Growth dimensions of Karnataka economy in post liberalization period

K K R PATIL, [1]MANJUNATHA G. R AND [1]VISHWAJITH K. P

Department of Agricultural Economics, UAHS, Shimoga-577 225.
[1] Department of Agricultural Statistics, BCKV, Mohanpur-741 252.

ABSTRACT

Karnataka's economy is composed of agriculture, manufacturing and service sectors in different combinations. For Economic growth, identification of key sector/factor is crucial and accordingly investment has to be made in such sector /factor rather than overall investment on all the sectors /factors which is called as hirshmanian unbalanced growth concept. Factor analysis was used to identify crucial dimension influencing economy during the post liberalization period (base period from 1997-2001 and terminal period from 2002-2006). The major dimensions identified in the base period are Technology lead Irrigated Agriculture, Services and Manufacturing, Farm Management and Savings and Market Potential. In terminal period the dimensions extracted were Technology lead rainfed agriculture, Services and Manufacturing, Marginalized agriculture and Irrigated agriculture. The change in the dimension was observed within the decade. Technology led rainfed agriculture is identified as the key factor in the terminal period which is the main source of stable staple food in Karnataka. Hence necessary action should be taken towards dissemination, adoption of technology pertinent to rainfed agriculture through effective extension system.

The pace of development after the economic liberalization is varying with the response of variables to different triggers of growth. As economic liberalization began distinctly from 1991, in this exercise two quinquinnial periods, the first base period from 1997 to 2001 and the second terminal period from 2002 to 2006 have been identified to reflect on distinct growth patterns. The hypothesis behind the choice of the two periods are to examine the variables and the dimensions of growth and whether there is consistency in the growth dimensions between the two quinquinnial periods, for policy implications. This is a Meta analysis for the data pertaining to the districts of Karnataka. Accordingly, as the uniformity of the data is crucial, since the districts considered for the base period should be the same as in the terminal period, the two quinquinnial periods from 1997 and from 2002 are considered for 27 districts of Karnataka. During the terminal period of analysis, agricultural years of 2002, 2003 and 2004 are regarded as drought periods. The remaining years *i.e.*, 2005 and 2006 of the terminal period are considered as normal years.

Ramesh chand *et. al*., (2012) while assessing the total factor productivity and returns to investment on agricultural research in India revealed that the returns to investment on agricultural research have been found to be a highly paying position. The returns to investment on agricultural research have been estimated at 42 per cent. Patil *et al.,* (2013) revealed that the transitional process in cropping pattern was observed among the traditional staple food crops likes paddy, jowar *etc* in Karnataka.

Email: kiranecon@gmail.com

The result of this study has prompted to work on this line.

MATERIALS AND METHODS

District wise data for both base (1997-2001) and terminal periods (2002-2006) are collected for 60 variables pertinent to agriculture, manufacturing and service sectors from the various published reports such as Karnataka at a glance and State income reports from Directorate of Economics and Statistics (DES), Bengaluru, Karnataka. The quinquinnial district wise data on 60 variables are used in both base and terminal period to identify the different triggers of growth in the economy, using exploratory factor analysis, a tool for dimension reduction. Interpretation of the factor analysis results is strongly the function of variable consideration and formulation. Therefore, the formulation of variables (described in Appendix I) becomes crucial in identifying growth dimension.

The appropriate tool for analyzing the meta data to identify the growth triggers through dimensions is the Factor Analysis (FA). FA is a multivariate technique that attempts to account for the correlational pattern in a set of observed random variables in terms of a minimal number of unobservable or latent variable called Factors (Dimensions). Exploratory factor analysis is used to achieve the scientific parsimony by reducing a set of large number of variables to a convenient number of dimensions. Factor analysis assumes that the observed variables are the linear combination of some underlying dimensions. The factor loading of each variable in conjunction with the dimension, explains the variation in the corresponding variable.

We assume a random sample $x_1, x_2, ..., x_p$ from a homogeneous population with mean vector μ and covariance ©. The factor analysis model expresses each variable as a linear combination of underlying common factors $f_1, f_2, ..., f_m$, with an accompanying error term to account for that part of the variable that is unique (not in common with the other variables). For $x_1, x_2, ..., x_p$ in any observation vector **X**, the model (Rencher, 2002; Bhuyan, 2005) is as follows:

$$X = \Lambda F + U$$

where $\mathbf{X} = (x_1, x_2, ..., x_p)'$, $\mathbf{F} = (f_1, f_2, ..., f_q)'$, $\mathbf{U} = (e_1, e_2, ..., e_p)'$ and

$$
\begin{matrix}
11 & 12 & \cdots & 1q \\
21 & 22 & \cdots & 2q \\
\vdots & \vdots & & \vdots \\
p1 & p2 & \cdots & pq
\end{matrix}
$$

'**X**' is the data vector

'**F**' is the vector of common factor

'**Λ**' is a (p x q) matrix of factor loadings, where $Ž_{ij}$'s (i = 1,2,…,p; j = 1,2,…,q) are unknown

'**p**' is the number of observations (=135)

'**q**' is the number of variables (=60)

'**U**' is the unique factor

The inter-correlation among the variables considered is a basic requisite for the factor analysis. The variable with very high correlation with other variables leads to multicollinearity and singularity. The presence of multicollinearity can be identified with the value of determinant of inter correlation matrix. If the determinant value is greater than 0.00001 then it can be concluded that, there is no problem of multicollinearity and singularity. Based on KMO (Keyser-Meyer-Olkin) criteria, the sample adequacy will be tested. If the KMO statistics is above 0.7 then the model is considered to be adequate with the sample size. The number of factors or dimensions to be extracted depends on the Kaiser's condition of Eigen value more than 1 or it can be judged based on the scree plot technique. In order to extract the factors, principal component method was used. The interpretability of the factors was improved by following the principle of varimax rotation (orthogonal). This rotation maximizes the loadings of each variable on one factor and minimizes the loading of

each variable on the remaining extracted factors. The dimensions extracted will be independent and the variables within the dimension will be interdependent. The only variables having factor loading of more than 0.30 are considered for interpretation.

RESULTS AND DISCUSSION

The crucial part of the analysis is the formulation and choice of variables which is according to the hypothesis and the diagnosis of the dimension, which subsumes the clustered variables according to factor loadings. The factor loading of each variable in conjunction with the dimension, explains the variation in the corresponding variable. The naming or identification of the dimension is crucial to get a feel for the policies and programs to be designed for facilitating growth.

Four important dimensions explaining the growth triggers of the Karnataka's economy are extracted during the base period using factor analysis. The extracted dimensions explain about 52 percent of the total variation in the formulated variables. The dimensions are named as under

The first dimension explains the maximum variation of about 21 percent (Table 1). This dimension can be named as Technology lead Irrigated agriculture. It is named as technology lead irrigated agriculture because of the fact that even with a limited rainfall of around 750 mm fraught with high evapo-transpiration, gross cropped area in Karnataka is taking the largest share of the variation in economic growth, followed by area under HYVs (High Yielding Varieties). The gross cropped area includes area sown once and more than once in all the three seasons. Since rainfall is limited to kharif, the only possibility for gross cropped area to figure as a crucial variable is due to the presence of irrigation. This is equally supported by the frequency of medium and large farmers (whose holding size is above 2 ha), as they have the 3Rs to delve into irrigation, the labor force (as absorbed in irrigated areas relative to rainfed areas), provision of food security in both rainfed (as in sorghum) and irrigated areas as in total food grains; this result is in conformity with Chad *et al*., (2011). Current fallow my be due to increasing seasonal migration of labor in search of employment, which reduces the work force for agriculture, which however is possible in the case of drip irrigation (Uma *et al*., 2013). Irrigation potential again figures through area sown more than once, complemented by groundwater irrigation, surface water irrigation. The agriculture component is from food and fodder security offered by

Jowar a hardy crop, total food grains, pulses providing proteins through Bengal gram, total pulse crop, food security through wheat, pulses providing proteins through tur, food and fodder security through millet Bajra, the oil seed crops such as groundnut and sunflower, and fiber crop such as cotton. The social capital measured through literacy and annual rainfall is showing negative association with the dimension of irrigated agriculture. This implies that as literacy increases, irrigated agriculture is affected as labors / cultivators move out of agriculture this result is in conformity with the results of Uma *et al.,* (2013). Literacy among farmers is crucial in understanding technical feasibility and economic viability of various technologies before its adoption. Rainfall in Karnataka is not an exception; it is also confronted with erratic nature and uneven distribution. Water requirement of crops are very specific. If rains are not received in the critical stage of crop development, irrigation becomes indispensible. Though, yearly received amount of rainfall may be fairly higher, but it is not uniformly distributed throughout the year or and Karnataka (Anon, 2004). Hence farmers reliance on irrigation increases. Thus the signs are in the appropriate direction.

The second dimension is almost as important as the first since it explained 17 per cent (Table 1) of the variation in the growth of economy. As this dimension largely includes services and manufacturing sectors, it is accordingly named as Services and Manufacturing. As Services and Manufacturing, sector is running almost neck to neck with irrigated agriculture, by contributing to 17% of the variation in the dimension, is crucial for the growth of the economy and virtually all the subsectors in this dimension excepting storage and railways, have exhibited uniform importance with even greater factor loadings as in the first dimension of irrigated agriculture. This dimension is relatively homogenous with complementing variables, therefore contributing almost equally to the cause of development, unlike the first dimension, where factor loadings vary vast from gross cropped area (0.94) to social capital represented by literacy with -0.59.

The third dimension explaining about 8.54 per cent (Table 1) of the variation in the growth of the economy is referred to be as farm management. The third dimension with heterogeneous variables, considering the importance of each variable indicated by the factor loading, can be named as Managerial service in agriculture or to be precise 'farm management'. The farm manager has decision making influence on the

cultivation of millets, use of potassic fertilizers and nitrogenous fertilizers, use of irrigation pumpsets to lift groundwater for irrigation, the net irrigated area representing irrigation potential, use of tank irrigation, market value of output given by aggregate income, food security by paddy and the road connectivity for market which is the prime mode of transportation of agricultural commodities; transportation is regarded as one of the primary marketing function; transportation cost alone accounts for more than 50 per cent of the total marketing cost (Acharya and Agarwal, 2004).

The fourth dimension explaining 6.81 percent (Table 1) of the total variation in the formulated variables influencing the growth triggers of the economy can be named as savings and market potential. The dimension has several heterogeneous variables from small scale industries to liquidity. The prime variables contributing to this dimension are small scale industries 0.66, followed by marketed surplus 0.606, cash crop (sugar cane) having larger marketed surplus and serve as a raw material to the industrial component. Maize constitutes the food and fodder security, with rising importance for its processed products, it will also serve as a basic raw material to agro based industries facilitate production of these crops are facilitated by the irrigation potential 4 (irrigation through other sources).

The factor analysis (during terminal period) yielded four dimensions influencing growth of the economy. The identified dimensions explained about 51.6 per cent of the total variation in the formulated variables governing the economy's growth. The dimension are named as under,

The first dimension explained 20.76 per cent (Table 2) of the total variation. This dimension can be named as Technology lead Rainfed agriculture. The gross and net cropped areas reflecting the irrigation and rainfall potential respectively have moved to the top in the first dimension in the terminal period. One of the reasons for the Gross Cropped Area and Net Cropped Area to have almost similar factor loadings is that the period 2002 to 2006 has drought in 3 out of 5 (60%) of years, affecting irrigation severely. Rainfed agriculture is supported by the technology in the form of High yielding varieties having biotic and abiotic stress resistance. This is also equally supported by the frequency of medium and large farmers (whose holding size is above 2 ha) and also by the small holders (whose holding size is between 1 and 2 ha), as they have the 3Rs and to delve into irrigation, the labor force (as absorbed in irrigated areas relative to

rainfed areas), provision of food security through total food grains, food security in rainfed areas through Jowar and Bajra (hardy crops), proteins through total pulses, Tur and Bengal gram. Current fallow is due to increasing seasonal migration of labor in search of employment, which reduces the work force for agriculture, which however is possible in the case of drip irrigation. Current fallow is also due to aberrant weather noticed during the quinquinnial period. Current fallow certainly brings down the agro-economic activity. Irrigation potential also figures through surface water irrigation. The other agricultural component is the oil crops such as total oilseeds, sunflower, groundnut, linseed and sessamum. In order to facilitate various physiological functions such as photosynthesis and respiration, phosphorous is used as an imperative source. The social capital measured through literacy and annual rainfall is showing negative association with the dimension of rainfed agriculture. This implies that as literacy increases agriculture in general gets affected as labours / cultivators move out of agriculture (Uma *et al*., 2013). Moreover, the magnitude of agricultural workers in Karnataka declined from 70 per cent in 1961 to 49 per cent in 2011. But the agricultural labour force in Karnataka has increased from 16.65 percent in 1961 to 25.67 per cent in 2011. Non agricultural sector is incapable of absorbing surplus labour force available in the agricultural sector is a reflection (Anon, 2012)

The second dimension can be termed as service and manufacturing, since this dimension mainly encompasses the variables related to service and manufacturing sectors. The total variance explained by the dimension about the variables representing the growth triggers of the economy is 14.69 per cent (Table 2).

The third dimension explaining about 8.25 per cent (Table 2) of the variation in the included variables representing growth triggers of the economy is referred to be as Marginalized agriculture. The crucial variables are the small holders and the number of cultivators who provide managerial support (0.807 and 0.782) which reflects the marginalization of agriculture, specialized in the cultivation of ragi (0.470). It is supported by the irrigation potential explained by the tank irrigation (0.465). The access to roads which provides connectivity to markets (0.672) also has significant influence on this dimension. The aggregate income from agriculture is having a factor loading only with this dimension (0.539). The uncultivable and cultivable wastes contribute substantially to this dimension (around 0.759 and 0.647 respectively).

The fourth dimension explained 7.97 per cent (Table 2) of the variation in the formulated variables responsible for the economy's growth. This dimension is named as irrigated agriculture. This dimension is referred as irrigated agriculture because of the very nature of crops influencing it, such as cash crop (sugarcane), Food security (wheat) and food security (maize). The production of these crops is facilitated by the irrigation potentiality explained by the net irrigated area, groundwater, and irrigation by other sources. Liquidity to the farmers also have facilitated in taking up these activities. In addition to these, use of resistance imparting (biotic stresses) and vegetative growth inducing nutrients also facilitated the farmers in performing irrigated agriculture. Since it has explained only modest of about 7.97 per cent of variation, it can be regarded that its influence on growth of economy is not as significant as technology lead rainfed agriculture.

The objective of the study is to identify important dimensions of growth in Karnataka's economy in post economic liberalization is accomplished using factor analysis (FA). It is crucial to note that FA is highly sensitive to the variable/s included. The naming of dimension/s in a succinct manner that subsumes the major factor loads and drawing policy implications are also equally important in the analysis. The major dimensions obtained in the base period are Technology lead Irrigated Agriculture, Services and Manufacturing, Farm Management and Savings and Market Potential. In terminal period the dimensions derived were Technology lead rainfed agriculture, Services and Manufacturing, Marginalized agriculture and Irrigated agriculture. Technology led rainfed agriculture is identified as the key factor in the terminal period which is the main source of stable staple food not only in Karnataka but also in India. Government should have to focus on key factors identified and necessary policies and programmes should formulate based on these factors. Such formulated policy will not only triggers economy's growth but also causes development through reduction of glaring inequality in income and equity. Hence necessary action should be taken towards dissemination, adoption of technology pertinent to rainfed agriculture through effective extension system.

Table 1: Factor loadings for the base period.

Variables	D-1	Variables	D-2	Variables	D-3	Variables	D-4
1	0.94	21	0.977	33	0.79	47	0.656
2	0.933	22	0.97	34	0.642	48	0.606
3	0.906	23	0.97	35	0.63	49	0.585
4	0.891	24	0.952	36	0.585	50	0.57
5	0.874	25	0.949	37	0.537	51	0.546
6	0.86	26	0.938	38	0.52	52	0.486
7	0.785	27	0.933	39	0.505	53	0.457
8	0.766	28	0.924	40	0.497	54	0.387
9	0.761	29	0.919	41	0.463	55	-0.355
10	0.723	30	0.914	42	0.449		
11	0.641	31	0.8	43	0.414		
12	0.625	32	0.485	44	0.399		
13	0.62			45	0.368		
14	-0.598			46	0.314		
15	0.578						
16	0.545						
17	0.538						
18	0.538						
19	0.528						
20	-0.523						
Total variation explained	**20.76%**		**14.69%**		**8.23%**		**7.97%**

Note: ***D****: Dimension*

Table 2: Factor loadings for the terminal period.

Variables	D-1	Variables	D-2	Variables	D-3	Variables	D-4
6	0.934	28	0.904	42	0.807	51	0.851
1	0.932	50	0.899	8	0.782	4	0.751
32	0.912	26	0.863	36	0.759	12	0.671
2	0.908	17	0.838	29	0.672	41	0.626
47	0.86	21	0.804	35	0.647	53	0.602
25	0.859	22	0.794	44	0.539	34	0.495
52	0.821	11	0.787	55	0.47	37	0.383
10	0.795	49	0.774	19	0.465	46	0.358
15	0.781	27	0.752			38	0.313
13	0.766	24	0.723				
14	-0.721	5	0.684				
7	0.686	30	0.629				
9	0.67	39	0.566				
45	0.668	31	0.517				
40	0.644	23	0.504				
43	0.591						
20	-0.545						
16	0.486						
3	0.479						
18	0.456						
33	0.421						
54	0.354						
48	0.339						
Total variation explained	**21%**		**17%**		**8.54%**		**6.81%**

Note: ***D****: Dimension*

Note : Variable number and name

1. Irrigation potential (Gross Cropped Area in'000ha); 2. Technology (Gross area under high yielding varieties in' 000ha); 3. Large holders (Number of farmers with land holding > 2 ha); 4. Food security (Gross area under Jowar '000 ha); 5. Labour force (Number of agricultural labourers); 6. Food security (Gross area under Total food grain in '000ha); 7. Current fallow (area under current fallow in '000 ha); 8. Irrigation potential (Area sown more than once in '000ha); 9. Protein (Gross area under Bengal gram in '000 ha); 10. Protein (Gross area under Total Pulse in'000 ha); 11. Food security (gross area under wheat in '000 ha); 12. Groundwater (Area irrigated by wells in' 000 ha); 13. Protein (Gross area under Tur in '000 ha); 14. Social capital (literacy in %); 15. Food and fodder security (Gross area under Bajra in '000 ha); 16. Photosynthesis and respiration (quantity of phosphorous in tonnes); 17. Rainfall potential (Net Cropped Area in'000ha); 18. Oil crop (Gross area under Ground nut in '000 ha); 19. Surface water (area irrigated by canal in'000 ha); 20. Annual rainfall (mm); 21. Trade services (Trade, Hotels and restaurants in lakh Rs); 22. Communication services (telecom and posts)(Lakh Rs.); 23. Construction services (lakh Rs.); 24. Public administration services (lakh Rs.); 25. Shipping (Transport)(lakh Rs.); 26. Banking and insurance services (lakh Rs.); 27. Electricity, gas and water supply services (lakh Rs.); 28. Unregistered manufacturing (lakh Rs.); 29. Registered manufacturing (lakh Rs.); 30. Other services (legal, consultancy, sports, cultural services etc) (lakh Rs.); 31.Warehousing services (storage)(lakh Rs.); 32. Railways (lakh Rs.); 33. Managerial force (Number of cultivators); 34. Food and fodder security (Gross area under ragi in 000ha); 35. Waste land (area under uncultivable wastes and barren land in'000 ha); 36. waste land (Area under cultivable wastes in' 000 ha); 37. Disease resistance (quantity of potassium in tonnes); 38. Vegetative growth (quantity of nitrogen in tonnes); 39. Road connectivity (km); 40. Marginal holders(number of farmers having land holding less than 1 ha; 41. Groundwater (number of pumpsets energized); 42. Irrigation potential (net irrigated area in '000 ha); 43. Surface water (Area irrigated by tanks in '000 ha); 44. Aggregate income (value of output in lakh Rs.); 45. Narcotics (Gross area under tobacco in '000ha); 46. Food security (Gross area under paddy in '000 ha); 47. Industries (Number of small scale industry); 48. Marketed surplus (turnover in the regulated marketing); 49. Telephone connections(number of telephones); 50. Saving potential (Total deposits in commercial and cooperative banks in lakh Rs); 51. Cash crop (Gross area under sugarcane in '000 ha); 52. Food and fodder security (gross area under maize in ' 000 ha); 53. Irrigation potential (Area irrigated by other sources in '000 ha); 54. Oil crop (gross area under sessamum in '000 ha) and 55. Liquidity (crop loans from cooperatives in lakh Rs.)

Appendix I: **Formulation / Definitions of variables**

The variables influencing growth need to be formulated / defined as they are quantitative as also reflect the Meta data at the district level. The explanations of variables along with their economic implications and their expected contributions to economic growth are provided

Variables	Quantification of variable for each district of Karnataka State	Expected contribution to economic growth
1. Irrigation potential	a) Gross cropped area ('000ha) and indicates the intensity of agro-economic activity	Irrigation potential and economic growth are positively related ceteris paribus the aggregate demand
	b) Area sown more than once ('000 ha).	
	c) Net irrigated area ('000ha)	
2. Current fallow	Current fallow in '000 ha - area uncultivated within five years	Current fallow is negatively related to economic growth and hinders agroeconomic activity
3. Wasteland	a) Area under cultivable waste ('000 ha) - is the area which can be brought under cultivation after suitable reclamation	Waste land is negatively related to economic growth

Appendix 1 Contd.

Variables	Quantification of variable for each district of Karnataka State	Expected contribution to economic growth
	b) Area under barren land ('000 ha) and uncultivable waste land ('000 ha). These require huge investment to bring them back under cultivation	
4. Rainfall potential	Net sown area ('000 ha) since this is the area sown in kharif season	It reflects agro-economic activity during Kharif season, and is positively related
5. Food and fodder security	a) Gross area ('000 ha) under Jowar, Bajra and Ragi under rainfed condition	Positive
	b) Goss area under Paddy, Maize, Wheat and total food grains under irrigated condition (000 ha)	
6. Social capital	Literacy rate (%), represents the potential for education, communication, employability, perception	Positive (as also improves with PURA (providing urban amenities in rural areas)
7. Labour force	Number of agricultural labourers	Positive
8. Ground water	a) Gross area irrigated by wells ('000 ha) b) Number of pumpsets energized.	Well irrigation is an indicator of level of diversity in low / high water intensive crops, positive relation with growth
9. Protein	Gross area ('000 ha) under total pulses, red gram and Bengal gram.	Indicator of major, minor, ethnic underutilized crops. An indication of supply side of protein.
10. Surface water	Gross area irrigated by canals and tanks ('000 ha). Canal irrigation is an indicator of level of specialization in irrigated or high water intensive crops.	Positive
11. Annual rainfall	Rainfall in mm. The key determinant of agriculture, manufacturing and service sector as also surface and ground water.	Positive. Its size is manifested in gross sown area
12. Agricultural technology	Gross area ('000ha) under HYVs (This data is available for each crop. Hence the proportion of Jowar area under HYV is taken as the basis and the same is used for all crops.	Positive sign as HYVs are crucial inputs enhancing agricultural output.
13. Vegetative growth	Application of nitrogen fertilizers (tonnes) in agriculture	Positive
14. Disease resistance	Application of potassium fertilizers (tonnes) to soils enhances disease resistance in crops	Positive
15. Photosynthetic and respiratory activities in crops	Application of phosphorous (tonnes) – the key nutrient responsible for physiological functions in crops	Positive
16. Managerial force	Number of cultivators engaged in agro-economic activities.	With increase in cultivators, management of those lands will improve

Variables	Quantification of variable for each district of Karnataka State	Expected contribution to economic growth
17. Oil crops	Gross area('000 ha) under total oilseed, groundnut, sunflower, sessamum, linseed.	Positive. India's import bill is huge on oils. Hence helps in import substitution
18. Fiber	Gross area under cotton ('000 ha) as also the largest commercial crop.	Positive since cotton is crucial for clothing and also has the highest value addition
19. Size of holdings	a) Number of marginal holders (< 1 ha)	Small farmers have contributed to economic growth. Higher the number of small / large holders, positive is the relationship
	b) Number of small holders (between 1 and 2 ha) c) Number of large holders (> 2 ha), (They are largely in Northern Karnataka with major area being rainfed.	
20. Savings potential	Total deposits (lakh Rs) in commercial and cooperative banks.	Higher the savings, higher the capital formation, hence positive
21. Marketable surplus	Total turnover in the regulated markets (Lakh Rs).	Marketable surplus is an indication of commercial agriculture, positive
22. Liquidity	Crop loan or short term loan lent by coop banks (lakh Rs). Capital starved, these loans will induce them to take up agricultural activity.	Loan lent has positive relationship since it enables adoption of modern technology
23. Warehousing service	Value addition due to storage (lakh Rs.).	Storage adds time utility. Positive relation
24. Transportation service	Value addition due to transportation (lakh Rs.).	Transportation adds place utility, reflects connectivity. Positive relationship
25. Trade service	Value of output from trade, hotels and restaurants (lakh Rs.)	Trade service positively contributes to growth
26. Communication service	a). Value of telecommunication, services and postal services.	
	b). Number of telephone connections.	Communication enhances growth
27. Other services	Value of output due to legal service, consultancy service, social service, R&D service, accounting and auditing services IT and ITes(enabled service) (lakh Rs.)	Services enhance growth (positive relation)
28. Public administration services	Value of the public admin service in Rs Lakhs indicates Governance	Positive
29. Manufacturing sectors	a) Value of output generated (lakh Rs) from Registered and Unregistered manufacturing sectors.	Positive relationship as it creates investment opportunities and increases production capacity
	b) Construction services	
30. Aggregate income	Gross value of output from selected 15 crops and the value of output generated from agricultural, horticultural and livestock component (Lakh Rs.).	Positive

REFERENCES

Acharya, S. S. and Agarwal, N. L. 2004. *Agricultural marketing in India,* Oxford and IBH Pub., pp 185-90.

Anonymous, 2004.http://dmc.kar.nic.in/data/annual/y04.pdf. Last assessed on 9th Jan-2015.

Anonymous. 2012. http://shodhganga.inflibnet.ac.in /bitstream/10603/5/chapter20final.pdf. Last assessed on 9th Jan-2015.

Ardeshna, N. J. and Shiyani, R. L. 2012. Growth dimension of agriculture in Gujarat state: A factor analysis approach. *Econ. Affairs*, **57**: 41-50.

Bhuyan, K. C. 2005. *Multivariate Analysis and its applications*. New central book agency (P) Ltd. Pub., pp.129-57.

Chand, R., Prassana P. A. L. and Singh, A. 2011. Farm size and productivity: understanding the strength of smallholders and improving their livelihoods. *Econ. Polit. Weekly. Supp.*, **156**: 5-11.

Patil, K. R., Manjunatha, G. R. and Aditya, K. S. 2013. Structural transsion in Karnataka agriculture during post liberalization era. *J Crop Weed*, **9**: 65-71.

Ramesh, C. 2012. Temporal and spatial variation in agricultural growth and its determinants. *Econ. Polit. Weekly.*, **7**: 26-27.

Ramesh, C., Praduman, K. and Sant, K. 2012. Total factor productivity and returns to public investment on agricultural research in India. *Agril. Econ. Res. Rev.,* **25:** 181-94.

Ranganatha, S. K. N. 1983. Growth dimension of agriculture in Karnataka. Ph.D thesis (unpublished), University of agricultural sciences, Bangalore.

Rencher, A. C. 2002. *Methods of Multivariate Analysis*. John Wiley & Sons, INC. Pub., pp.408-47.

Uma, H. R., Madhu, G. R. and Habeeb, M. 2013. An analysis of the causes of regional migration using Garrett's scale. *J. Human. Soc. Sci.*, **12**:20-23.

Uma, H. R., Madhu, G. R. and Habeeb, M. 2013. Regional migration for inclusion: a study of agricultural labourers from North Karnataka to South Karnataka. *Inter. J. Scient. Res. Pub.*, **3**: 1-3.