RESEARCH PAPER

Performance of National Horticulture Mission in India- An economic analysis

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Abstract: The study was conducted to investigate the performance of National Horticulture Mission (NHM) in India during 2016-17. Secondary data on different components of NHM during the period from 2005-06 to 2013-14 were used. Descriptive statistics, Compound Annual Growth Rate (CAGR), Coefficient of Variation, Principle Component Analysis (PCA) and coefficient of variation techniques were employed for analysis of data. About 76 per cent of the total number of districts in the country and an additional area of 48.63 lakh hectares horticulture area was covered under NHM. About ₹ 9223 crore released for NHM which included ₹ 8602.60 crore to State Horticulture Missions (SHMs) and about ₹ 620.17 crores to National Level Agencies (NLAs). About ₹ 7971 crore expenditure was made by different states and about ₹ 560.80 crores by NLAs under NHM during 2005-06 to 2013-14. Among different states, the highest amount was released to Maharashtra state followed by Karnataka, Andra Pradesh and so on. Among the different horticultural crops, the highest area was covered on fruit crops followed by flowers and spices. But the least coverage was on plantation crops and medicinal and aromatic plants. Protected cultivation, mechanization of horticulture, water resources, post-harvest management, area coverage, rejuvenation and organic farming were the important components in influencing the performance of the NHM programme. Markets and promotion of INM/IPM were the least influencing variables on NHM performance in India. So government needs to give more importance in performing of these components with revised budget under National Horticulture Mission in India as a whole.

Key words: Growth rates, Horticulture, Instability index, Market

Introduction

The National Horticulture Mission (NHM) was a centrally sponsored scheme in which government of India contributes 85 per cent and 15 per cent is met by the state governments, launched by the Department of Agriculture & Cooperation of the Ministry of Agriculture, Govt. of India during the year 2005-06. The scheme aims at holistic development of horticulture sector duly ensuring forward and backward linkages, with the active participation of all the stake-holders including farmers and private entrepreneurs.

The National Horticulture Mission works on "Cluster Basis'. All the States and three Union Territories of Andaman Nicobar Islands, Lakshadweep and Puducherry are covered under the Mission to develop horticulture to the maximum potential available in the states and to augment production of all horticultural products including fruits, vegetables, flowers, plantation crops, spices and medicinal and aromatic plants and an additional area of 48.67 lakh hectares of horticulture area was covered with an expenditure of ₹ 4,207.94 crores under the scheme. At present, out of total 483 districts in the 18 States and three Union Territories, 371 districts have been covered under NHM (Anon., 2014). The thrust of the Mission has been area-based, regionally differentiated cluster approach for the development of horticulture crops, having comparative advantage.

Presently Indian horticulture became the prominent segment under Agriculture sector, which has horticulture area of about 24.3 million hectares and production of about 280.7 million tonnes. At present, India becomes the second largest producer of fruits (88.9 million tonnes) and vegetables (162.9

million tonnes, which accounted 13 per cent and 15 per cent respectively in the world next only to Brazil (for fruits) and China (for vegetables). Out of the total 180 million tonnes of horticultural produce, vegetables formed an important component, which accounts about 59 per cent followed by fruits (34%), plantation crops (4%), spices (2%) and flowers, and aromatic and medicinal plants together contributed about one per cent (Anon., 2014a). India is the largest producer of fruits like mango, banana, papaya, sapota, pomegranate and aonla. Apart from this it has 12.41 per cent of total gross cropped area, 17.17 per cent of net sown area and about 37 per cent of net irrigated area. Horticulture emerged as a highest contributor to Indian agriculture GDP, which contributed about 30 per cent followed by cereals (29%), oilseeds (9%), pulses (7%), sugarcane (5.9%), cotton (4.5%) and others contributed about 14.60 per cent (Indiastat, 2014-15).

Farmers are getting financial assistance under different components of NHM in India. With this background the study attempted to investigate the performance of National Horticulture Mission (NHM) in India. This will provide necessary inputs to policy makers and programme implementing agencies.

Material and methods

The present study is based entirely on secondary sources. In order to address the objective of the study, data were collected from secondary sources. The secondary data regarding different components (physical and financial) of National Horticulture Mission scheme for the period from

2005-06 to 2013-14 were collected from National Horticulture Board database, Department of Horticulture, GOK and other published sources.

Compound Annual Growth Rate (CAGR)

For computing compound annual growth rate of a financial progress of NHM scheme, the exponential function of the following form was used.

$$Y = a\, b^t e^{Ut}$$

Where,

Y = Release/Expenditure

a = Intercept

b = Regression coefficient

'a' and 'b' are the parameters to be estimated

t = time period

U_t = Disturbance term in year 't'

The equation (1) was transformed into log linear form and written as;

$$\log Y = \log a + t \log b + U_t$$

Equation (2) was estimated by using Ordinary Least Squares (OLS) technique.

Compound growth rate (g) was then computed

$$g = (b - 1)\, 100$$

Where,

g: Compound growth rate in per cent per annum

b: Antilog of log b

The standard error of the growth rate was estimated and tested for its significance with 't' statistic.

Compound annual growth rate in financial progress was computed during the period from 2005-06 to 2013-14. NHM period was covered for 9 years.

Coefficient of Variation

The coefficient of variation was used as measure to study the variability in progress of different components of NHM scheme in India. The coefficient of variation (CV) was computed by using the following formula

$$CV = \frac{\text{Standard Deviation } (\sigma)}{\text{Mean } (\bar{X})} \times 100$$

Principle Component Analysis (PCA)

The selected physical and financial variables measure many facets of the performance of NHM. Principal component analysis was employed, with a view to aggregate the performance indicators into a few groups of factors. This technique was used by many researchers for grouping the variables and is the oldest and the best known technique of multivariate analysis. The physical and financial indicators were chosen for the study and the analysis was made in India as whole for the period from 2005-06 to 2013-14.

The main purpose of adopting principal component analysis was to economize the number of variables. To achieve this objective, linear transformation of the variables of the following type was done.

$$Z_i = a_{i1}X_1 + a_{i2}X_2 + \text{- - - - - - - - - - -} + a_{ip}X_p$$

Where,

Z_i = Standardize variables

$X_1 - X_2$ - - - - - - - X_p are the P variables considered for the study and i = 1, 2....... p are the components.

The coefficients $a_{i1}\ a_{i2}......\ a_{ip}$ are chosen so that the new variables Z_1 has as large a variance as possible, the second Z_2 was chosen to be uncorrelated with the first and to have as large a variance as possible, *etc.* The technique of principal component analysis was adopted in order to identify the most important physical and financial indicators which had greater influence on the performance of NHM scheme in India. Once a set of variables are transformed by successfully extracting the largest common elements, then the principal component with Eigen value less than one would be eliminated as per Kaiser's rule (Kaiser, 1960). Those principal components whose eigen values are greater than or equal to one would be retained and which determine the number of components in the present study. Each component measures a dimension of performance and it is possible to correlate a component with a group of variables.

Results and discussion

National Horticulture Mission (NHM) is centrally sponsored scheme, launched by the Department of Agriculture & Cooperation of the Ministry of Agriculture, Govt. of India during the year 2005-06. All the States and three Union Territories of, Andaman Nicobar Islands, Lakshadweep and Puducherry are covered under the Mission except the eight North Eastern States including Sikkim and the States of Jammu & Kashmir, Himachal Pradesh and Uttrakhand, which have been covered under the Horticulture Mission for North East and Himalayan States (HMNEH). The scheme was implemented in 372 districts in the country during 2005-06 to 2013-14, which is about 76 per cent of the total number of districts in the country and an additional area of 48.63 lakh hectares horticulture area was covered. In case of Karnataka all 30 districts were covered under National Horticulture Scheme. Apart from this it also covered about 17 crops, which was highest among all states (Table 1). The mission envisaged two fold increase in horticulture production including fruits, vegetables, flowers, plantation crops, spices and medicinal and aromatic plants. These findings are in the line with the study conducted by Anand and Pandurang (2016) and Satishgowda (2014).

Year-wise figures of amount released and expenditure made under National Horticulture Mission in India during the period 2005-06 to 2013-14 are furnished Table 2. It can be seen from the table that, the amount released and expenditure made were increasing at the rate of 8.5 per cent and 17.5 per cent per annum, respectively during the period of 2005-06 to 2013-14. At beginning with per cent financial expenditure to amount released was very low (about 27.5 %) but the figures improved in later period and reached to about 71.86 per cent in 2013-14. This might be due to the fact that at the initial period of implementation most of the components were not implemented properly in all the states and in later period all components

Table 1. State-wise details of districts included under National Horticulture Mission (NHM)

Name of State/ UT	Total No. of Districts in the State	No. of Districts include till date	Districts covered under NHM (%)	No. of Crops covered
Andhra Pradesh	23	20	86.96	10
Bihar	38	23	60.53	5
Chhattisgarh	16	11	68.75	11
Goa	2	2	100.00	12
Gujarat	25	15	60.00	10
Haryana	20	17	85.00	9
Jharkhand	22	17	77.27	17
Karnataka	30	30	100.00	17
Kerala	14	14	100.00	10
Madhya Pradesh	50	39	78.00	8
Maharashtra	33	33	100.00	11
Orissa	31	24	77.42	6
Punjab	21	16	76.19	6
Rajasthan	32	24	75.00	10
Tamil Nadu	29	20	68.97	6
Uttar Pradesh	72	45	62.50	15
West Bengal	18	14	77.78	9
Delhi	1	1	100	4
Lakshadweep	1	1	100	4
Andaman & Nicobar	2	2	100	4
Puducherry	2	2	100	8
Total	483	371	76.60	

(Indiastat, 2014-15)

Table 2. Year wise financial progress under National Horticulture Mission (NHM) in India (2005-06 to 2013-14)

₹ in crores

Years	Amount released	Expenditure	Per cent expenditure
2005-06	630.00	173.21	27.49
2006-07	945.29	718.99	76.06
2007-08	917.33	925.49	100.89
2008-09	1,010.50	1,082.50	107.13
2009-10	800.00	1,099.68	137.46
2010-11	970.86	1,024.19	105.49
2011-12	1,050.00	1,085.20	103.35
2012-13	1,089.27	1,122.82	103.08
2013-14	1,809.56	1,300.39	71.86
Total	9,222.81	8,532.48	92.51
CAGR (%)	8.47	17.48	
C.V. (%)	56.37	59.04	

(Indiastat, 2014-15)

become active. The total amount released and expenditure made during the same period was about ₹ 9222.81 crores and about ₹ 8532.48 crores, respectively. The percentage of total expenditure to the total amount released was estimated to be 92.51 per cent, which showed the good performance of NHM

scheme in India. During the same period the variation in amount released and expenditure made were observed to be 56.37 per cent and 59.04 per cent, respectively. The similar results were found in the study conducted by Bajpai (2012) and Chattopadhayay and Roy (2011).

State-wise position on release and expenditure under National Horticulture Mission in India during the period from 2005-06 to 2013-14 was concerned (Table 3), about ₹ 9222.81 crore had released for NHM which included ₹ 8602.65 crore to State Horticulture Missions (SHMs) and about ₹ 620.17 crores to National Level Agencies (NLAs). Expenditure was concerned, about ₹ 7971.68 crore was invested by different states and about ₹ 560.80 crores by NLAs, contributed about 93.43 per cent and 6.57 per cent respectively to total amount released under NHM during 2005-06 to 2013-14 (Jothi *et al.,* 2012). Among different states, the highest amount was released to Maharashtra state (₹ 1605.4 crores) followed by Andhra Pradesh (₹ 799.78 crores), Karnataka (₹ 796.68 crores), Tamil Nadu (₹ 636.57 crores) and Chhattisgarh (₹ 595.82) (Table 3). In terms of percentage, Maharashtra state accounted for 13.26 per cent followed by

Table 3. State-wise financial release and expenditure under National Horticulture Mission (NHM) in India (2005-06 to 2013-14)

₹ in cores

State and UTs	Amount released	Expenditure	Per cent expenditure	Per cent contribution
Andaman & Nicobar	11.34	8.25	72.77	0.10
Andhra Pradesh	799.78	792.07	99.04	9.94
Bihar	199.93	190.34	95.20	2.39
Chhattisgarh	595.82	604.74	101.50	7.59
Delhi	3.00	2.96	98.76	0.04
D N Haveli	0.25	0.00	0.00	0.00
Goa	17.06	14.71	86.26	0.18
Gujarat	505.66	510.62	100.98	6.41
Haryana	511.41	501.29	98.02	6.29
Jharkhand	315.49	326.39	103.45	4.09
Karnataka	796.68	810.15	101.69	10.16
Kerala	414.71	425.69	102.65	5.34
Laksha Dweep	0.93	0.00	0.00	0.00
Madhya Pradesh	434.53	405.87	93.41	5.09
Maharashtra	1,605.36	1,057.26	65.86	13.26
Odisha	406.94	374.09	91.93	4.69
Puducherry	2.74	2.72	99.34	0.03
Punjab	303.15	303.39	100.08	3.81
Rajasthan	368.33	362.56	98.43	4.55
Tamil Nadu	636.57	611.51	96.06	7.67
Uttar Pradesh	491.40	495.58	100.85	6.22
West Bengal	181.59	171.48	94.43	2.15
Sub Total	8,602.65 (93.28)	7,971.68 (93.43)	92.67	93.28
For NLAs	620.17 (6.72)	560.80 (6.57)	90.43	6.72
Total	9,222.81	8,532.48		100

(Indiastat, 2014-15)

Karnataka (10.16%), Andra Pradesh (9.94 %), Tamil Nadu (7.76%) and Chhattisgarh (7.59 %) and so on. The highest expenditure was made by Maharashtra (₹ 1,057.26 crores) followed by Karnataka (₹ 810.15 crores), Andhra Pradesh (₹ 792.07 crores), Tamil Nadu (₹ 611.51 crores) and Chhattisgarh (₹ 595.82 crores). This was mainly because of the fact that the area under horticulture is highest in Maharashtra state followed by Karnataka in turn required more expenditure to cover these area under NHM scheme (Usha, 2011).

The NHM scheme also made expenditure through different National Level Agencies (NLAs) namely National Horticulture Board (NHB), National Horticulture Research & Development Foundation (NHRDF), Directorate of Cashew and Cocoa Development (DCCD), Directorate of Arecanut and Spices Development (DASD), Spices Board and so on. The release and expenditure for National Level Agencies under NHM in India during the period from 2005-06 to 2013-14 are furnished in

Table 4. During this period, about ₹ 620.17 crore was released to NLAs under NHM which contributed about 6.72 per cent of total release under NHM. Expenditure was concerned, ₹ 560.8 crore expenditure made by different NLAs, which contributed about 90.43 per cent of total release to NHM. Table also indicates the performance of different agencies in terms of per cent contribution to total release. Among different NLAs, the highest amount released to the National Horticulture Board (₹ 203.34 crores), which contributed 23.8 per cent followed by National Horticulture Research & Development Foundation (NHRDF) (15%) and Directorate of Arecanut and Spices Development (DASD) (9%). This was mainly because the National Horticulture Board undertook major activities of horticulture development in all states.

The National Horticulture Mission works on "Cluster Basis'. The focus crops identified under the programme included Mango, Banana, Grape, Pomegranate, Pineapple, Cashew, Cocoa, Ginger, Pepper, Flowers and Aromatic plants. Crop-wise total physical and financial achievements under National Horticulture Mission during 2005-06 to 2013-14 in India is showed in Table 5. The total physical and financial achievement is concerned, about 48,63,617 hectares were covered with an expenditure of ₹ 4,207.94 crores under NHM on different crops since inception. Out of total physical achievement under different horticultural crops, about 57 per cent area has been covered under fruit crops followed by flowers (25%), spices (10%), plantation crops (6.5%) and least coverage was on medicinal and aromatic plants (1.3%). Apart from this, table also shows the co-efficient of variation (CV) in coverage of different horticultural crops. Among all crops, the highest variation was observed in flowers (119.49%) followed by medicinal and aromatic plants (101.72%), plantation crops (72.78 %), fruit crops (71.1 %) and least variation was observed in case of spices (68.75%).

Out of total financial achievement under horticultural crops, about 54 per cent (₹ 2,277.51 crores) expenditure was made on fruit crops followed by flowers (27%), spices (12%), plantation crops (4.42%) and least expenditure was made on medicinal and aromatic plants (only 1.67 %) (Table 5). Co-efficient of Variation (CV) in financial achievements during the same period were concerned, the highest variation has been observed in flowers (106.94%) followed by medicinal and aromatic plants (97.97%), plantation crops (72.36%), spices (69.45%) and least variation was observed in case of fruits (65.25%). These figures

Table 4. Release and expenditure for National Level Agencies (NLAs) under National Horticulture Mission (NHM) in India (2005-06 to 2013-14) ₹ in cores

National Agencies	Amount Released	Expenditure	Per cent Expenditure	Per cent contribution
DASD	50.42	51.00	101.14	9.09
DCCD	75.28	75.09	99.74	0.88
FHEL	0.06	0.00	0.00	0.00
HIL	4.08	1.91	46.81	0.34
IFFCO	20.25	20.45	100.97	3.65
MANAGE	2.05	2.46	119.69	0.44
NAFED	3.05	0.20	6.56	0.04
NBB	8.31	3.48	41.91	0.62
NCCD	1.50	0.41	27.55	0.07
NCPAH	24.50	24.61	100.47	4.39
NHB	203.34	133.34	65.58	23.78
NHRDF	85.51	84.27	98.55	15.03
NRCC	19.96	30.88	154.71	5.51
NSC	33.21	35.04	105.52	6.25
SFCI	37.08	47.69	128.61	8.50
SPICES BOARD	43.00	49.98	116.23	8.91
Subtotal (NLAs)	620.17 (6.72)	560.80 (6.57)	90.43	100.00
Grand total	9222.81	8532.48	92.51	

(Indiastat, 2014-15)

Table 5. All India crop wise total physical and financial achievement under National Horticulture Mission (NHM) (2005-06 to 2013-14)

₹ in crores

Crops	Achievements					
	Physical (ha)	Per cent	C.V. (%)	Financial (₹)	Per cent	C.V. (%)
Fruits	27,53,565	56.62	71.10	2,277.51	54.12	65.25
Flowers	12,18,854	25.06	119.49	1,154.07	27.43	106.94
Spices	5,09,180	10.47	68.75	519.88	12.35	69.45
Medicinal & Aromatic plants	63,015	1.30	101.72	70.28	1.67	97.97
Plantation crops	3,19,002	6.56	72.78	186.20	4.42	72.36
Total	48,63,617	100	-	4,207.94	100	-

(Indiastat, 2014-15)

Table 6. Principal component and factor loadings of physical and financial indicators influencing the performance of National Horticulture Mission (NHM) in India

Variables/Indicators	Physical indicators		Variables/Indicators	Financial indicators		
	I	II		I	II	III
Protected cultivation*	0.971	-0.087	Vermicomposting units/ Bio-digester unit**	0.940	-0.171	0.117
Horticulture mechanization**	0.941	-0.291	Rejuvenation*/ replacement of senile plantation*	0.913	-0.039	0.270
Water resources**	0.903	0.262	Area coverage*	0.896	-0.003	0.145
Post-harvest management**	0.836	-0.208	Water resources**	0.769	0.470	0.281
Markets**	0.829	-0.190	Nurseries**	0.751	-0.496	0.114
Vermicomposting units/ Bio-digester unit**	0.761	0.083	IPM Infrastructure**	0.741	-0.563	-0.099
IPM Infrastructure**	-0.613	0.574	Organic farming*	0.699	-0.442	0.426
Organic farming*	0.233	0.929	Post-harvest management**	-0.020	0.971	-0.035
Rejuvenation*/ replacement of senile plantation*	0.108	0.915	Protected cultivation*	-0.109	0.961	0.044
Promotion INM / IPM *	-0.132	0.907	Horticulture mechanization**	-0.171	0.958	-0.028
Area coverage*	-0.414	0.888	Markets**	0.135	0.118	0.925
Nurseries**	-0.533	0.704	Promotion INM / IPM *	0.618	-0.217	0.708
Eigen values	6.366	3.545		6.438	3.240	1.083
Variation explained (%)	53.047	29.541		53.652	27.000	9.027
Cumulative variation explained (%)	53.047	82.588		53.652	80.652	89.680

Note: *- Area in ha, **- Quantity in number

clearly indicate that more importance was given to the fruit crops. This might be the fact that area under fruit crops like mango, banana, grapes pomegranate, sapota and papaya were increased during this period as compared to flowers, spices, medicinal and plantation crops. The results are on par with the study conducted by Mankar *et al.* (2013).

Principal component and factor loadings of physical and financial indicators influencing the performance of NHM in India (2005-06 to 2013-14) are depicted in the Table 6. To identify the physical indicators having the bearing on the performance of the NHM, 12 variables were subjected to principal component analysis. Out of these variables, seven variables had higher factors loadings in the first dimension/component and five variables in the second dimension (Table 6). The results revealed that the variation explained by first two components was 82.58 per cent, of which 53.04 per cent was explained by first component and 29.54 per cent by second component.

The first principal component included the variables such protected cultivation, horticulture mechanization, water resources, post-harvest management, markets, vermi-composting units/bio-digester unit and IPM Infrastructure. This was clearly indicated by the principal component analysis technique itself indicating their prime importance in influencing the performance of the NHM programme. The second principal component captured five indicators namely organic farming, rejuvenation, promotion Integrated Nutrient Management (INM) /Integrated Pest Management (IPM), area coverage and nurseries. These were considered as the next best influencing factors in the performance of the NHM programme. These indicators reflect the efficiency of the NHM programme. The scores ranged from 0.97 to 0.61 (Anon., 2012).

The technique of principal component analysis was also extended to identify financial indicators closely associated with the performance of the NHM scheme considering 12 variables were subjected to principal component analysis and the results are depicted in the Table 6. The first three components were selected for detailed analysis and they together accounted for 89.68 per cent variation. Out of which 53.65 per cent was explained by first component, about 27 per cent was explained by second component and 9.02 per cent by third component. In the first component, seven variables were closely associated with the performance of the NHM scheme and they were vermi-composting units/ bio-digester unit, rejuvenation/ replacement of senile plantation, area coverage, water resources, nurseries, IPM Infrastructure and organic farming of which scores ranged from 0.94 to 0.69.

Three variables closely associated with second components were post-harvest management, protected cultivation and horticulture mechanization for which scores ranged from 0.97 to 0.95. Only two financial variables closely associated with third components namely markets and promotion INM / IPM. The most important financial variables which influence the performance of NHM were vermi-composting units/bio-digester unit, rejuvenation, area coverage, water resources, nurseries, IPM infrastructure and organic farming and which explained about 53.65 per cent variation. Markets and promotion INM/IPM were the least influencing variables on NHM performance and explained only 9.02 per cent variation (Diwas and Pramod Kumar, 2011).

Conclusion

Among different states which received funds from NHM, the highest amount was released to Maharashtra followed by Karnataka, Andhra Pradesh and so on. These were the important states as they had highest area under different horticulture crops in turn required more expenditure to cover this area under NHM scheme. Among the different horticultural crops, the highest area covered on fruit crops followed by flowers and spices. But least coverage was on plantation crops and medicinal and aromatic plants. This was clearly indicated that more importance was given to the fruits and flower crops under NHM. Hence, NHM needs to cover more area of these crops along with vegetable crops.

The initial investment in these fruit crops was higher and the subsidy provided under the present scheme forms only a negligible amount of the total investment requirement. It is therefore needed to revise the amount of subsidy to promote horticulture and to make subsidization more meaningful. Since, protected cultivation, horticulture mechanization, water resources, post-harvest management, area coverage, rejuvenation and organic farming were the important components in influencing the performance of the NHM programme. Markets and promotion INM/IPM were the least influencing variables on NHM performance in India. So government needs to give more importance in performing of these components with revised budget under National Horticulture Mission in India as a whole.

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