per cent, indicating again a stability in value of output in the market. But, the sudden jump of 40.37 per cent in value of output in 2011-12 over 2010-11 indicated a dramatic increase in the prices of fishes, especially marine fishes. Excluding the incremental output value in 2011-12, the output values ranged between 0.33 per cent and 6.25 per cent only.

The comparison of output values across sectors over the X^{th} and the XI^{th} Plan periods, does not indicate a clear advantage of one sub-sector over the other in terms of rates at which the output values have been growing. Nevertheless, the trends do indicate the relative advantage of the livestock sector and also of the fisheries sector. In the case of the latter, the performance has been remarkable in terms of absolute values for quantity and value during 2012-2014. The fish production has risen from 8.6 Mt in 2011-12 to 9.4 Mt in 2012-13 and further to 9.5 Mt in 2013-14.

The contribution to GDP of agriculture ranged from 15.18 per cent (2011-12) to 16.04 per cent (2004-05), of livestock ranged from 3.61 per cent (2006-07) to 4.02 per cent (2004-05) and of fisheries ranged from 0.78 per cent (2011-12) to 1.08 per cent (2004-05) during 2004-05 to 2011-12. The combined contribution of the three sub-sectors to GDP ranged from 19.82 per cent (2008-09) to 21.13 per cent (2004-05). Examination of the ratios of sub-sectors to GDP in

Table 3. Change in output values from agriculture, livestock and fisheries sub- sectors, 2004-2012 (Base=Preceding year)

(per cent)

Year	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
				Agriculture				
2004-05	100	112.83 (12.83)	112.95 (0.83)	117.94 (4.99)	115.69 (-2.25)	115.24 (-0.45)	120.42 (5.18)	112.07 (-8.35)
2005-06		100	100.1 (0.10)	104.52 (4.42)	102.53 (-1.99)	102.11 (-0.42)	106.72 (4.61)	99.32 (-7.40)
2006-07			100	104.41 (4.41)	102.42 (-1.99)	102.02 (-0.40)	106.61 (4.59)	99.22 (-7.39)
2007-08				100	98.09 (-1.91)	97.71 (-0.38)	102.10 (4.39)	95.02 (-7.08)
2008-09					100	99.61 (-0.39)	104.08 (4.47)	96.87 (-7.21)
2009-10						100	104.49 (4.49)	97.24 (-7.25)
2010-11							100	93.06 (-6.94)
2011-12								100
				Livestock				
2004-05	100	107.05 (7.05)	112.21 (5.16)	118.12 (5.91)	121.63 (3.51)	118.39 (-3.24)	115.05 (-3.34)	118.79 (3.74)
2005-06		100	104.82 (4.82)	110.34 (5.52)	113.61 (3.27)	110.59 (-3.02)	107.47 (-3.12)	110.97 (3.50)
2006-07			100	105.26 (5.26)	108.38 (3.12)	105.50 (-2.88)	102.53 (-2.97)	105.86 (3.33)
2007-08				100	102.96 (2.96)	100.22 (-2.74)	97.40 (-2.82)	100.56 (3.16)
2008-09					100	97.34 (-2.66)	94.59 (-2.75)	97.67 (3.08)
2009-10						100	97.17 (-2.83)	100.33 (3.16)
2010-11							100	103.25 (3.25)
2011-12								100
				Fisheries				
2004-05	100	106.25 (6.25)	105.0 (-1.25)	105.60 (0.60)	103.18 (-2.42)	102.83 (-0.35)	105.0 (2.17)	145.37 (40.37)
2005-06		100	98.88 (-1.12)	99.38 (0.50)	97.11 (-2.28)	96.78 (0.33)	98.82 (2.04)	136.81 (37.99)
2006-07			100	100.57 (00.57)	98.26 (-2.37)	97.93 (-0.33)	100.0 (2.07)	138.44 (38.44)
2007-08				100	97.70 (-2.30)	97.37 (-0.33)	99.43 (2.06)	137.65 (38.22)
2008-09					100	99.66 (-0.34)	101.76 (2.11)	140.88 (39.12)
2009-10						100	102.11 (2.11)	141.37 (39.26)
2010-11							100	138.44 (38.44)
2011-12								100

Note: Figures within parentheses depict the change with respect to previous year value

Table 4. Contribution of agriculture, livestock and fisheries to GDP and combination ratios, 2004-2012

Sector	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Agriculture/GDP	16.04	15.83	15.30	15.63	15.21	15.20	15.58	15.18
Livestock/GDP	4.02	3.76	3.61	3.69	3.78	3.88	3.80	3.92
Fisheries/GDP	1.08	0.93	0.89	0.85	0.83	0.82	0.79	0.78
Agriculture+Livestock+ Fisheries/GDP	21.13	20.53	19.79	20.18	19.82	19.91	20.17	19.89
Livestock/Agriculture	25.04	23.75	23.60	23.64	24.85	25.53	24.39	25.85
Fisheries/Agriculture	6.71	5.90	5.82	5.44	5.46	5.42	5.07	5.17
Fisheries/Livestock	26.82	24.86	24.66	23.00	21.99	21.25	20.78	19.99

Table 4 revealed that the contribution of the livestock/ agriculture sectors was between 23.60 per cent (2006-07) and 25.85 per cent (2011-12), of the fisheries/ agriculture sectors was between 5.07 per cent (2010-11) and 6.71 per cent (2004-05) and of the fisheries/ livestock sectors was between 19.99 per cent (2011-12) and 26.82 per cent (2004-05).

Though individually the contributions of the three sub-sectors have not changed substantially, the performance of ratios does indicate a trend in favour of the ratio of fisheries/livestock sectors, though the tapering of the values is not encouraging.

Capital Formation and Growth

The capital formation through investment in agriculture helps in improving the stock of farm equipment, tools and management of natural resources, which in turn, enables the farmers to use their resources, particularly land and labour, more productively (Goliat and Lokare, 2008). The investment as a proportion of GDP has been on a rising trend since 1970s, but agricultural investment as a share of total investment has been falling since 1980s and investment in agriculture has been stagnant while subsidy for agriculture has risen sharply (Jha, 2007). One of the important reasons for deceleration in agricultural growth has been declining levels of investment in agriculture and allied sectors and irrigation. A key reason for the declining public investment in agriculture has been the increasing agricultural subsidies on fertilizers, power, irrigation, food, etc. In addition, there has been a deterioration of institutions/ organizations providing inputs and services such as credit, seeds, technology, and extension to the agricultural sector (Sharma, 2007).

The capital formation is an important determinant of growth in a sector. The gross fixed capital formation (GFCF) in fisheries took off at over 6 per cent in the 1996, peaked at around 16 per cent in 1999 and has been hovering above 10 per cent for the past 5 years (Figure 1). But, GFCF in agriculture sector turned positive after 1999, and reached a maximum of 5 per cent; and in livestock, it turned positive only in the X^{th} Plan period and still remains below the 5 per cent mark.

Table 5 depicts the investment elasticity, investment efficiency ratio and incremental capital output ratio in agriculture, livestock and fisheries sub-sectors for the period 1980-81 to 2010-11 on a 5-year class interval basis. The investment elasticity of growth in agriculture sector has been varying over the period considered, while that of the livestock and fisheries sector has been improving. The incremental capital output ratio (ICOR) has shown an inverse relationship with its value. The higher the ICOR, the lower is the productivity. It means that more incremental units of capital are needed to produce one incremental unit of output. The efficient use of capital reduces the ICOR, which can lower investment requirements to achieve a higher growth rate in the economy. A higher ICOR implies higher cost of production and lower profitability as well as marginal efficiency of capital (Sivakumar, 2013). The inverse relationship between investment elasticity of growth and ICOR can clearly be seen. In all the three sub-sectors, when the investment elasticity is higher, the ICOR is lower and vice-a-versa. It is also seen from Table 5 that the investment efficiency ratio is increasing in agriculture and fisheries and is reducing in the livestock sector.

Despite the fact that agriculture sector is the largest private investment sector in India, the investment

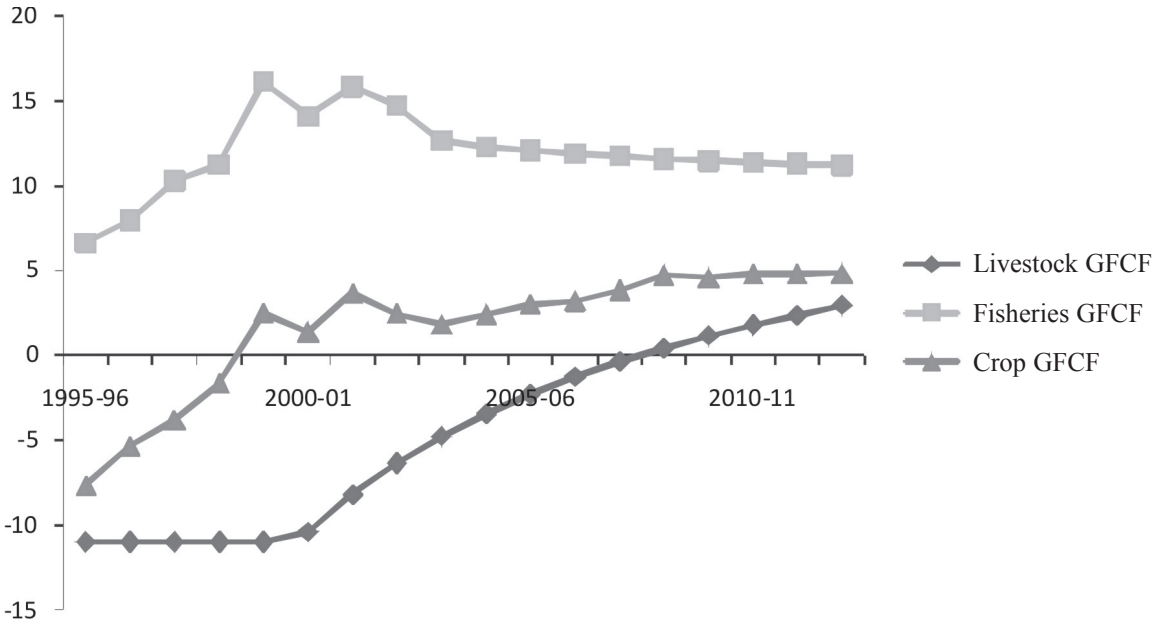

Figure 1. Gross fixed capital formation in agriculture, livestock and fisheries sub-sectors, 1995-96 to 2010-11

Table 5. Investment elasticity, investment efficiency and incremental capital output ratio in agriculture, fisheries and livestock sub-sectors (2004-05 Prices)

Year	Investment elasticity of growth			Investment efficiency ratio			Incremental capital output ratio		
	Agriculture	Fisheries	Livestock	Agriculture	Fisheries	Livestock	Agriculture	Fisheries	Livestock
1980-81	-0.103	0.079	-1.293	0.112	0.056	0.077	6.49	-9.19	0.834
1985-86	-0.038	0.404	-0.755	0.082	0.051	0.038	9.46	0.49	0.483
1990-91	0.019	0.478	-0.133	0.125	0.081	0.020	1.61	0.78	0.452
1995-96	1.548	0.493	-0.314	0.072	0.073	0.003	0.713	0.94	0.067
2000-01	0.138	0.162	0.202	0.114	0.175	0.001	2.74	2.73	0.033
2005-06	0.833	0.467	0.358	0.146	0.214	0.001	2.87	-4.80	0.028
2010-11	0.823	0.540	0.424	0.203	0.331	0.002	2.63	5.33	0.036

elasticity is low and the ICOR is high, indicating the need for a relook at the composition and direction of investment in agriculture and livestock. The estimates of investment elasticity of growth in fisheries are positive, but the ICOR is declining, indicating an increased output resulting from the increasing capital formation. The lone ICOR value of 5.33 in fisheries in 2010-11 may be attributed to the over-capitalization of marine fisheries arising from the improper composition of the fleet strength.

Co-integration

The co-integration analysis has revealed a long-run equilibrium of time series with a common ground in the values of agriculture, livestock and fisheries GDP and GFCF. The Phillips Perron Unit Root test (Table 6) was used whose negative and significant values at first differencing indicated that the data are related in

Table 6. Phillips-Perron unit root test

Series (1980-2012)	Dicky Fuller Z alpha value	Level of Integration
Agriculture GDP	-44.96***	I(1)
Agri.GFCF	-43.29***	I(1)
Fisheries GDP	-36.07***	I(1)
Fisheries GFCF	-37.92***	I(1)
Livestock GDP	-31.22***	I(1)
Livestock GFCF	-37.49***	I(3)

Note: ***indicates significance at 1 per cent level

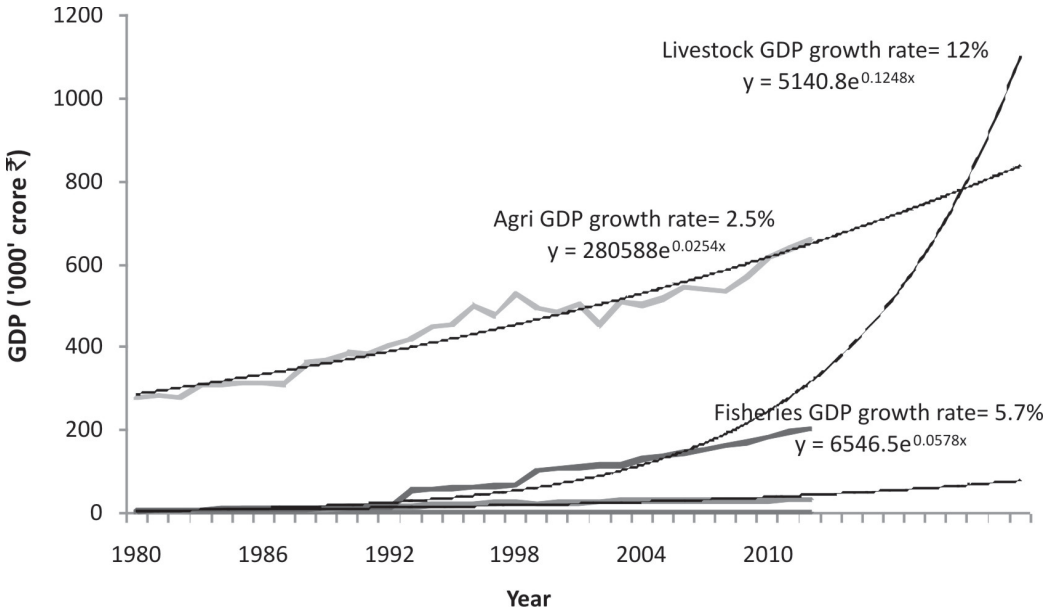

Figure 2. Growth rates of GDP in agriculture, fisheries and livestock sub-sectors (at 2004-05 prices)

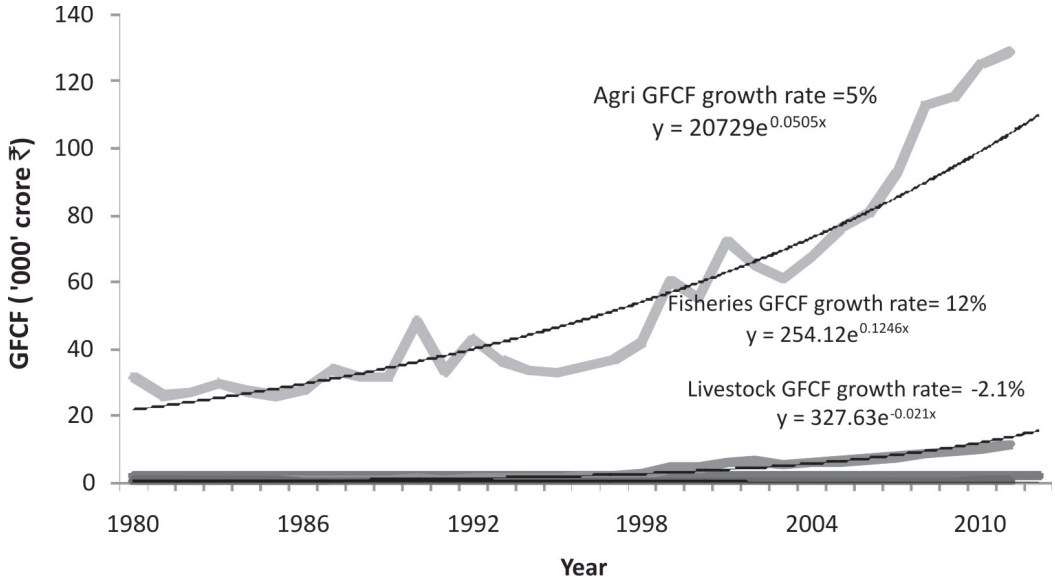

Figure 3. Growth rates of GFCF in agriculture, fisheries and livestock sub-sectors (at 2004-05 prices)

the long-run, except for livestock GFCF, which after the third differencing became stationary. This indicated that gross livestock capital formation and livestock GDP were not moving in tandem in the long-run. This may be attributed to the possible misdirected investments in the livestock sub-sector. This needs serious corrections as the livestock currently contributes 28 per cent to the agricultural GDP.

The annual compound growth rate of GFCF and GDP in the three sub sectors for the period 1980-2012 is presented in Figures 2 and 3, respectively. The gross fixed capital formation has been growing at a compound annual growth rate of 5 per cent in agriculture, 12 per cent in fisheries and by -2.1 per cent in livestock, while their respective contributions to the GDP were 2.5 per cent, 5.7 per cent and 12 per cent.

These values can be related to those in Table 5. It can be seen that the ICOR in livestock sub-sector has been declining, indicating the excess capacity of capital

in this sub-sector despite the fact that investment efficiency ratio is positive just marginally. The excess capacity could also arise because of misdirected investments areas within the livestock sub-sector. It needs to be examined if investments in the livestock sub-sector are being made in required segments that could generate more output per unit of input or in areas that can only yield marginal increments in output per unit of input. The elasticity of investment in the livestock sub-sector is positive, but the growth rate of GFCF is -2.1 per cent, indicating that the efficiency of the existing capital is improving as indicated by the falling ICOR, while the performance of the livestock sub-sector is recording a growth rate of 12 per cent.

Conclusions

The above discussions turns our attention to the key drivers of growth as envisaged by the XIIth Plan Working Group on Agriculture, which are: (1) Availability of farm enterprise and returns to investment that depend on scale, market access, prices and risk, (2) Availability and dissemination of appropriate technologies that depend on quality of research and extent of skill development, (3) Plan expenditure on agriculture and infrastructure which together with policy must aim to improve the functioning of markets and more efficient use of natural resources; and governance in terms of institutions that make possible better delivery of services like credit, animal health care and of quality inputs like seeds, fertilizers, pesticides and farm machinery. An effective implementation of these priorities should enable improvement in the performance of the agriculture sector to the desired levels.

For achieving growth rate of 5–6 per cent per annum, the livestock sub-sector would have to address important challenges during the XIIth Plan. These include delivery of services, shortage of feed and fodder and frequent occurrence of deadly diseases. Compared to its contribution to the economy, the livestock sector has been receiving much less resources and institutional support. The livestock extension remains grossly neglected. The country still lacks adequate facilities and the infrastructure for disease diagnosis, reporting, epidemiology, surveillance and forecasting. Livestock markets are underdeveloped, which is a significant barrier to commercialization of livestock production. Besides, this sub-sector is also coming under significant pressure of increasing globalization of agri-food markets. Although there is a demand for the Indian meat products in international markets, lack of international processing standards is a hindrance. Unfortunately, schemes on modernization of slaughterhouses and by-product utilization have not been effectively implemented. In the animal husbandry sub-sector, the major priority areas during XIIth Five-Year Plan will be breed improvement, enhanced availability of feed and fodder and provision of better health services, including proper breeding management. The conservation and perpetuation of diverse local germplasm, which are adaptable to Indian climate conditions and are resistant to various endemic diseases, will be another important area, with a clear focus on sub-sectors such as small ruminants that have so far remained neglected (GoI, 2013).

The performance of fisheries sub-sector in terms of growth is restricted by over-capitalization of marine fisheries. The post-Tsunami recapitalization of the marine fishing fleet has been much in excess of that required for the sustained exploitation of the fishery resources, leading to a decline in the catch per unit effort of the fleet. The growth in fisheries can be largely attributed to the bull run of the inland fisheries sub-sector compensating for the losses in the marine fisheries sub-sector. Therefore, despite the positive investment elasticity and investment efficiency ratio and also the marginally declining ICOR, the fisheries investments would yield more growth if the direction of investments is shifted more towards the inland sub-sector and away from marine fisheries sub-sector. The stable investment elasticity and investment ratio plus a barely declining ICOR have indicated again the necessity for evaluating the size and direction of GFCF in agriculture. The focus of the current plan towards the value-addition is a step in the right direction.

Acknowledgements

The authors are grateful to Dr S. Ayyappan, Secretary, DARE and Director General, ICAR and Dr Gopal Krishna, Director/ Vice Chancellor, Central Institute of Fisheries Education, Mumbai, for constant encouragement and support during the entire period of this work. They are also thankful to the referee for his useful comments which helped in improving the earlier draft of the paper.

References

Birthal, Pratap S., Joshi, P.K. and Kumar, Anjani (2002) *Assessment of Research Priorities for Livestock Sector in India*. NCAP Policy Paper No.15, National Institute of Agricultural Economics and Policy Research, New Delhi.

Dastagiri, M.B. (2010) Investments, value of output and trade in livestock sector in India, pre and post-WTO era. *Indian Journal of Animal Sciences*, **80**(2): 172-176.

GoI (Government of India) (2013) *XII Five-Year Plan Working Group on Agriculture*. Planning Commission Report. pp 6-8.

Goliat, Ramesh and Lokare, S.M. (2008) Capital adequacy in Indian agriculture: A riposte. *Occasional Papers*, **29**(1), Reserve Bank of India, Mumbai.

Jha, Raghabendra (2007) *Investment and Subsidies in Indian Agriculture*. Australia South Asia Research Centre (ASARC) Working Paper 2007/03, Canberra.

Planning Commission (2012) *Report of the Working Group on Development and Management of Fisheries and Aquaculture*. XII Five Year Plan, Government of India, New Delhi.

Singh, Rajendra and Lal, Krishan (1990) Contribution of fisheries, livestock and agriculture in national economy. *Agricultural Situation in India*, September: 405-407.

Sivakumar, Marimuthu (2013) *Gross Capital Formation and GDP Growth in Indian Agriculture Sector*. Munich Personal RePEc Archive, MPRA Paper No. 46946. 13 May.

Sharma , Paul Vijay (2007) *India's Agrarian Crisis and Smallholder Producer's Participation in New Farm Supply Chain Initiatives: A Case Study of Contract Farming*. Working Paper No: 2007-08-01, Indian Institute of Management (IIM), Ahmedabad.