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INFRASTRUCTURE AND AGRICULTURAL DEVELOPMENT IN KARNATAKA STATE

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PREFACE

The focus of World Development Report on infrastructure during 2002 was an important step towards underscoring its basic necessity in the process of economic growth in developing countries. Time and again it has been emphasised that infrastructure is the best conduit of development. However, the fact is obliviated due to other mounting pressures in the process of development. This happens mainly due to the intrinsic and indirect role that infrastructure plays in the process. To that extent even the academic studies on development process rarely underscored infrastructure as a major determinant of the process. It is only in the recent past that this lacuna is identified strongly by the academicians and infrastructure became a major issue. This project was undertaken by me initially to highlight the role of infrastructure in agricultural development. Keeping in view the Low Level of Equilibrium Hypothesis of Nelson and theoretical backup provided by Theodore Shultz I thought of getting into the basic premises of infrastructure as major determinant of agricultural development. I preferred to hand over the project to Dr Venkatachalam who has been recently transferred to the Agricultural Development & Rural Transformation (ADRT) Unit. He took keen interest in undertaking this study which he completed single handedly with a lot of zeal and enthusiasm. He has reviewed significant literature as well as analysed volumes of data to produce this fine document.

The study underscores the prime role of infrastructure in the development process in India as well as in Karnataka. It also helps to find out the regions and the districts lagging in terms of development of infrastructure and points out the lacunae. The study also sets tone for further work in this direction especially on the background of the report of the Committee on Regional Disparities in Karnataka. I am sure that this report will be useful to researchers and policy makers in the State as well as elsewhere.

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L. Venkatachalam

CHAPTER I

INTRODUCTION

Having realised the importance of infrastructure to achieve faster rate of economic growth, the Government of India as well as the State Governments have ventured into making heavy investment in agricultural infrastructure especially from the First Five-Year Plan onwards. The major focus of infrastructural investment has been on irrigation, transportation, electric power, agricultural markets, etc and these not only contributed to the agricultural growth at the macro level but also to wide disparity between different regions in terms of agricultural growth. Since the responsibility of providing infrastructure is with the state which aims at rapid growth of agricultural production for attaining other kinds of developmental goals such as poverty alleviation, there exists a tendency among the decision-makers to invest heavily in those areas where there is a potential for fast agricultural growth. This is also supported by the financial resources available with the concerned governments. Therefore, the bias in decision-making and the financial strength of different governments also determine the level of infrastructure in different regions, leading to imbalance in the agricultural growth as well as regional development. This being the case, the major objective of the present study is to analyse the role of infrastructure in accelerating agricultural development. This will facilitate the policy makers to take up some normative measures to address issues in infrastructural development.

Definition of Infrastructure

Infrastructure refers to services drawn from the set of public works that traditionally has been supported by the public sector, though in many cases, the infrastructure services may be produced in the private sector. Water supply, sanitation, transportation, electricity, telecommunications, irrigation dams, regulated markets and banks are some of the examples of infrastructure that generate services. The agricultural infrastructure includes all of the basic services, facilities, equipment, and institutions needed for the economic growth and efficient functioning of the food and fiber markets. Infrastructure investment demands a strong commitment to the research and cooperative extension system that enhances production, marketing, food safety,

nutrition, natural resource conservation, and all other functions of different agencies concerned with agricultural infrastructure.

As far as nature of infrastructure is concerned, there are different kinds of infrastructure such as economic infrastructure, social infrastructure, financial infrastructure, technological infrastructure, agricultural infrastructure, etc defined in broader terms. All kinds of infrastructures are complementary to each other and are essential and integral part of economic development. It should be noted that the benefits derived from all these kinds of infrastructure *collectively* are greater than that of the combination of benefits from each type of individual infrastructure. In other words, the net benefit of providing different kinds of essential infrastructure together tend to generate more amount of net benefits than that of providing a single infrastructural facility. The policy implication of this statement is that the regional or sectoral development and the phase at which the economy grows depends mainly on the level of infrastructure, both vertically as well as horizontally.

Importance of Infrastructure

One of the central questions in the economic growth paradigm is how different factors of production contribute to aggregate output. This contribution is made by income earned by the factors of production, which in a perfectly competitive economy, will equal their marginal value products in the absence of externalities. This has important policy implications in terms of appropriate level of investment in different sectors, since the market will tend to provide capital in response to price signals, which reflect private benefits and ignore "externalities". If there are large externalities, there is a need for government intervention to achieve more efficient allocation of resources, though government intervention itself has its own costs. The fact that infrastructure services are often provided by the public sector means they are often not priced at all, or are rationed, and we have difficulty even in estimating the private productivity of infrastructure capital.

The strong positive correlation between the level of infrastructure and the economic development has been a well-established fact in the development economics literature. In Keynesian macroeconomic model, the income or the output in the economy derives also from the level of investment made in the economy. It should be noted that out of all the four factors contributing to income of a nation namely, consumption

expenditure, investment expenditure, government expenditure and net income from abroad, income from investment comes both from investment expenditure especially by private individuals as well as from government spending. Though the income in the Keynesian model refers to short-term income, usually measured on annual basis, the investment made also includes long-term investment such as investment in basic infrastructural facilities. Since the model is based on the notion that there is a direct positive correlation between income and the investment, investment in infrastructure is economically justified.

While discussing different stages of growth of the economy, Rostow (1960) argues that expansion and improvement of the transport and the infrastructure is considered as a necessary pre-condition for capital formation and increase in the production and productivity. Given the fact that the investment in infrastructure impacts positively on economic development, the supply of the infrastructure has to match with the demand for it so that no dis-equilibrium arises-which ultimately results in any imbalances between and within a region.

The theory of infrastructure derives mainly from the "public goods theory" in economics. The investment on basic infrastructure generates lot of benefits that posses the characteristics of public goods. Two major characteristics are worth mentioning here: (a) 'non-excludability' character which implies that nobody in the 'user group' can be excluded from consuming the benefits from the infrastructural facilities unless or until a strict enforcement is enacted to exclude certain individuals. Even if somebody can be excluded through enforcement from utilising the benefits, the `transaction cost' of doing so would be a costly option and therefore, the decision would be economically non-viable. For example, it would be a costlier option to prevent a farmer in the downstream of a newly constructed irrigation dam from utilising the groundwater recharged by dam; and (b) 'non-rival' consumption of the benefits in the sense that the consumption of the benefits by one individual does not result in affecting the consumption of same benefits by another individual unless or until a negative externality problem such as water pollution arises. For example, consumption of the service provided by water and utilised by a particular agent (say, industry utilising the disposal service of the river) does not affect the consumption of another service utilised by another agent (say, farmer utilising water for irrigation purpose) unless they are encountered with excess level of water

pollution. Hence, infrastructure is a "social capital" that positively affects larger society, in the absence of externality.

Among all kinds of infrastructure discussed above, agricultural infrastructure plays an important role especially in a developing country context where a larger percentage of poorer section of the society depends on this sector for subsistence. The growth enhancing nature of the infrastructure warrants a closer scrutiny of the relationship between the level of agricultural development and the level of agricultural infrastructure from the regional perspectives. This assumes importance because, the agricultural sector plays a dominant role in alleviating poverty and the overall growth of the agricultural sector and its components such as growth of agricultural employment, income, output, etc depend largely on the level of investment made in infrastructure. In other words, level of infrastructure in agricultural sector is one of the major factors that could explain the regional balances and imbalances in the agricultural growth. This being the case, as we have already seen, our major aim here is to analyse the role of infrastructure in promoting agricultural development vis-à-vis the regional development. The net result expected out of the present analysis is to identify the backward regions based on the adequacy or inadequacy of the level of agricultural infrastructure, as well as to suggest policy measures to improve upon the performance of the regional economy.

Before going into the details of our analysis of the regional economy, we will discuss various roles played by the agricultural infrastructure in regional development.

1. Infrastructure Increases Agricultural Production and Productivity

It should be noted that the infrastructure in the agricultural sector enhances the 'comparative advantages' of that region in which the infrastructural investment is made. When the region gains comparative advantage in the agricultural activities, the net result is increase in the production and productivity of various agricultural goods and services in general. The increased level of production and productivity results in a shift in the supply curve upwards, which has its positive implications on the price factor depending on the nature of the elasticity of demand for the commodity under consideration. Increased comparative advantage at the regional level due to increased agricultural infrastructure implicitly reveals that any less

amount of investment in other regions would automatically lead to 'comparative disadvantage' of that region and, therefore, this requires a balanced investment in agricultural infrastructure. An empirical study by Binswanger *et al* (1993), which we are going to discuss in more detail in a latter section, demonstrated that increased marketing infrastructure that includes components such as road facilities in India enhanced the total agricultural output with the elasticity of 0.20. However, one of the questions that need to be addressed here is that though there exists a direct correlation between the level of infrastructure and the agricultural output at the macro level, whether the increased infrastructure at the regional level has resulted in balanced growth in the agricultural output between different regions. The present study aims at shedding light on this particular aspect in detail.

2. Infrastructure Reduces Cost of Production

Development of agricultural infrastructure in a particular region not only enhances the agricultural production and productivity but in many cases, leads to reduce the marginal cost of production. Some of the empirical studies on the agricultural infrastructure (which we will discuss later) have proved that there exists a negative correlation between level of infrastructure investment and the marginal cost of production. For example, an empirical study by Ahmed and Hussain (1990) demonstrated that the fertiliser use in the agricultural sector increases with the improvement in the quality of road. It should be noted that the transaction cost – that generally falls outside the cost of input prices –can be one of the major components of the total cost of production in the agricultural sector and the infrastructure plays a dominant role in reducing the transaction cost. For example, the transportation cost incurred by the farmers in a particular region, both for transporting inputs to the field from the place of purchase and transporting the output to the market place for final sale, can be substantial in the absence of proper transportation facilities. Once the transportation infrastructure has been introduced, the transaction cost may considerably be reduced which has the bearing on the total marginal cost of production. This will either result in benefiting the farmers by way of increased 'producer surplus' or it would result in diversion of the additional cost saved towards other productive activities by the farmers that would enhance the overall output and income of the region.

3. Infrastructure Increases the Regional Value Added.

An important benefit derived from the agricultural infrastructure is that it helps to increase the level of 'value added' in the region. Increased level of agricultural infrastructure in a particular region would lead to extend investment in allied sectors which can produce high value added products. The increased level of capital formation in a region due to the availability of agricultural infrastructure leads to 'derived demand' for the investment in the industries that produce value added commodities. For example, increased banking or agricultural training facilities introduced in a particular region may attract new kind of investment in areas such as food processing, etc. This would increase the regional income and employment that will have its multiplier effect.

4. Infrastructure and the Social Benefits

Provision of initial level of agricultural infrastructure or enhancement of the existing one may lead to a different kind of cropping pattern from the existing one that would generate some indirect positive benefits that may be called social benefits. These benefits are enjoyed not only by the regional economic activities but also by activities beyond the administrative and political boundaries of the region. For example, introduction of a new technology such as sprinkler irrigation in a region may reduce the exploitation of groundwater in that region and this would make more amount of groundwater available for downstream farmers several miles away. This would probably save the marginal cost of digging bore-wells, preventing failure of wells, etc that would save considerable cost to the farmers downstream. Also, introduction of a new technology may lead to cropping pattern change that would move from those crops that causes soil erosion, to another crop that may protect the soil erosion. The secondary effects of soil erosion such as loss of fertility of the top soil, sedimentation of irrigation tanks, eutrophication of lakes, etc are considerably reduced and this results in a reduction in the social costs or an increase in the social benefits. One of the classic examples that fall under this category is the irrigation dams. Though designed for irrigation purpose, these dams could play a major role in providing social benefits to the larger group of users other than the 'identifiable' and 'well-defined' user group. Increased availability of fish, benefits from the bio-diversity, eco-system protection, water for drinking and industrial purposes, tourism benefits, groundwater recharge, flood control, etc are some of the indirect benefits

that are made available by the irrigation dams, apart from the water for irrigation purpose. Though not properly quantifiable, these 'non-market' benefits are considerably high in the total benefits generated by the irrigation dams and these benefits are used by many different stakeholders in the concerned region.

5. Infrastructure and the Economies of Scale

Some types of infrastructure may result in increased economies of scale that would increase the agricultural income. The economies of scale is realised when the cost of production of a particular firm declines due to external advantages. Provision of one particular infrastructure for a specific objective may result in satisfying multiple objectives thereby increasing the economies of scale in the production activities. For example, rural electrification for providing electricity for the agricultural sector or rural road network may attract small-scale industrial units that also consume electricity and road in the production process. The small-scale units in this case need not have to spend additional amount of expenditure on the infrastructure required for consumption of electricity (such as electricity posts, etc) or road since that kind of facility is readily available for immediate consumption. This adds to saving of costs, increasing the private benefits.

6. Infrastructure and Accelerator Effects

It should be noted that a particular type of agricultural infrastructure in one region will have its multiplier as well as accelerated effects in other areas, especially in urban centres. For example, additional area of land can be brought under cultivation due to construction of an irrigation dam in a particular region. This would lead to increased consumption of fertiliser which would either warrant expansion of the reserved capacity in the fertiliser industry or would require investment in the new fertiliser units in urban areas. This multiplier effect in turn would lead to increase the investment in the 'producer goods'– such as machines required for the fertiliser units – putting the accelerator effect in operation. In this way, infrastructure in one area may have cascading effects in other areas, resulting in increased real output and employment.

7. Infrastructure and Increased Welfare of Producers and Consumers

Certain types of agricultural infrastructure enhances improvements in both producer as well as consumer surplus. Increase in the number of regulated market committees, increased availability of banking operations in rural areas, increased availability of transportation facilities, etc prevent the middle-men and the money lenders from appropriating a substantial amount of producer and consumer surplus. It should be noted that the welfare of the producers and the consumers improves from the fact that increased infrastructural facility brings producers and consumers to one place where producer could get an higher price for his products and consumers could pay lower price for the same product.

The presence of infrastructure such as roads and regulated markets is expected to increase the efficiency of both marketing and production since they reduce transaction costs and ensure competitive pricing. A recent empirical study by Minten (1999) documented the relationship between access to infrastructure, output markets and rural agricultural prices using community survey in Madagascar. The study concludes that the hard infrastructure is an important determinant of the price level but adding the soft infrastructure on top of it would be more beneficial in terms of reducing the price variability and the resulting food security in the rural areas. Studies of this kind suggest that provision of need-based infrastructural facilities would always result in expected outcome.

8. Infrastructure and Reduction in Price Oscillation

Another form of loss of producer and consumer surplus is caused by the oscillation in the price of the agricultural commodities. When there is a supply shortage and the demand for the commodity being constant, the producer/seller will charge a price equivalent to the 'quasi-rent' thereby converting a considerable amount of consumer surplus into profit. When there is an excess supply of the same commodity, the market becomes a buyer's market and the price paid by the consumers would be sub-optimal. The price oscillation in this case is attributed mainly to the information asymmetry existing in the market and once adequate amount of investment is made in the communication infrastructure, then this would facilitate a long-term forecasting in the supply and demand factors thereby eliminating the price oscillation. In the case of highly perishable commodities, not

only the information asymmetry but also non-availability of storage facilities would lead to the price oscillation phenomenon.

In a nutshell, infrastructure potentially can influence rural economic performance through three avenues (Fox and Porsa's, undated): expanding the use of existing resources (labor, capital, etc.); attracting additional resources to rural areas; and making rural economies more productive. First, existing resources will be used more intensively, both in the short and long run, when derived demand is increased in rural economies. Infrastructure creation, such as laying roads and creating other forms of capital, provides the potential for short-term economic stimulus if labour and capital in rural areas are used up say, during the construction process. Infrastructure generates longer-term benefits if the existing firms become more productive and engage workers as their capacity is expanded. Second, infrastructure can have an effect by raising the productivity level of businesses operating in rural areas. Though it interacts with the other avenues, this is the primary economic benefit that is expected since existing resources will be used more intensively and new resources will be attracted for more productive business. Third, infrastructure can attract other productive inputs to an area. Infrastructure, as we have already seen, can attract new or startup firms and the expanded level of economic activity offer employment opportunities and increases regional product. Firms may come to an area because the infrastructure is very productive, is less expensive than that available in other places, is relatively unique in its availability (such as a more advanced telecommunications network than is available in other nearby locations), or is plentiful. Similarly, the improved quality of life associated with infrastructure services may attract or help retain workers who otherwise would leave rural areas.

The discussion above suggests that increased agricultural infrastructure plays a strong positive role not only in promoting agricultural growth of a concerned region but also other regions of the economy since enormous amount of indirect benefits are generated by the infrastructure and enjoyed by outside regions. The positive correlation between the level of agricultural infrastructure and the level of agricultural growth, as hypothesised, implies that imbalance in the level of agricultural infrastructure between sectors and regions would result in regional imbalances correspondingly. The immediate question that one needs to ask is, what does the empirical evidence regarding the relationship between infrastructure and agricultural output show? To answer this

question, we will look at some of the empirical studies available from the literature on infrastructure.

Review of Literature

Literature on the economic effects of infrastructure has emerged in economic literature during the past several decades. Researchers have used various techniques that range from a simple to a most sophisticated econometric methodologies and have used different types of data in an effort to identify the relationship between output or productivity and the availability of infrastructure (see Fox and Porsa, undated). One school of thought is that the incremental infrastructure investments will have only a modest effect on rural economic performance. Even in those cases where large benefits from infrastructure investments could be achieved in the past, similar expansions would generate marginal benefits that would be declining. Even situations where large benefits from infrastructure investments have been reaped in the past do not necessarily provide evidence that future gains will result from similar expansions. The inter-state highway system is cited as an example, where large benefits resulted from creating a network, but similar benefits have not arisen from developing (or massively expanding) a new network. The resources for financing infrastructure normally are obtained through taxes or user fees, and generation of secondary benefits such as employment opportunities are possible only to the extent that construction generates more jobs than private expenditure of the revenues. Even without local financial resources employment can be generated in rural places, if gross-subsidisation of rural infrastructure is possible through taxes and fees collected from urban areas. Second, construction related jobs last only as long as the construction process. Therefore, the argument of this school is that "enhancing rural infrastructure generally should not be the primary focus of an economic development strategy, but infrastructure probably needs to be a component of well-structured programs" (Fox and Porsa, undated: 3).

However, these kinds of arguments could be challenged. For instance, while there exists no guidelines on what is the optimum level of investment that results in maximum benefit, the conclusions about the relationship between the incremental investment and the marginal benefits should be based on individual cases, as well as on the level of development of a particular economy. This being the case, the following section reviews the existing literature on infrastructure so as to understand the nature of

the relationship between the infrastructure and the productivity, with the major focus on the agricultural sector. Let us first review the general studies on infrastructure and economic growth.

In an attempt to estimate the general productivity of infrastructure, Canning (undated) used an aggregate production function approach incorporating labor, physical capital, human capital (education) and other infrastructure variables namely, number of telephones, electricity generating capacity and kilometers of transportation routes (paved roads and railroads). The panel of annual cross-country data (82 countries) for the period 1960–90 has been used in the analysis. Using a simple least-square regression analysis, the author finds that the elasticity of output with respect to physical capital is around 0.37. For human capital in the form of education, the elasticity was found to be around 0.1, which is substantially lower than that estimated by similar kind of other studies. Regarding infrastructure, it was found that there was no significant impact of electricity generating capacity, or transportation infrastructure on the agricultural output. Since infrastructure capital is already included in the physical capital stock, this implies that these types of infrastructure have the normal productivity effect of capital as a whole. It should be noted that a large impact was realised when increasing the telephone stock and removing an equal amount of investment in other physical capital, in the model. The elasticity of output with respect to the telephone stock was found to be around 0.14. This result suggests that there is a large externality to telecommunications infrastructure and this result was found to persist when the sample was split into developed and less developed countries. For developed countries, transportation routes appeared to have above average productivity. The implication of this study is that investment in some of the specific infrastructure would increase the productivity manifold.

Previous research on the impact of marketing infrastructure on agriculture concludes that road quality increases the use of fertilizer (Ahmed and Hossain 1990) and enhances total agricultural output with an elasticity of about 0.20 (Binswanger *et al*. 1993). It has been shown that lack of transport infrastructure results in low technological adoption, cropping choices and low agricultural productivity in developing countries (see Omamo 1998; Zeller *et al*.1998) while price policies, with respect to transport pricing might lead to distorting signals. For example, Gersovitz (1989, 1992) shows how territorial pricing affects transport investment strategies while Masters and

Nuppenau (1993) show how liberalization accompanied by increased infrastructural development would improve efficiency and equity in the case of production of maize in Zimbabwe.

Minten (1999) attempted to understand the level of influence of infrastructure on the prices of agricultural produces in Madagascar. Since changes in the prices of food grains do impact on the welfare of the individuals through alteration in consumption, the study investigated whether presence of infrastructure (especially the transportation) often determines the price level after market liberalization as transport costs, that is different due to distance and the quality of infrastructure, influence how the benefits (costs) from a liberalized environment are shared between producers and other economic agents, i.e. transporters, middlemen, and consumers. The study found that hard infrastructure is an important determinant of producer price levels. Price levels decrease significantly as the distance to main roads increases and the quality of infrastructure decreases, and they decrease relatively faster over shorter distances than over longer distances. It is shown that distance matters more than road quality as there is no strong relationship between road quality and the decline of producer prices per unit of time, and as increased quality decreases time traveled only marginally. Moreover, this study found that road infrastructure does not automatically lead to more competition among traders as hard infrastructure by itself does not seem to increase the possibility of choice between traders.

In a study by Deno and Eberts (1989), it was found that a significant increase in personal income was appropriated when infrastructure (of all types) was created in rural areas. However, the authors concluded that most of the effect lasted only for a short span of time – usually less than one year. The installation of physical infrastructure has the potential to generate employment as workers are used in the construction process. Jacoby (1994) observes that construction jobs are created rather rapidly following the brief contracting period that is necessary after a decision is made to invest in a project. The specific number of workers needed in the construction process varies considerably based on the size and type of project and the labor intensity of the facility being built. He also reviews some U.S. research on job creation in transportation construction. He finds an average of 10.4 jobs are created in rural areas for each $1.0 million (1984 dollars) spent. Only 9.6 jobs are generated for each $1.0 million in urban areas. He notes that job creation ranges from 7.4 jobs for every $1.0 million spent for resurfacing

to 11.5 jobs per $1.0 million spent for major road widening. Two different criticisms against this finding come from other empirical studies, which is discussed in the next section.

Two types of research have been conducted on the direct productivity gains from infrastructure. One is benefit-cost analysis of economic rates of return from specific projects. The second is research focused on measuring econometric relationships between infrastructure, private capital, and labor and economic output. Gramlich (1994) reports that benefit-cost analysis in the 1980s found real rates of return were very high for highway maintenance (35 per cent) and for new urban highway projects (15 per cent). Rates of return were acceptable for upgrading road sections to minimum standards (5 per cent). However, rates of return were generally found to be low for new rural road projects and negative for work performed on roads that were already at or above minimum standards. Gramlich (1994) questions the current value of such general studies because most of them were performed at a time when infrastructure investments were smaller, suggesting that returns could be much lower today. Further, he notes that such general conclusions may be of little value, since the real question is whether specific investments at specific locations would yield the desired returns. As he observes, some places have sufficient infrastructure and others do not, and the key issue is whether returns are acceptable at the specific locations that infrastructure is so productive that it can pay for itself in a single year, a seemingly unlikely result. His research also suggests that returns to transportation were much greater in the period up to the early 1970s than in subsequent years. These results can lead to the conclusion, for example, that investments in building the initial highway network were very large, but the returns to building another network (or significant expansions in the existing network) would be very small (Fernald 1999). The findings of Aschauer and others, based on aggregated macroeconomic data, have been subjected to a number of technical criticisms, including the direction of causality, missing variables, simultaneity bias, and trending. Various authors have sought to correct the research to account for these problems, and in many cases found a smaller contribution from infrastructure. For example, the return to infrastructure is found to be much smaller when the data are corrected through first differencing (for example, Tatom 1991). The overall finding of the time series literature is that infrastructure is productive but the strong impacts found in Aschauer's original work do not hold up to further scrutiny.

Aschauer's (1989) first study, using aggregate macroeconomic data, motivated the recent spate of research with his finding that infrastructure is extremely productive. Some of his research indicated that infrastructure is so productive that it can pay for itself in a single year, a seemingly unlikely result. His research also suggests that returns to transportation were much greater in the period up to the early 1970s than in subsequent years. These results can lead to the conclusion, for example, that investments in building the initial highway network were very large, but the returns to building another network (or significant expansions in the existing network) would be very small (Fernald 1999).

Fox and Murray (1990) examine the start-up rate for businesses in county areas of Tennessee. They consider the effects on business start-ups of a number of public policy factors such as taxes, government spending, infrastructure, and education. They find limited evidence that infrastructure is a determinant of where start-ups occur. The presence of interstate highways is consistently related to the start rates of firms of essentially every size. Local rail service also affects the start-up of certain sized firms. Access to airports, broader measures of highway availability, and infrastructure prices did not have a consistent effect on start-up rates.

Fox, Herzog, and Schlottmann (1989) do not directly investigate the effects of infrastructure but do determine that the public sector characteristics of an area, such as local public services and taxes, are important determinants of migration decisions. They separate migration decisions into the decision to move, the decision to move within the general area where one already lives, and the decision to enter a new area. They find that public variables are generally more important in pushing people from the area where they live than in attracting them to a new area. The greater information that people have about where they live versus where they might go is hypothesized as the reason. Thus, the lack of quality infrastructure in many rural areas will have its greatest effect through pushing existing residents out, to the extent these same effects hold for infrastructure.

In a parallel set of literature, economists have used cross section or cross section-time series data for states, cities, and countries to examine the role of infrastructure in production. This literature generally concludes that infrastructure contributes much less to aggregate output than was found in the time series literature.

For example, in an analysis using state-level data Holtz-Eakin (1994) finds essentially no impact of infrastructure on productivity when proper econometric techniques are used. The following table summarises the findings of studies on infrastructural development and aggregate output.

Table-1: Summary of Infrastructure Studies

Author	Focus/Relevance	Key findings
Aschauer (1989).	Evaluates the effect of public investment on the growth of private inputs, and in turn, the effect of input growth on output growth. Author views public capital and private capital as substitutes in production.	Increase in public investment expenditure of $1 billion is found to crowd out between $1 to $1.5 billion of private investment expenditure. Author interprets this to mean that firm managers appear to take directly into account the availability of public capital for use in private production.
Aschauer (1990)	Considers the relationship Between aggregate productivity and stock and flow government-spending variables.	The nonmilitary public capital stock is more important in determining productivity than is either flow of non-military or military spending.

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Aschauer (1998)	Looks at the role of public Infrastructure capital in economic growth of 46 developing countries. Develops and empirically implements a growth odel. In growth model, output depends on private capital, human capital, and public capital.	Finds empirical support for the importance of infrastructure provided, an efficient financing system exists.
Cummings et al. (1986)	Use late 1970s panel data set of dollar value of investment in SMSAs to study the responsiveness of wages to municipal infrastructure.	Measure of responsiveness is -.035. Survey findings of this variable range from -.037 to -.04.
Deno (1988)	Considers effect of infrastructure on growth path of regional private manufacturing.	Finds water and sewers have the largest effect in expanding regions, while highways have the largest effect in declining regions.
Diamond (1990)	Uses "denison growth accounting approach" to examine evidence on the contribution that public capital expenditure makes to the growth of developing countries.	Concludes that while current private capital expenditures for directly productive purposes exert a positive influence on economic growth, public capital expenditure appears to exert no influence.
Ethier (1982)	Discusses economies of scale in regional factors and their contribution to international trade.	Suggests exports may depend on regional efficiency.
Ford & Poret (1994)	Examine the relationship between infrastructure and economic development. Utilize data for 12 OECD countries.	The study finds weak support for Aschauer's hypothesis that boosting infrastructure investment promotes economic growth. In particular, the regression results are not sufficiently robust to provide much support for the policy of a sharp rise in infrastructure investment.
Fox & Murray (1990)	Focus on startup and relocation of business establishments within county areas of Tennessee in response to presence of infrastructure.	Long-run policy, as evidenced through providing infrastructure, is an important accommodating factor for economic activity. The rate of new-firm entry is higher where interstate highways are present, but the responses are small.

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Garcia-Mila (1989)	Estimates real GNP components, including government purchases.	Concludes that state and local purchases have positive multiplier effect while military purchases do not.
Garcia-Mila, McGuire (1992)	Find that with every dollar of education spending output increases by 16.5 cents.	Investigate the productive contribution of publicly provided Goods and services, highways, and education in particular. Output increases 4.5 cents for every dollar increase in highway spending.
Glomm & Ravikumar (1992)	Build a growth model with Infrastructure as an external input into private production functions.	Show that public infrastructure negatively affects the cost function.
Harmatuck (1996)	Examines the influence of Transportation infrastructure on economic development.	Finds the aggregate output response to net nonmilitary public investment is about .03.
Holtz-Eakin & Schwartz (1994)	Examines the role of infrastructure in a "structural model of economic growth".	Find little support for dramatic productivity boost from increased infrastructure outlays. In a statistical specification designed to provide an upper bound for the influence of infrastructure, the authors estimate that raising the rate of infrastructure investment would have had a negligible impact on annual productivity growth between 1971 and 1986.
Holtz-Eakin And Lovely (1996)	Study productivity and economies of scale of public Infrastructure. Also consider returns to variety.	Find public capital elasticity of manufacturing output is .637. Public capital elasticity on non-manufacturing output is .360. Find productivity effects only in manufacturing sector. In the non-manufacturing sector, infrastructure may increase the number of firms (variety) and, thus, output.
Hulten & Schwab (1991)	Consider the possibility of Over investment in infrastructure.	Note that correlation between growth and public capital exists but suggest no causation.

Conti….

Hulten & Schwab (1997)	Discuss the role of the bond Market on financing infrastructure growth.	Conclude public investment reduces private costs.
Lynde & Richmond (1991)	Illustrate the cost reducing effect of public capital on the private sector.	Find that the marginal product of public capital is positive and that constant returns to scale is supported when public capital is included in the production function.
Martin & Rogers (1995)	Consider model with increasing returns to scale with various infrastructure types.	Find that regional policies affecting domestic firms leads to high growth, while policies subsidizing international firms cause domestic firms to exit the market.
Morrison & Schwartz (1992)	Examine the relationship between state infrastructure and productive performance.	Find that infrastructure investment does provide a significant direct benefit to manufacturing firms and thus augments productivity growth.
Munnell (1990)	Explores "significant contribution" of public capital investment on national output, productivity, growth, and international competitiveness at the state and regional level.	Concludes that those states that have invested in infrastructure tend to have greater output, more private investment, and more employment growth. Author's findings suggest that public investment comes before the pickup in economic activity and serves as a base.
Nadiri & Mamuneas (1991)	Consider the productivity of public capital and research and development using a production function with these inputs.	Find positive effect of infrastructure investment on growth, at the same time that infrastructure investment is declining.
Neill (1996)	Uses a growth model to study the responsiveness of output to growth.	Suggests that output's responsiveness to infrastructure should determine optimal infrastructure investment.
Nijkamp (1986)	Focuses on the role of infrastructure in a regional development strategy. Uses different statistical techniques and a so-called quasi-production function to show importance of infrastructure.	The extent to which infrastructure contributes to regional development varies over time and depends on the overall level of economic welfare. The statistical results demonstrate a high degree of correlation among successive infrastructure indicators. Also, the results demonstrate that densely populated industrialized areas tend to have higher network infrastructure endowment than peripheral, agricultural, and less densely populated areas.

Conti…..

Rubin (1990)	Reviews infrastructure/ productivity issues.	Finds a weak link between growth and Infrastructure and recommends caution in developing public policy that "pumps" money into infrastructure.
Shah (1992)	Using data from Mexico to construct a production function that mirrors circumstances in developing countries with imperfect markets, credit rationing, and price controls, examines the effect of infrastructure on output.	Finds an infrastructure elasticity of output equal to .046.
Stover (1987)	Discusses infrastructure's effect on the supply of housing using pooled data on 64 MSAs from 1973 to 1982. Also measures private costs of infrastructure.	Finds housing quality variables sensitive to a number of infrastructure variables.
Wylie (1996)	Studies aggregate growth attributable to infrastructure changes in Canada from 1946 to 1991; also considers marginal productivity of inputs.	Finds marginal product of labor is .54. Marginal product of capital is .213, and marginal product of infrastructure is .248. All are diminishing.

Source: Fox and Porsa (undated).

In summary, a reasonable conclusion is that infrastructure and agricultural output are complements, at least in part because improved infrastructure allows the combination of all firms to reach a higher optimal level of output. The somewhat inconsistent findings in the research can be attributed to several factors. The aggregate nature of data used in the studies mixes industries (including agriculture) where infrastructure is complementary with industries where infrastructure is substitutable with labor. Another is the studies use widely different methodologies and databases. Also, researchers define substitutes and complements in different ways. Infrastructure is found to have a positive effect on agricultural output and employment. Since this relationship is well established and has implication on the regional imbalances, it is essential to look into the trends in infrastructural development across states in the country vis-à-vis agricultural growth. There are a few states/regions which could derive

benefits out of the growth of infrastructure but the regions left out are obviously the areas requiring larger investment and policy attention. Further it becomes necessary to test the hypothesis linking infrastructure to quality and structure of growth.

Objective of the present study:

Keeping this in view, the present project proposes to investigate into the role of infrastructure in accelerating agricultural development and especially to bring out its catalytic role in a cross-sectional perspective. Following are the major objectives of the present study:

a. To estimate the trends in major components of infrastructure for agricultural development in the country across major states so as to understand the Karnataka's position.

b. To analyse the level of development of various agriculture infrastructural indicators across different districts in Karnataka, so as to understand the disparity in infrastructure development;

c. To provide broader policy suggestions on infrastructural development in Karnataka state.

Methodology:

The study is mainly focused on the secondary data at state level for all the major states in the country regarding agricultural development and major infrastructural variables, for two time periods. The analytical framework will rely on estimating the production surfaces and finding the contributions of individual components. District-wise analysis of Karnataka will be attempted to further highlight and underscore the state level findings. Secondary data of all the major states in the country and for the districts of Karnataka would be utilised in this study.

CHAPTER 2

AGRICULTURAL INFRASTRUCTURE IN INDIA

In this chapter, we discuss the infrastructure development in India in relation to agricultural sector. The need for a state-wise analysis of the infrastructural indicators arises from two different dimensions: (i) we would be interested in understanding the relative performance of the Karnataka state in terms of certain important infrastructural facilities, compared to the other states in the country; and (ii) we want to establish a case in which the State's performance in terms of agricultural indicators is relatively better so that this performance indicator can be used, in the following chapter, as a benchmark for analysing the infrastructural facilities within Karnataka. Analysing infrastructural data in order to arrive at this benchmark level is a pre-requisite for making inter-district comparison because, no such yardstick is available to make such as kind of comparison at present. One of the major aims of our study is to make policy suggestions for appropriate infrastructure investment strategy in future so that any imbalance in infrastructural investment among different districts in Karnataka could be addressed properly. Therefore, in this chapter, we make an attempt to understand the relative position of the Karnataka State by way of analysing the secondary level data on different kinds of infrastructural indicators.

One way of comparing the inter-sate as well as inter-district performance is through rigorous econometric analyses where the agricultural output is taken as a `dependent variable' and is regressed against the infrastructural indicators to capture the influence of each indicator on the dependent variable. This approach basically assumes that the agricultural output of a particular state or district depends largely on the infrastructural indicators taken in the model, and other variables are treated as error term. But in many cases, it is the other variables in the error term that largely influence the agricultural development. Take for instance, apart from infrastructural indicators, there are factors such as labour availability, land and water resource management regime, rainfall, etc which are exogenous to the model which influence the agricultural output. An alternative way of dealing with this issue is to perform a 'factor analysis' in which all the related variables are grouped together and used for regressing against the dependent variable. The major problem wit this type of analysis is that the influence of

each variable included in a group may not be specifically identified. This being the case, our methodology does not involve any rigorous modeling which, in any way, may not reveal the true picture of the scenario. Through the present methodology, as already described, we are trying to establish a benchmark and then use that benchmark (through inter-state comparison) as a criterion for assessing the inter-district infrastructural facilities in Karnataka.

The infrastructural facilities do differ among different states and the differences are influenced by various factors. These factors are both quantitative and qualitative in nature and have different degree of influence on the agricultural sector in each state. We would identify certain selected rural and agricultural infrastructure indicators established in various states, and try to analyse the trend in these indicators over a period of time. The major objective of doing such an analysis is to understand the regional disparities in terms of these indicators and to understand the relative performance of the state of Karnataka in relation to these indicators.

In this chapter, we focus mainly on the trend in the growth of various kinds of agricultural infrastructure indicators in major states and Union Territories (UTs) in the country, especially between two available time periods. Let us first start with the state-wise percentage of irrigated area to the total cross-cropped area since there exists a positive correlation between irrigation development and agricultural output, influenced indirectly by the level of agricultural infrastructure. It should be noted that during the 1960s, enormous amount of investment has been made on creating the irrigation infrastructure in the country to bring more area of land under irrigation. Since the green revolution of late 1960s required irrigation as the major input, the central government as well as the state governments has ventured into investing heavily on the irrigation infrastructure in the country. Large-scale irrigation dams, canals, bridges, etc have been the major areas which attracted large percentage of infrastructural investment. All these developments were reflected in terms of increased irrigated area to the total cross-cropped area in the country. The following table reflects the changes in the percentage of irrigated area to the total cross-cropped area in various states in the country.

Table-2: State-wise percentage of irrigated area to the total cross-cropped areas

States	% of irrigated to cross-cropped area	
	1990-91	1997-98
Punjab	52.12	49.06
Tamil Nadu	35.78	44.79
Uttar Pradesh	41.37	45.92
Andhra Pradesh	32.63	32.77
Haryana	43.91	45.36
West Bengal	22.06	21.10
Gujarath	24.06	27.65
Kerala	11.03	11.82
Karnataka	**17.97**	**18.85**
Maharastra	9.31	11.82
Bihar	31.92	35.74
Himachal Pradesh	10.06	11.09
Orissa	20.16	25.44
Madhya Pradesh	18.07	25.14
Rajasthan	20.14	27
All India	**25.52**	**29.09**

Source: Indiastat.com

It should be noted that at the national level, approximately 29 percent of the total cross-cropped area has been brought under irrigation during 1997-98. It should be noted that the percentage of irrigated area to cross-cropped area at the national level has gone up by 3.5 percent between 1990-91 and 1997-98. Except Punjab and West Bengal, in almost all other states the irrigated area to the total cross-cropped area has gone up during the reference years. The Karnataka's position in terms of percentage of irrigated area to the total cropped area can be assessed in two different angles: (i) the irrigated area has increased by less than 1 percent during the reference years; and (ii) it is much less than the national average. The scarcity of water for irrigation in the state can be attributed to this phenomenon and therefore, any analysis of level of investment in the irrigation sector needs to be explained by the investment in dry land farming, watershed programmes, etc.

One of the areas that indirectly reflect the level of infrastructure made in the agricultural sector is the area brought under the High Yielding Varieties (HYV) crops. Since HYV crops are highly technology and infrastructure dependent, the area under HYV in different regions depend mainly on the level of infrastructural development such as irrigation development, agricultural training centres, increased availability of credit, etc.

Table-3: State-wise Area under HYVP- Crops*(1990-91 to 1996-97)

('000 Hectares)

Zone/States	1990-91	1991-92	1992-93	1993-94	1994-95 (Revised)	1995-96 (P)	1996-97 (P)	**Compound Growth Rate**
East	**11306**	11955	11662.00	13551	**14664**	**15578**	**16693**	**7.13**
Arunachal Pradesh	36	40	42.00	50	30	33	40	**-1.44**
Assam	1088	1226	1284.00	1259	1300	1362	1537	**4.60**
Bihar	3540	3700	3396.00	5201	5780	5950	6750	**12.98**
Orissa	2613	2806	2825.00	2939	3017	3145	3142	**3.07**
West Bengal	3576	3710	3698.00	3698	4139	4703	4814	**5.42**
Manipur	90	92	82.00	83	80	77	79	**-2.72**
Meghalaya	52	56	57.00	60	60	58	63	**2.52**
Mizoram	10	29	9.00	10	11	9	5	**-13.99**
Nagaland	40	42	44.00	5	4	5	5	**-36.90**
Sikkim	48	40	41.00	33	30	33	31	**-6.92**
Tripura	213	214	184.00	213	213	203	227	**0.83**
North	**22760**	22282	22916.00	23019	**23934**	**24261**	**24533**	**1.58**
Haryana	2693	2598	2673.00	2683	2804	2839	2823	**1.32**
Himachal Pradesh	539	561	563.00	520	574	612	601	**1.87**
Jammu & Kashmir	418	419	671.00	440	667	702	716	**9.89**
Punjab	5377	5368	5364.00	5519	5578	5407	5421	**0.28**
Uttar Pradesh	13733	13336	13645.00	13857	14311	14701	14972	**1.81**
South	**10517**	11360	10495.00	10504	**11813**	**10975**	**12314**	**1.88**
Andhra Pradesh	4525	4684	4148.00	4045	4846	4009	4699	**-0.15**
Karnataka	**3165**	**3340**	**3158.00**	**3166**	**3641**	**3936**	**4219**	**4.88**
Kerala	163	166	175.00	172	174	164	400	**9.98**
Tamil Nadu	2664	3170	3014.00	3121	3152	2866	2996	**0.70**
West	**20297**	19028	20269.00	19813	**20409**	**21377**	**22786**	**2.12**
Gujarat	2573	2317	2600.00	2250	2497	2296	2129	**-2.21**
Madhya Pradesh	6977	6775	6621.00	6592	7395	7786	7801	**2.62**
Maharashtra	7629	7086	7691.00	7978	7731	7919	8956	**2.56**
Rajasthan	3074	2802	3308.00	2944	2741	3327	3854	**3.02**
Goa	44	48	49.00	49	45	49	46	**0.32**
Total States	64880	64625	65342.00	66887	70820	72191	76326	**2.86**
Uts/Other States	104	99	62.00	105	111	119	102	**3.24**
India	**64984**	64724	65404.00	66992	**70931**	**72310**	**76428**	**2.86**

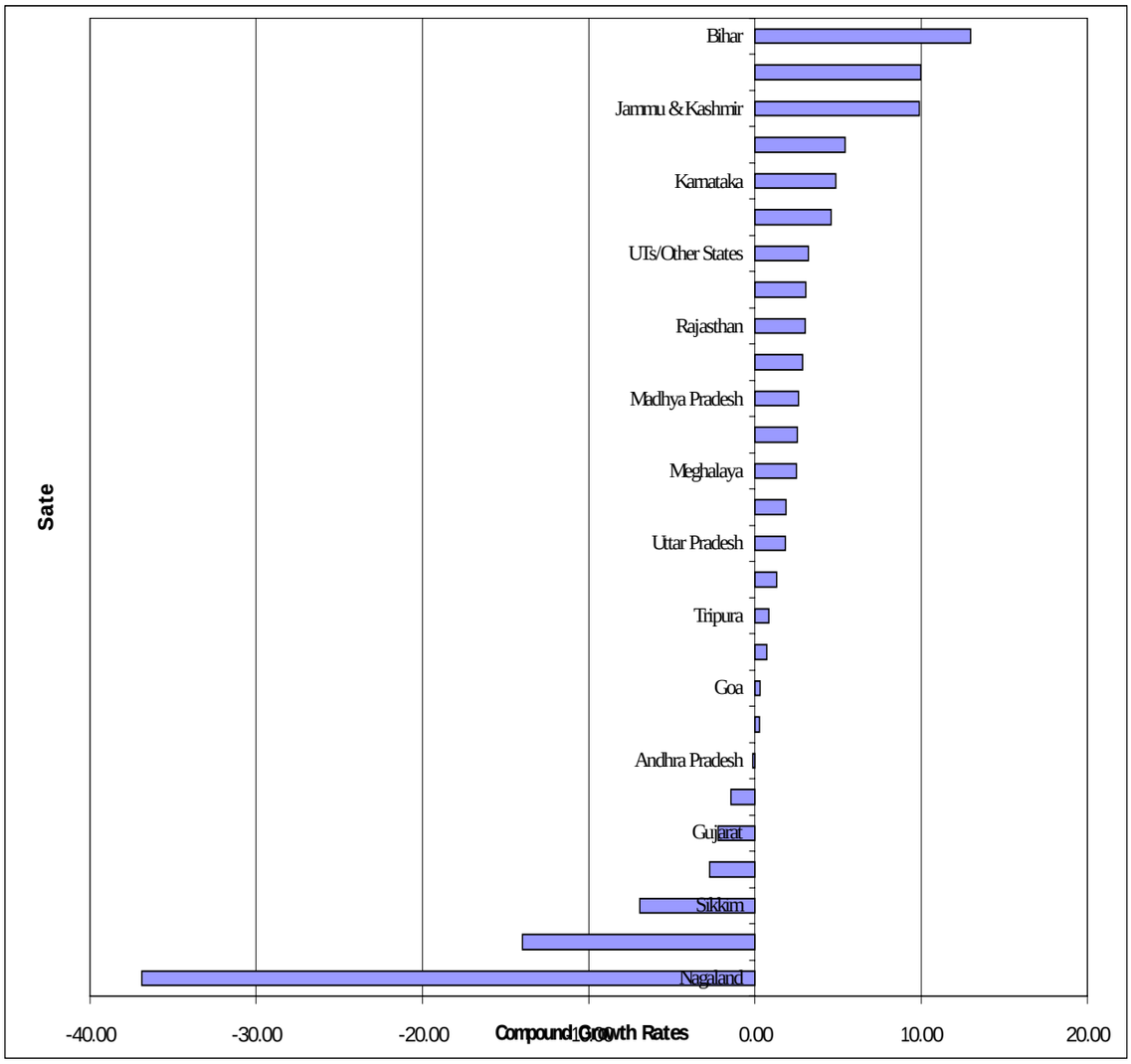
Abbre.: P : Provisional ,

Note: * Constitute Paddy, Wheat, Jowar, Bajra, Maize and Ragi.

Source: Fertiliser Statistics, 1998-99, The Fertiliser Association of India.

Despite the fact that several states have registered a negative growth rate in the area brought under the HYV crops during 1990-91 and 1996-97, Karnataka registered a positve growth rate of approximately 5 percent during the above period. While the compound growth rate at the national average in terms of area under HYV crops is 2.86 percent, the 5 percent growth rate in Karnataka is considered as to emerge from the better performance of the state in bring cultivable areas under HYV crops. This has come bearings on the level of investment made on the infrastructural front in those areas such as dry-land farming, watershed management, etc.

Chart-1: State wise Compound Growth Rates of Area under HYV- crops (1990 to 1996)



Apart from the specific agricultural indicators on the output side such as percentage of irrigated area and area brought under HYV crops, we need to discuss about the level of physical infrastructural inputs available in various states. In the case of transport infrastructure, the railways play a crucial role in transporting goods among different regions of the country. The development of a particular state depends also on the total length of the railways established. Among the major states, Karnataka's relative position is slightly deteriorated in terms of increase in the length of the railway line between 1982-83 and 2000-01.

Table-4: Statewise Railway Route Length (Kms.)

Sl. No.	States/UTs	**1982-83**	**Rank**	**2000-01**	**Rank**
1	Andhra Pradesh	4872	7	5135	7
2	Assam	2179	11	3442	10
3	Bihar	5362	5	5362•	5
4	Gujarat	5633	3	5312	6
5	Haryana	1500	14	1548	14
6	Himachal Pradesh	256	16	269	16
7	Jammu & Kashmir	77	17	96	17
8	**Karnataka**	**3014**	**10**	**3024**	**11**
9	Kerala	916	15	1050	15
10	Madhya Pradesh	5736	2	5965*	2
11	Maharashtra	5297	6	5459	4
12	Orissa	1982	13	2309	12
13	Punjab	2139	12	2139	13
14	Rajasthan	5614	4	5926	3
15	Tamil Nadu	3894	8	4188	8
16	Uttar Pradesh	8882	1	8889	1
17	West Bengal	3726	9	3760	9
	All India	**61385**		**61850**	

Source : Government of India (various years), Indian Railways Yearbook, Ministry of Transport, New Delhi.

Though the railway route length may be an important infrastructure indicator, it may not have any direct, easily quantifiable impact on the agricultural growth of the states. This is because, the railway lines may cover only a small percentage of the concerned state and moreover, transportation of agricultural related goods will constitute only a fraction of the total goods transported. This being the case, we need to look at the development of substitute network namely, the road network in the states.

Table-5: State wise Road Length (Surfaced & Unsurfaced) (As on 31.3.1997)

(In Kms.)

States/UTs	Surfaced	Unsurfaced	Total	Per capita Road Length
Andhra Pradesh	109739	68273	178012	0.002677
Arunachal Pradesh	3991	10101	14092	0.0163
Assam	11590	56828	68418	0.003052
Bihar	32998	55354	88352	0.001023
Goa	5695	2868	8563	0.00732
Gujarat	79380	11516	90896	0.0022
Haryana	25538	2626	28164	0.001711
Himachal Pradesh	15143	15050	30193	0.005839
Jammu & Kashmir	8225	13221	21446	0.002778
Karnataka	**99339**	**44673**	**144012**	**0.003202**
Kerala	45249	100455	145704	0.005007
Madhya Pradesh	88620	111517	200137	0.003024
Maharashtra	271694	90199	361893	0.004585
Manipur	3598	7343	10941	0.005955
Meghalaya	3923	4557	8480	0.004778
Mizoram	1983	2846	4829	0.007001
Nagaland	5241	13115	18356	0.015176
Orissa	86929	175774	262703	0.008298
Punjab	52423	11929	64352	0.003173
Rajasthan	76813	52861	129674	0.002947
Sikkim	1527	307	1834	0.004512
Tamil Nadu	140414	66089	206503	0.003697
Tripura	4577	10152	14729	0.005342
Uttar Pradesh	148303	107164	255467	0.001836
West Bengal	42558	32877	75435	0.001108
Andaman & Nicobar Islands	1273	44	1317	0.004692
Chandigarh	1753	Nil	1753	0.002728
Dadra & Nagar Haveli	533	Nil	533	0.003849
Daman & Diu	101	Nil	101	0.000994
Delhi	24071	2511	26582	0.002822
Lakshadweep	1	Nil	1	1.93E-05
Pondicherry	1849	556	2405	0.002977
All India	**1394061**	**1071816**	**2465877**	**0.002914**

Source: Motor Transport Statistics of India 1997-98, Ministry of Surface Transport, Govt. of India.

Per capita road length is another indicator of the infrastructure development that has proved to enhance the economic development of the regions. It should be noted that the per capita road length in Karnataka State is above the national average. Though Karnataka performs well in terms of road length, the road length may still be insufficient in the sense that the existing road network may not cover many of the rural areas in the state. Since agricultural activities are carried out mainly in rural areas, rural road network is considered to be an important indicator. Each year, a certain amount of fund is allocated by each state for provision of especially rural roads. The level of allocation of

funds for rural roads is another indicator that reflects the commitment of states towards infrastructural development for agricultural growth. Before going into the details of the financial allocation for rural roads, let us briefly discuss the progress made in the improvement in the road length in some of the major states in the country.

Table-6: State-wise Improved Length of Roads (During 1998-99 to 2000-2001)
(Figures in Km.)

States/Uts	**Length of Roads**
Andhra Pradesh	897.66
Arunachal Pradesh	Included in BRDB
Assam	61.61
Bihar	246.15
Chandigarh	12.25
Chhatisgarh	Included in Madhya Pradesh
Delhi	34.65
Goa	19.50
Gujarat	468.96
Haryana	322.90
Himachal Pradesh	134.27
Jammu & Kashmir	Included in BRDB
Jharkhand	Included in Bihar
Karnataka	**284.20**
Kerala	127.10
Madhya Pradesh	264.89
Maharashtra	441.35
Manipur	30.44
Meghalaya	38.00
Mizoram	18.00
Nagaland	55.00
Orissa	366.80
Pondicherry	13.33
Punjab	68.81
Rajasthan	282.60
Sikkim	Included in BRDB
Tamil Nadu	465.66
Tripura	Included in BRDB
Uttar Pradesh	1007.83
Uttaranchal	Included in Uttar Pradesh
West Bengal	357.99

Note : In addition to above Border Road Development Board have improved 289.77 kms during last two year.
Source : Lok Sabha Unstarred Question No. 2787, dated 20.03.2002.

A glance at the above table reveals that some of the states are performing well in terms of improved road length. However, while some states have shown a considerable progress in improving the road length (such as, Uttar Pradesh) many states are not still struggling in achieving progress in this front. As far as Karnataka is concerned, the total road length that was improved during the three years time period

ending 2000-2001 stands only at 284.20 km only. In other words, the annual total length of the roads improved in the state stands at 95 km only, which needs to be enhanced.

Table-7: State-wise Allocations for Rural Roads (during 2000-01)

States/UTs	**Amount (Rs. In crores)**
Andhra Pradesh	190
Bihar	150
Chhattisgarh	87
Goa	5
Gujarat	50
Haryana	20
Himachal Pradesh	60
Jammu & Kashmir	20
Jharkhand	110
Karnataka	**95**
Kerala	20
Madhya Pradesh	213
Maharashtra	130
Orissa	175
Punjab	25
Rajasthan	130
Tamil Nadu	80
Uttar Pradesh	315
Uttaranchal	60
West Bengal	135
Andman & Nicobar Island	10
Dadra & Nagar Haveli	5
Daman & Diu	5
Lakshadweep	5
Pondicherry	5
North Eastern States	
Arunachal Pradesh	35
Assam	75
Manipur	40
Meghalaya	35
Mizoram	20
Nagaland	20
Sikkim	20
Tripura	25
Total	**2370**
National Average	**71.81**

Note : An amount of Rs. 130 crore has been earmarked for rural roads in special problem area.

Source : Annual Report 2000-01, Ministry of Rural Development, Govt. of India.

The above table highlights the level of fund allocation for rural roads by various states during 2000-01.It should be noted that on an average, the amount of fund allocated for rural road projects at the national level stands at Rs. 71. 81 crores during

2000-01. Karnataka's investment on rural roads during the same period stands at Rs.95 crores, which is above the national average. One of the important aspects to be noted here is that just allocation of funds for rural roads may not necessarily lead to realise the objective. There may be so many constrains that lead to long delay between fund allocation and actual work and identifying these constraints and eliminating them will improve the situation faster.

Another important infrastructural indicator that would positively and directly contribute to the agricultural development is the total number of villages electrified during a particular time period. The village electrification has direct impact on the use of motor pumpests for irrigation purpose, which will increase the production and productivity in the agricultural sector.

Table-8: State-wise villages electrified

Sl.No.	States	**Total villages electrified**	
		1989-90	1996-97
	Northern Region		
1	Haryana	6745	6759
2	Himachal Pradesh	16761	16635
3	Jammu & Kashmir	6117	6301
4	Punjab	12342	12428
5	Rajasthan	26178	33554
6	Uttar Pradesh	80358	87079
	Western Region		
7	Gujarat	17892	17927
8	Madhya Pradesh	60027	67496
9	Maharashtra	39106	40412
	Southern Region		
10	Andhra Pradesh	27358	26565
11	Karnataka	26483	26663
12	Kerala	1219	1384
13	Tamil Nadu	15813	15822
	Eastern Region		
14	Bihar	46195	47832
15	Orissa	30086	32825
16	West Bengal	26392	29271
	North Eastern Region		
17	Assam	20984	18999
	All India	**470838**	**498836**

Source : Central Electricity Authority (various years);Public Electricity Supply : All India Statistics, Ministry of Energy, Government of India, New Delhi.

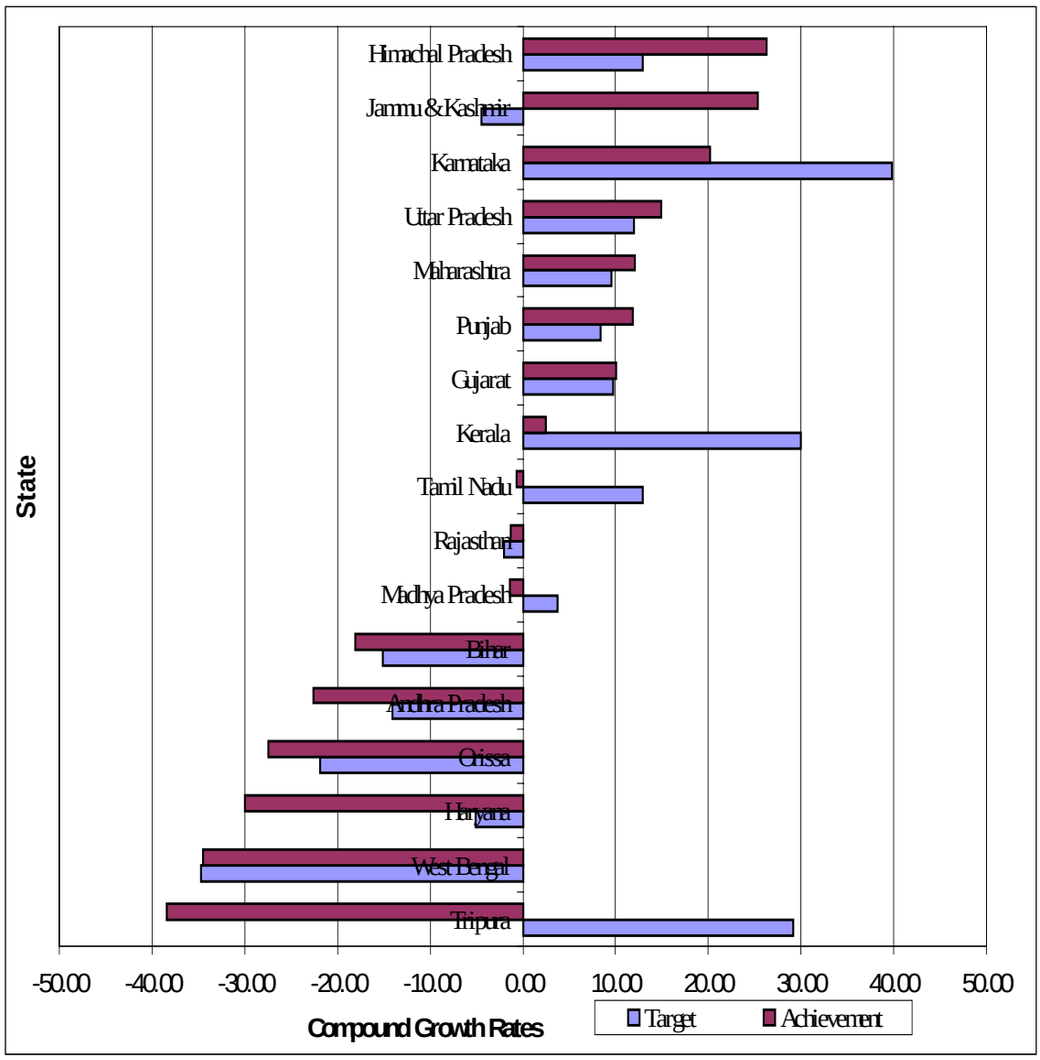
Also, village electrification generates positive externality benefiting not only the agricultural sector but also the allied activities such as growth of small-scale units, etc. As far as Karnataka is concerned, the villages electrification between 1989-90 and 1996-97 has been a slow process and marginally 180 villages (0.67 per cent) have been electrified during this particular period. It should be noted that village electrification should be accelerated at a faster rate in the coming years.

Table-9: Statewise Progress of Pumpset Energisation Plan under REC Programmes (During Eight Five Year Plan)

States	1992-93		1993-94		1994-95		1995-96		1996-97	
	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement
Andhra Pradesh	48000	102978	53000	91485	53000	87742	53000	37145	22500	44914
Arunachal Pradesh	-	-	-	-	-	-	-	-	-	-
Assam	-	-	-	-	-	-	-	-	-	-
Bihar	2955	2592	1000	1909	1000	1746	1000	610	1300	1689
Goa	-	-	-	-	-	-	-	-	-	-
Gujarat	14500	12260	16000	16030	18000	18001	28000	15084	17450	20370
Haryana	5000	8692	6500	4005	5000	3230	6000	2501	4000	1849
Himachal Pradesh	-	92	100	148	150	150	150	201	150	254
Jammu & Kashmir	-	216	200	210	100	667	150	1012	150	305
Karnataka	11000	15718	19500	23249	5000	55962	55000	38601	35000	30516
Kerala	7000	11778	1800	8636	1000	13035	15000	12517	9000	11029
Madhya Pradesh	25000	50198	15000	38478	12000	45026	12800	41855	32500	44882
Maharashtra	35000	46284	44000	54261	43000	87954	47000	92395	53500	62655
Manipur	-	-	-	-	-	-	-	-	-	-
Meghalaya	-	-	-	-	-	-	-	-	-	-
Mizoram	-	-	-	-	-	-	-	-	-	-
Nagaland	45	-	20	4	-	-	-	-	-	-
Orissa	5500	3241	3500	2607	3500	2772	3500	2260	1600	702
Punjab	6000	6096	3500	5495	4000	10224	5000	11004	7500	7552
Rajasthan	18000	19594	16300	22544	13350	21058	17530	17616	15650	20779
Sikkim	-	-	-	-	-	-	-	-	-	-
Tamil Nadu	18000	38405	37400	40587	40000	40617	40000	40649	32000	37113
Tripura	-	100	60	90	100	40	100	26	-	-
Uttar Pradesh	11500	10562	9500	11760	11769	9305	14239	20963	16500	15846
West Bengal	6500	2021	4650	1931	800	1348	1910	1007	1200	337
India	214000	330827	232030	323429	211769	398877	300379	335446	250000	300792

Abbr. : REC : Rural Electrification Corporation.
Source: Lok Sabha Unstarred Question No.3454, dated 17.04.2000.

Chart-2: State wise CGR of Progress of Pumpset Energisation Plan under REC Programmes (During Eight Five Year Plan)



The above chart describes the targets and achievements of various states regarding pumps energised. It should be noted that based on the compound growth in pumps energised in each sate during 1990-91 and 1996-97, the states could be classified into three different categories: (i) states whose achievements are greater than the targets; (ii) states whose achievements are below target but which could still make a considerable progress in the objective; and (iii) states where the targets and achievements are negative. Karnataka belongs to the (ii) category states and its performance is comparatively better than some of the other states in the country, during the reference period. However, the achievement rates is far below the target rate and this needs to be taken care of in near future.

Table-10: State-wise Percentage of Inhabited Villages Having Different Types of Communication Facilities (1991)

States/UTs	Any Comm.Fac.(%)	Bus Stand (%)	Railway Station (%)	Navigable waterways (%)
Andhra Pradesh	56.82	56.38	1.83	0.58
Arunachal Pradesh	11.46	11.32	0	0
Assam	25.7	23.77	1.81	1.39
Bihar	20.5	19.12	0.97	1.01
Goa	87.5	85.28	3.06	12.22
Gujarat	86.75	86.48	4.09	1
Haryana	75.69	75.28	3.14	0
Himachal Pradesh	44.3	43.8	0.33	1.25
Karnataka	**67.24**	**67.14**	**0.8**	**0.09**
Kerala	99.78	99.42	0.02	23.92
Madhya Pradesh	19.7	19.44	0.65	0
Maharashtra	63.42	62.84	1.48	0.57
Manipur	15.67	15.67	0	0
Meghalaya	17.3	17.3	0	0
Mizoram	21.35	18.48	0	2.87
Nagaland	17.02	17.02	0.08	0
Orissa	16.14	15.6	0.46	0.37
Punjab	59.86	59.25	2.37	0.37
Rajasthan	33.2	32.76	1.71	0
Sikkim	40.49	40.49	0	0
Tamil Nadu	77.51	77.46	3	0.06
Tripura	53.22	49.36	0.82	5.03
Uttar Pradesh	20.72	20.32	0.91	0.22
West Bengal	26.49	25.12	3.17	1.09
Andaman & Nicobar Island	61.11	40.08	0	25.2
Chandigarh	88	88	0	0
Dadra & Nagar Haveli	87.32	87.32	0	0
Daman & Diu	70.83	70.83	0	0
Delhi	100	100	3.02	0
Lakshadweep	100	100	0	100
Pondicherry	57.41	57.41	0.76	0
India *	**34.4**	**33.77**	**1.36**	**0.57**

Note : * :- Excludig Jammu and Kashmir, where Census was not held in 1991
Source : Census of India 1991.

In terms of percentage of total villages having any kind of communication facilities and other infrastructural facilities like bus stands, Karnataka's position stands above the national average. However, there is a considerable number of villages that have not been covered by these basic facilities in the state. Since the Karnataka state gives top priority to communication sector and the rural communication is an essential part of overall economic development in general and agricultural development in particular, the state is obliged to give top priority to improve the rural communication network.

Table-11: State-wise Percentage of Inhabited Villages Having Post & Telegraph Offices and Telephone Connections (1991)

States/UTs	Any P&T Fac.(%)	Post Office(%)	Telegraph Office # (%)	Telephone Connections (%)
Andhra Pradesh	54.49	52.35	6.67	13.82
Arunachal Pradesh	6.06	5.84	0.19	0.08
Assam	13.34	12.33	0.82	0.70
Bihar	15.58	14.40	1.15	1.39
Goa	45.83	34.44	10.28	16.11
Gujarat	55.58	46.22	4	28.62
Haryana	37.93	31.13	2.40	17.58
Himachal Pradesh	21.07	13.23	1.69	11.30
Karnataka	**31.62**	**30.30**	**9.06**	**16.05**
Kerala	98.70	94.73	53.83	59.39
Madhya Pradesh	13.09	12.14	1.08	3.14
Maharashtra	28.91	25.60	2.64	6.08
Manipur	14.21	13.02	0	3.02
Meghalaya	5.98	5.38	0.62	0.20
Mizoram	34.10	34.10	0	0
Nagaland	12.99	12.83	0.16	0.82
Orissa	16.98	15.78	1.21	1.30
Punjab	27.52	23.65	2.71	8.62
Rajasthan	51.08	48.83	2	8.06
Sikkim	30.43	29.98	0.45	3.13
Tamil Nadu	55.72	47.93	7.53	14.09
Tripura	59.18	57.89	4.68	5.38
Uttar Pradesh	16.04	15.39	1.12	1.58
West Bengal	18.52	17.67	1.52	1.89
Andaman & Nicobar Island	17.86	9.92	5.36	5.56
Chandigarh	16	16	0	0
Dadra & Nagar Haveli	43.66	43.66	2.82	4.23
Daman & Diu	50	41.67	4.17	16.67
Delhi	74.87	43.72	0.50	67.34
Lakshadweep	85.71	85.71	85.71	71.43
Pondicherry	19.01	15.97	3.04	11.41
India *	22.73	22.48	2.38	5.65

Note : * :- Excluding Jammu and Kashmir, where census was not held in 1991
: Including Post & Telegraph Offices.
Source : Census of India 1991.

Similarly, in the case of other facilities such as post-office, telegraph office and telephone connections provided to the households in rural areas, the state's performance is not satisfactory[1].

[1] This conclusion is arrived at on the basis of the data from Census 1991. A considerable improvement would have been made during the past 12 years in the state. Due to non-availability of latest data on these infrastructural indicators, we could not make any assessment regarding the latest scenario.

Table-12: State-wise number of Schools per thousand population (1992-93 and 1997-98).

	1992-93		1997-98	
States/Uts	**Primary**	**Upper primary**	**Primary**	**Upper primary**
Andhra Pradesh	6.99	1.55	5.34	1.56
Arunachal Pradesh	10.53	4.52	8.21	4.64
Assam	8.89	3.07	8.62	3.58
Bihar	4.88	2.24	3.97	1.92
Goa	7.74	1.37	7.10	1.00
Gujarat	3.14	6.51	2.86	6.12
Haryana	2.38	1.16	4.06	1.24
Himachal Pradesh	12.78	3.07	10.03	2.19
Jammu and Kashmir	10.62	5.31	7.89	4.93
Karnataka	**4.44**	**5.40**	**3.82**	**6.61**
Kerala	2.19	1.62	2.20	1.54
Madhya Pradesh	8.74	3.40	8.18	3.76
Maharashtra	5.22	3.98	3.97	3.68
Manipur	13.10	5.17	8.69	4.02
Meghalaya	17.97	5.30	13.38	6.05
Mizoram	12.65	10.68	11.17	11.11
Nagaland	8.89	4.08	6.80	4.56
Orissa	11.49	5.64	9.66	4.99
Punjab	6.04	1.12	4.84	1.65
Rajasthan	5.29	2.65	4.88	3.88
Sikkim	8.35	3.57	6.72	3.05
Tamil Nadu	5.18	1.65	4.91	1.43
Tripura	6.81	2.58	4.14	1.77
Uttar Pradesh	4.44	1.58	4.21	1.71
West Bengal	6.74	0.97	5.28	0.54
Andaman & Nicobar Island	4.01	1.95	3.83	2.04
Chandigarh	0.62	0.62	0.64	0.60
Dadra & Nagar Haveli	7.44	4.29	5.38	4.73
Daman & Diu	-	-	3.53	2.10
Delhi	1.74	0.80	1.55	0.75
Lakshadweep	3.17	1.29	2.38	0.67
Pondicherry	4.58	2.61	3.05	1.78
India	**5.75**	**2.69**	**5.04**	**2.75**

Source: National Human Development Report, 2001.

Apart from the infrastructural indicators discussed above, investment in infrastructural facilities that contribute to the education of the people plays a crucial role in appropriating the benefits of the agricultural growth. It should be noted that the level of infrastructure that enhances the human capital in rural areas in terms of improving the educational status of the individuals plays a major role in improving the agricultural productivity and employment. Number of schools per given population is one of the major determinants of the level of infrastructure in a particular region. It may be

observed from the above table that number of schools per 1000 population at the national level had declined from 1992-93 to 1997-98. However, this indicator shows a better performance during this particular time period.

Another important infrastructural indicator that has direct impact on the agricultural output is the animal operated implements, but mostly available with the farmers. The following tables are self explanatory in nature in revealing the level of availability of such implements state-wise.

Table-13: State-wise Number of Agricultural Animal Operated Implements (1992) - Part I

(' 00 number)

States/UTs	Wooden Plough	Soil Stirring	Soil Turning	Disc Harrow	Cultivator (Triphali)	Seed cum Fertiliser Drill	Seed Drill	Levelling Karah (Leveller)	Wet Land Paddler	Olpad Thresher	Animal Cart	Persian Wheel	Ghanis	Total No. of AOI	**Per cent to state total**
Andhra Pradesh	25823	530	3256	230	18456	1932	5751	3791	5630	586	12817	27	29	78858	**8.95**
Arunachal Pradesh	283	4	1	3	1	-	-	-	55	-	4	-	1	352	**0.04**
Assam	17362	60	34	197	104	2	3	3198	175	-	794	-	-	21929	**2.49**
Bihar	57086	10302	-	1440	59	887	-	7751	20	48	11253	-	-	88846	**10.09**
Goa	229	15	26	7	33	-	1	154	6	-	3	-	-	474	**0.05**
Gujarat	12075	4683	1600	567	1408	4093	6118	2564	659	128	6328	12	6	40241	**4.57**
Haryana	3902	1610	827	685	1225	373	703	949	362	71	3916	36	7	14666	**1.66**
Himachal Pradesh	5237	1414	409	1517	468	6	25	2577	706	5	10	2	1	12377	**1.41**
Jammu & Kashmir	7819	1262	1449	79	3337	1	15	950	531	9	16	1	14	15483	**1.76**
Karnataka	29684	8783	7029	8431	8102	1806	6667	3457	895	2189	9874	-	-	86917	**9.87**
Kerala	1400	270	-	10	10	-	-	640	-	10	60	-	-	2400	**0.27**
Maharashtra	-	-	-	375	1038	6981	78	4622	77	-	10481	19	11	23682	**2.69**
Manipur	392	-	-	-	133	-	-	382	169	-	329	-	-	1405	**0.16**
Meghalaya	100	10	-	170	-	-	-	70	-	-	-	-	-	350	**0.04**
Madhya Pradesh	55449	1425	1963	1927	1855	5325	15904	17946	6656	633	24065	679	49	133876	**15.20**
Orissa	34200	1125	766	351	105	19	115	6316	1184	101	5834	19	-	50135	**5.69**
Punjab	-	3596	-	1960	1545	1463	-	1090	-	-	2099	20	-	11773	**1.34**
Rajasthan	23131	1860	1603	393	1781	2203	4121	1614	404	103	9140	219	42	46614	**5.29**
Sikkim	710	-	-	890	-	750	-	-	-	-	-	-	-	2350	**0.27**
Tamil Nadu	15627	3163	1888	109	306	20	60	1917	658	132	4038	3	17	27938	**3.17**
Tripura	1411	13	50	1	16	1	2	898	36	8	5	2	-	2443	**0.28**
Uttar Pradesh	68282	9446	19695	2240	12348	1366	4602	15344	3142	506	20470	536	136	158113	**17.95**
West Bengal	29071	407	927	407	-	14	141	17730	1931	-	8411	-	-	59039	**6.70**
Andaman & Nicobar Islands	94	-	1	-	3	-	-	74	-	-	1	-	-	173	**0.02**
Dadra & Nagar Haveli	156	1	-	-	-	-	-	140	-	-	12	-	-	309	**0.04**
Pondicherry	28	18	-	-	-	-	-	-	6	-	-	-	-	52	**0.01**
India	389595	49999	41525	21990	52333	27243	44306	94184	23303	4529	129982	1575	313	880877	**100.00**

Source : 15th Indian Livestock Census 1992, Volume - 1, Directorate of Economics & Statistics, Department of Agriculture & Co-operation, Ministry of Agriculture, Govt. of India.

Table-14: State-wise Number of Agricultural Animal Operated Implements (1992) - Part II

(' 00 Number)

States/Uts	Seed Drill	Levelling Karah (Leveller)	Wet Land Paddler	Olpad Thresher	Animal Cart	Persian Wheel	Ghanis
Andhra Pradesh	**5751**	3791	5630	586	12817	27	29
Arunachal Pradesh	-	-	55	-	4	-	1
Assam	3	3198	175	-	794	-	-
Bihar	-	7751	20	48	11253	-	-
Delhi	-	-	-	-	3	-	-
Goa	1	154	6	-	3	-	-
Gujarat	6118	2564	659	128	6328	12	6
Haryana	703	949	362	71	3916	36	7
Himachal Pradesh	25	2577	706	5	10	2	1
Jammu & Kashmir	15	950	531	9	16	1	14
Karnataka	6667	3457	895	2189	9874	-	-
Kerala	-	640	-	10	60	-	-
Maharashtra	78	4622	77	-	10481	19	11
Manipur	-	382	169	-	329	-	-
Meghalaya	-	70	-	-	-	-	-
Mizoram	-	-	-	-	-	-	-
Madhya Pradesh	15904	17946	6656	633	24065	679	49
Nagaland	-	-	-	-	-	-	-
Orissa	115	6316	1184	101	5834	19	-
Punjab	-	1090	-	-	2099	20	-
Rajasthan	4121	1614	404	103	9140	219	42
Sikkim	-	-	-	-	-	-	-
Tamil Nadu	60	1917	658	132	4038	3	17
Tripura	2	898	36	8	5	2	-
Uttar Pradesh	4602	15344	3142	506	20470	536	136
West Bengal	141	17730	1931	-	8411	-	-
Andaman & Nicobar Islands	-	74	-	-	1	-	-
Chandigarh	-	1	-	-	2	-	-
Daman & Diu	-	-	-	-	-	-	-
Dadra & Nagar Haveli	-	140	-	-	12	-	-
Lakshadweep	-	-	-	-	-	-	-
Pondicherry	-	-	6	-	-	-	-
India	**44306**	**94184**	**23303**	**4529**	**129982**	**1575**	**313**

Source : 15th Indian Livestock Census 1992, Volume - 1, Directorate of Economics & Statistics, Department of Agriculture & Co-operation, Ministry of Agriculture, Govt. of India.

Apart from animal operated implements, other energy operated implements that are both privately as well as government owned do also play a crucial role in agricultural development in states. The following tables reveal that status of availability of these implements in various states in the country.

Table-15: State-wise Number of Tractor, Power & Other Agricultural Implements in Rural Areas (1992) - Part I

(' 00 Number)

States/UTs	Power Tiller for Agricultural Purposes	Tractor used for Agricultural Purposes	Mould Board Plough	Disc Harrow	Seed cum Fertiliser Drill
Andhra Pradesh	104	555	365	204	47
Arunachal Pradesh	3	1	-	1	-
Assam	7	7	124	68	-
Bihar	280	135	-	10	-
Delhi	1	5	4	1	4
Goa	1	-	-	-	-
Gujarat	31	633	-	211	287
Haryana	501	1533	335	1248	753
Himachal Pradesh	9	24	20	22	3
Jammu & Kashmir	-	13	5	3	-
Karnataka	167	373	342	122	32
Kerala	20	20	10	-	-
Maharashtra	29	422	675	532	-
Manipur	4	3	-	3	-
Meghalaya	-	-	-	-	-
Mizoram	-	-	-	-	-
Madhya Pradesh	284	843	161	95	406
Nagaland	-	-	-	-	-
Orissa	11	22	69	2	18
Punjab	1439	2090	1572	1443	1013
Rajasthan	123	1430	719	618	707
Sikkim	-	-	-	-	-
Tamil Nadu	101	295	71	67	3
Tripura	2	1	-	2	4
Uttar Pradesh	-	3340	246	1581	515
West Bengal	88	62	105	11	2
Andaman & Nicobar Islands	-	-	-	-	-
Chandigarh	1	2	1	1	1
Daman & Diu	-	-	-	-	-
Dadra & Nagar Haveli	-	1	-	-	-
Lakshadweep	1	-	-	-	-
Pondicherry	2	5	1	2	-
India	**3209**	**11815**	**4825**	**6247**	**3795**

Source : 15th Indian Livestock Census 1992, Volume - 1, Directorate of Economics & Statistics, Department of Agriculture & Co-operation, Ministry of Agriculture, Govt. of India.

Table-16:State-wise Number of Tractor, Power & Other Agricultural Implements in Rural Areas (1992) - Part II (' 00 Number)

States/UTs	Planter	Leveller	Potato Digger	Trailer	Combine Harvester	
					Tractor Operated	Self Propelled
Andhra Pradesh	10	154	10	426	19	3
Arunachal Pradesh	-	-	-	-	-	-
Assam	21	30	-	1	-	-
Bihar	-	-	9	-	-	-
Delhi	2	4	2	10	8	-
Goa	-	-	-	-	-	-
Gujarat	40	250	66	461	11	4
Haryana	87	752	27	803	54	23
Himachal Pradesh	1	7	34	3	6	2
Jammu & Kashmir	-	9	24	9	1	3
Karnataka	69	180	83	107	-	-
Kerala	-	20	-	-	-	-
Maharashtra	-	-	22	-	12	-
Manipur	-	-	-	2	-	-
Meghalaya	-	-	-	-	-	-
Mizoram	-	-	-	-	-	-
Madhya Pradesh	3	184	9	691	9	3
Nagaland	-	-	-	-	3640	-
Orissa	1	313	1	4	3	1
Punjab	546	855	108	-	28	9
Rajasthan	47	370	27	940	29	8
Sikkim	-	-	-	-	-	-
Tamil Nadu	4	64	2	161	5	-
Tripura	8	51	36	-	-	110
Uttar Pradesh	77	2360	386	895	-	-
West Bengal	-	136	64	32	-	-
Andaman & Nicobar Islands	-	-	-	-	-	-
Chandigarh	-	1	-	1	-	-
Daman & Diu	-	-	-	-	-	-
Dadra & Nagar Haveli	-	-	-	-	-	-
Lakshadweep	-	-	-	1	-	-
Pondicherry	-	2	-	3	-	-
India	**916**	**5742**	**910**	**4450**	**3825**	**166**

Source : 15th Indian Livestock Census 1992, Volume - 1, Directorate of Economics & Statistics, Department of Agriculture & Co-operation, Ministry of Agriculture, Govt. of India.

Table-17: State-wise Number of Tractor, Power & Other Agricultural Implements in Rural Areas (1992) - Part III

(' 00 Number)

States/Uts	Thresher			Maize Sheller	Chaff Cutter	Sugarcane Crusher	Reaper
	Wheat	Paddy	Multi-Purpose				
Andhra Pradesh	1	5	8	35	6	149	13
Arunachal Pradesh	-	-	-	-	-	-	-
Assam	-	1	-	-	-	33	-
Bihar	-	-	-	172	-	-	10
Delhi	17	-	-	-	19	-	3
Goa	-	-	-	-	-	-	-
Gujarat	123	8	494	22	105	5	138
Haryana	1380	33	81	45	1863	20	27
Himachal Pradesh	124	11	10	34	71	4	31
Jammu & Kashmir	9	2	-	-	43	1	34
Karnataka	1	3	15	7	5	19	12
Kerala	-	-	-	-	-	-	-
Maharashtra	-	-	435	-	51	52	-
Manipur	-	-	-	-	-	5	-
Meghalaya	-	-	-	-	-	-	-
Mizoram	-	-	-	-	-	-	-
Madhya Pradesh	662	24	439	16	52	61	8
Nagaland	-	-	-	-	266	323	-
Orissa	-	25	1	-	1	11	-
Punjab	-	-	-	35	1722	632	-
Rajasthan	381	24	22	14	222	11	14
Sikkim	-	-	-	-	-	-	-
Tamil Nadu	-	11	3	1	9	22	195
Tripura	-	2	-	-	1	141	6
Uttar Pradesh	7832	134	95	183	4966	683	2326
West Bengal	46	54	2	1	49	4	149
Andaman & Nicobar Islands	-	-	-	-	-	-	-
Chandigarh	-	-	-	-	5	-	-
Daman & Diu	-	-	-	-	-	-	-
Dadra & Nagar Haveli	-	-	-	-	-	-	-
Lakshadweep	-	-	-	-	-	-	-
Pondicherry	-	-	-	-	-	-	-
India	**10576**	**337**	**1605**	**565**	**9456**	**2176**	**2966**

Source : 15th Indian Livestock Census 1992, Volume - 1, Directorate of Economics & Statistics, Department of Agriculture & Co-operation, Ministry of Agriculture, Govt. of India

Table-18: State-wise Number of Agricultural Plant Protection Equipments and Engines (1992)

(' 00 Number)

States/UTs	Sugarcane Crusher	Power Operated Sprayer/Duster	Diesel Engine Pump set	Electric Pump set
Andhra Pradesh	105	590	1647	9279
Arunachal Pradesh	1	-	1	-
Assam	27	4	38	5
Bihar	416	103	3594	2978
Delhi	1	1	1	13
Goa	-	-	4	17
Gujarat	22	-	4093	2022
Haryana	35	69	1890	3095
Himachal Pradesh	13	18	13	11
Jammu & Kashmir	10	3	20	13
Karnataka	192	663	1193	4733
Kerala	10	20	370	1600
Maharashtra	22	621	956	6922
Manipur	4	-	9	1
Meghalaya	-	-	-	-
Mizoram	-	-	1	-
Madhya Pradesh	130	287	2047	6792
Nagaland	-	-	-	-
Orissa	67	17	157	192
Punjab	979	98	2204	4863
Rajasthan	225	58	5104	3624
Sikkim	-	-	-	-
Tamil Nadu	168	252	2735	8162
Tripura	3	1	8	-
Uttar Pradesh	3341	109	18714	3705
West Bengal	-	-	-	-
Andaman & Nicobar Islands	1	1	6	1
Chandigarh	-	-	-	1
Daman & Diu	-	-	-	-
Dadra & Nagar Haveli	-	-	4	1
Pondicherry	-	2	3	96
India	**5772**	**2917**	**44812**	**58128**

Source : 15th Indian Livestock Census 1992, Volume - 1, Directorate of Economics & Statistics, Department of Agriculture Co-operation, Ministry of Agriculture, Govt. of India.

Table-19: State-wise Number of Agricultural Hand Operated Implements (1992)

(' 00 Number)

States/Uts	Seed Fertiliser Drill	Seed Drill	Chaff Cutter	Wheel Hoe	Sprayer	Rice Planter	Thresher
Andhra Pradesh	609	883	8683	17421	3680	77	-
Arunachal Pradesh	-	-	-	1	4	-	-
Assam	7	7	216	128	30	3	1
Bihar	1579	-	1379	-	889	-	1261
Delhi	2	3	152	283	4	129	2
Goa	-	1	3	1	3	-	1
Gujarat	-	-	2989	832	4392	73	185
Haryana	439	605	5324	806	1613	19	390
Himachal Pradesh	43	49	1124	19531	326	11	27
Jammu & Kashmir	15	7	819	277	368	2	27
Karnataka	749	1119	4922	591	1509	236	-
Kerala	230	-	60	20	310	-	20
Maharashtra	895	78	400	-	4897	-	314
Manipur	-	5	447	5	15	-	945
Meghalaya	-	-	-	-	10	-	-
Mizoram	-	-	-	-	3	-	-
Madhya Pradesh	516	1078	4299	14691	2561	6	368
Nagaland	-	-	-	-	-	-	-
Orissa	58	46	20	6	384	-	-
Punjab	-	-	4700	-	730	-	-
Rajasthan	2325	3201	7732	353	774	113	110
Sikkim	-	-	830	-	-	-	-
Tamil Nadu	90	66	12891	2152	1239	125	26
Tripura	6	29	67	6	21	5	43
Uttar Pradesh	653	1795	55321	87132	1080	1324	1576
West Bengal	64	94	2045	574	-	-	3413
Andaman & Nicobar Islands	-	-	-	-	16	2	-
Chandigarh	-	-	6	-	-	-	-
Daman & Diu	-	-	-	-	-	-	-
Dadra & Nagar Haveli	-	-	-	-	4	-	-
Lakshadweep	-	-	-	-	1	-	-
Pondicherry	-	-	2	-	6	-	-
India	**8280**	**9166**	**114431**	**144810**	**24869**	**2125**	**8709**

Source : 15th Indian Livestock Census 1992, Volume - 1, Directorate of Economics & Statistics, Department of Agriculture & Co-operation, Ministry of Agriculture, Govt. of India.

Since many of the agricultural produces are perishable in nature, adequate amount of storage facilities, especially the cold storage, contributes to the increased surplus to both producers as well as consumers.

Table-20: State-wise Number of Cold Storages in India (As on 31.12.2001)

States/Uts	No. of Cold Storages	Percentage to total
Andaman & Nicobar Islands	02	0.04
Andhra Pradesh	200	4.82
Arunachal Pradesh	00	0.00
Assam	13	0.31
Bihar	203	4.89
Chandigarh	05	0.12
Delhi	92	2.21
Gujarat	327	7.88
Goa	23	0.55
Haryana	201	4.84
Himachal Pradesh	17	0.41
Jammu & Kashmir	18	0.43
Jharkhand	20	0.48
Kerala	163	3.93
Karnataka	**102**	**2.46**
Lakshadweep	01	0.02
Maharashtra	385	9.28
Madhya Pradesh	186	4.48
Manipur	00	0.00
Meghalaya	00	0.00
Mizoram	00	0.00
Nagaland	01	0.02
Orissa	75	1.80
Pondicherry	05	0.12
Punjab	390	9.40
Rajasthan	87	2.09
Sikkim	00	0.00
Tamil Nadu	111	2.67
Tripura	04	0.09
Uttar Pradesh	1129	27.23
West Bengal	386	9.31
India	**4146**	**100.00**

Source : Indiastat.com

It should be noted that Karnataka's share of cold storage facilities to the total available storage facility in the country as a whole stands at 2.46 percent. In the context of Karnataka producing more amount of perishable commodities like fruits and flowers, there exists a need for increasing the investment in cold storage in the coming years.

Even if the production and productivity in the agricultural sector is maintained high, enormous amount of producer and consumer surplus will be wasted if they are

not properly marketed. It should be noted that in the absence of regulated markets, the price escalation between the point of production and the point at which it is consumed will be many times greater, reducing a considerable amount of consumer surplus. Moreover, the middlemen outside the regulated market would eat a considerable portion of producer's surplus. This being the case, establishment of proper marketing facilities will enhance the agricultural development at the state level. The following tables reveal how the level of establishment of various kinds of marketing facilities have changed over the three year time period ending year 2000.

Table-21: State-wise Number of Wholesale Assembling and Regulated Markets (As on 31st March 1998 to 2000)

States/Uts	Wholesale Markets	Regulated Markets		Total
		Principal	Sub-Yards	
Andhra Pradesh				
1998	841	284	557	841
1999	841	284	557	841
2000	861	294	567	861
Assam				
1998	172	16	19	35
1999	172	16	19	35
2000	172	16	19	35
Bihar				
1998**	443	122	706	828
1999**	443	122	691	813
2000*	443	122	691	813
Goa				
1998	11	1	5	6
1999	11	1	5	8
2000	11	1	5	6
Gujarat				
1998	397	165	232	397
1999	396	161	235	396
2000	396	162	234	396
Haryana				
1998	281	104	177	281
1999	284	105	179	284
2000	284	105	179	**284**
Himachal Pradesh				
1998	35	8	27	35
1999	35	8	27	35
2000	35	8	27	35

Contd..

Jammu & Kashmir				
1998	26	APMR Act not yet implemented		
1999	26	APMR Act not yet implemented		
2000	26	APMR Act not yet implemented		
Karnataka				
1998	469	137	332	469
1999	473	140	333	473
2000	473	140	333	473
Kerala				
1998	348	APMR Act not yet passed		
1999	348	APMR Act not yet passed		
2000	348	APM R Act not yet passed		
Madhya Pradesh				
1998	633	296	311	607
1999	633	296	310	606
2000	633	300	316	616
Maharashtra				
1998	847	260	587	847
1999	855	266	589	855
2000	857	266	591	857
Manipur				
1998	20	APMR Act not yet passed		
1999	20	APMR Act not yet passed		
2000	20	APMR Act not yet passed		
Meghalaya				
1998	101	0	0	0
1999	101	0	0	0
2000	101	0	0	0
Mizoram				
1998	8	0	0	0
1999	8	0	0	0
2000	8	0	0	0
Nagaland				
1998	16	p	0	0
1999	16	0	0	0
2000	16	p	0	0
Orissa*				
1998	163	57	87	144
1999	163	57	87	144
2000	163	57	87	144
Punjab*				
1998	670	143	527	670
1999	675	143	532	675
2000	675	143	532	675
Rajasthan				
1998	397	124	273	397
1999	403	124	279	403
2000	410	124	286	410
Sikkim				
1998	10	0	0	0
1999	10	0	0	0
2000	10	0	0	0

Contd...

Tamil Nadu				
1998	300	270	0	270
1999	300	270	0	270
2000	300	270	0	270
Tripura				
1998*	84	21	0	21
1999	84	21	0	21
2000	84	21	0	21
Uttar Pradesh				
1998	645	263	382	645
1999*	645	263	382	645
2000*	645	263	382	645
West Bengal				
1998**	279	44	496	540
1999**	279	43	499	542
2000*	279	44	511	555
Andaman & Nicobar Islands				
1998	0	APMR Act not yet passed		
1999	0	APMR Act not yet passed		
2000	0	APMR Act not yet passed		
Chandigarh				
1998	3	1	2	3
1999	3	1	2	3
2000	3	1	2	3
Dadra & Nagar Haveli				
1998	0	APMR Act not yet passed		
1999	0	APMR Act not yet passed		
2000	0	APMR Act not yet passed		
Daman & Diu				
1998	0	0	0	0
1999	0	0	0	0
2000	0	0	0	0
Delhi				
1998	25	8	12	20
1999	25	8	14	22
2000	30	8	14	22
Lakshadweep				
1998	0	APMR Act not yet passed		
1999	0	APMR Act not yet passed		
2000	0	APMR Act not yet passed		
Pondicherry				
1998	6	4	2	6
1999	6	4	2	6
2000	6	4	2	6
India				
1998	7230	2328	4734	7062
1999	7255	2333	4742	7075
2000	7289	2349	4778	7127

Abbr. : APMR : Agriculture Produce Marketing Regulation.
Note:* Figures are provisional.
** : Yard include rural markets and cold stores and hence figures of total regulated markets and wholesale assembling are not comparable.
Source : Bulletin on Food Statistics 1998 - 2000, Directorate of Economics & Statistics, Dept. of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India.

Table-22: State wise Number of Wholesale, Primary and Regulated Markets

(As on 31.3.2001)

States/ Uts	Number of Markets			Regulated Markets		
	Wholesale Markets	Rural Primary Markets	Total	Principal	Sub-Market	Total
Andhra Pradesh	861	290	1151	294	567	861
Arunachal Pradesh	-	50	50	-	-	-
Assam	172	650	822	16	19	35
Bihar * (1)	443	7000	7443	122	691	813
Goa	11	8	19	1	7	8
Gujarat	396	137	533	161	235	396
Haryana	284	157	441	105	179	284
Himachal Pradesh	35	30	65	8	27	35
Jammu & Kashmir	26	47	73	@	@	@
Karnataka	484	941	1425	141	343	484
Kerala	351	2000	2351	@@	@@	@@
Madhya Pradesh (2)	633	3000	3633	300	321	621
Maharashtra	857	3500	4357	266	591	857
Manipur	20	49	69	@@	@@	@@
Meghalaya	101	82	183	-	-	-
Mizoram	8	35	43	-	-	-
Nagaland	16	80	96	-	-	-
Orissa*	163	1150	1313	57	87	144
Punjab*	675	-	675	143	532	675
Rajasthan	412	558	970	125	287	412
Sikkim	10	30	40	-	-	-
Tamil Nadu	300	677	977	270	-	270
Tripura	84	554	638	21	-	21
Uttar Pradesh (3)	645	3322	3967	265	380	645
West Bengal	279	2925	3204	46	541	587
Andaman & Nicobar Islands	-	-	-	@@	@@	@@
Chandigarh	2	-	2	1	1	2
Dadra & Nagar Haveli	-	6	6	@@	@@	@@
Daman & Diu	-	-	-	-	-	-
Delhi	30	7	37	9	12	21
Lakshadweep	-	-	-	@@	@@	@@
Pondicherry	6	9	15	4	2	6
India	**7304**	**27294**	**34598**	**2355**	**4822**	**7177**

Abbre. : APMR : Assembling, Primary and Regulated Markets.
Note : In Bihar and West Bengal sub-yards include rural markets and cold stores and hence figures of total regulated markets and wholesale markets are not comparable.
*: Figures are provisional.
(1) : Includes Jharkhand.
(2) : Includes Chhatisgarh.
(3) : Includes Uttranchal.
@ : APMR Act not yet implemented.
@@ : APMR Act not yet passed.
Source : Directorate of Marketing and Inspection, Ministry of Agriculture.

The growth of HYV crops depends on the soil condition. Also, in recent years increased environmental pollution such as water pollution, land pollution, etc, the soil quality has deteriorated much. This being the case, the need to analyse the soil quality

and suggesting suitable crops has become an essential component of the modern agricultural development in the country. In view of this, a number of soil testing laboratories have been developed in different states and the following table provides number of soil testing laboratories along with the analysing capacity for various states in the country.

Table-23: State-wise Number of Soil Testing Laboratories and Analysing Capacity (1999-2000)

States/Uts	No. of Labs.			Analysing Capacity (' 000 Nos.)
	Static	Mobile	Total	
East Zone	**65**	**14**	**79**	**706.5**
Arunachal Pradesh	1	-	1	5.0
Assam	7	4	11	100.0
Bihar*	29	2	31	295.0
Orissa	11	-	11	120.0
West Bengal	8	4	12	96.0
Manipur	1	1	2	15.0
Meghalaya*	1	1	2	10.0
Nagaland	3	-	3	30.0
Sikkim	1	1	2	13.0
Tripura	2	1	3	15.0
Mizoram	1	-	1	7.5
North Zone	**147**	**33**	**180**	**2193.0**
Haryana	26	-	26	301.0
Himachal Pradesh	11	2	13	70.0
Jammu & Kashmir	3	3	6	41.0
Punjab	50	13	63	575.0
Uttar Pradesh	56	15	71	1200.0
Delhi	1	-	1	6.0
South Zone	**77**	**30**	**107**	**1814.0**
Andhra Pradesh	23	4	27	338.0
Karnataka	19	3	22	327.0
Kerala*	13	7	20	275.0
Tamil Nadu	19	16	35	842.0
Pondicherry	2	-	2	20.0
Andaman & Nicobar Islands	1	-	1	12.0
West Zone	**74**	**22**	**96**	**911.0**
Gujarat	16	4	20	210.0
Madhya Predesh	19	5	24	277.0
Maharashtra	29	-	29	152.0
Rajasthan	8	12	20	248.0
Goa	1	1	2	23.0
Dadra & Nagar Haveli	1	-	1	1.0
Total India	**363**	**99**	**462**	**5624.5**
Soil Testing Labs with Fertilizer Industry*	**36**	**20**	**56**	**542.7**
Grand Total	**399**	**119**	**518**	**6167.2**

Note : * : Figures of 1998-99.
Source : Fertiliser Statistics 2000-01, The Fertiliser of Association of India.

Table-24: State/Season-wise Farmers Benefited under National Agricultural Insurance Scheme (Rs. In lakh).

States/Uts	Farmers Benefited	
	Rabi 1999-2000	**Kharif 2000**
Andhra Pradesh	Not Implemented	117227
Assam	34	52
Bihar	Not Implemented	15093
Chhattisgarh	Part of Madhya Pradesh	416585
Goa	33	58
Gujarat	7915	974167
Himachal Pradesh	2	Nil
Kearla	2726	9370
Karnataka	Not Implemented	21734
Madhya Pradesh	4891	426298
Maharashtra	12391	869176
Meghalaya	Not Implemented	43
Orissa	15	Claims under process
Tamil Nadu	Not Implemented	Claims under process
Uttar Pradesh	Not Implemented	93480
Andaman & Nicobar Islands	No Season	23
Pondicherry	172	Nil
India	**28179**	**2943306**

Source: Indiastat.com

Under institutional infrastructure, introduction of insurance schemes to the farmers is considered a better policy option for strengthening the infrastructure. It should be noted that Karnataka has made some progress in implementing the agricultural insurance scheme and during the year 2000, the insurance scheme covered around 21734 lakh farmers. However, compared to the total number of farmers in the state, the coverage is minimum and there is ample scope for widening the coverage in coming years. Complete coverage of farmers with this scheme is warranted because constant failure of monsoon, crop failure due to other reasons, etc put the farmers in worse-off situation and to protect the farmers' interest this insurance scheme should be implemented all over the state. Moreover, a proper institutional mechanism should be established so that the farmers could be provided with adequate information about the scheme. This will ensure the maximum benefits reaching the farmers.

Table-25: State-wise Number of Kisan Credit Cards Issued by All Banks (Up to 31st March, 2002)

States/UTs	Commercial Banks	Cooperative Banks	Regional Rural Banks	Total	**Per cent to total**
Andaman & Nicobar Islands	554	597	0	1151	**0.0048**
Andhra Pradesh	1356592	3168667	309040	4834299	**20.37**
Arunachal Pradesh	151	74	246	471	**0.00**
Assam	14001	144	3211	17356	**0.07**
Bihar	270333	263081	23324	556738	**2.35**
Chhatisgarh	16139	132947	14601	163687	**0.69**
Goa	1672	651	0	2323	**0.01**
Gujarat	381490	516928	61042	959672	**4.04**
Haryana	177981	648651	33040	859672	**3.62**
Himachal Pradesh	42923	22272	2419	67614	**0.28**
Jammu & Kashmir	2481	22278	1760	26519	**0.11**
Jharkhand	44787	77279	15268	137334	**0.58**
Karnataka	**653555**	**646461**	**250227**	**1550243**	**6.53**
Kerala	426499	204470	153488	784457	**3.31**
Lakshadweep	98	0	0	98	**0.00**
Madhya Pradesh	293124	460821	39915	793860	**3.34**
Maharashtra	484291	2170923	48765	2703979	**11.39**
Manipur	621	0	177	798	**0.00**
Meghalaya	1434	670	1255	3359	**0.01**
Mizoram	8	1094	0	1102	**0.00**
Nagaland	10	10	6	26	**0.00**
Delhi	721	1228	0	1949	**0.01**
Orissa	171206	1030089	67717	1269012	**5.35**
Pondicherry	10421	1765	0	12186	**0.05**
Punjab	414533	665453	19660	1099646	**4.63**
Rajasthan	244255	1550473	47345	1842073	**7.76**
Sikkim	439	347	0	786	**0.00**
Tamil Nadu	789468	933565	54326	1777269	**7.49**
Tripura	1780	1096	1047	3923	**0.02**
Uttar Pradesh	1258625	1926633	478180	3663438	**15.44**
Uttaranchal	14713	117371	5266	137350	**0.58**
West Bengal	197085	234488	30440	462013	**1.95**
India	7271990	14800526	1661675	23734191	**100.00**

Source: indiastat.com

The distribution of credit cards to farmers through banks also enhances the agricultural performance of the states. It should be noted that out of total number of kisan cards issued in the country as a whole, Karnataka's share stands at 6.53 percent. There exists a need for increasing the distribution of kisan credit cards in future by the state government.

Chart -3: Statewise Percentage of Kisan Credit cards

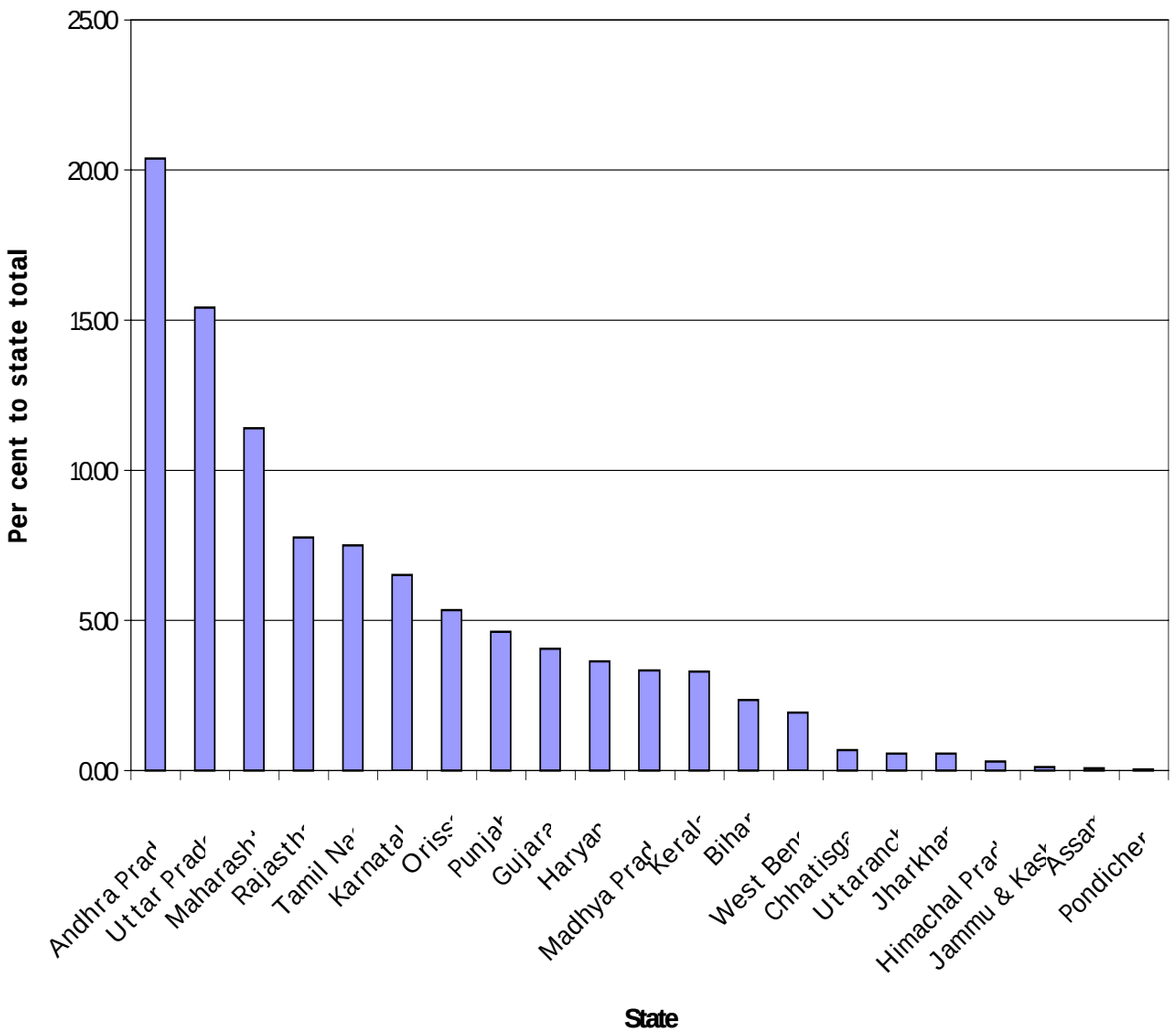


Table-26: Consumption of Fertiliser Products -1990-91–2000-01.

('000 Metric Tonnes)

Zones/states	Urea	A/S	ACI	CAN	SSP	MOP	SOP	DAP	ROCK
East	**3083.93**	**97.21**	**0.7**	**36.27**	**633.46**	**520.16**	**-**	**956.54**	**25.9**
Assam	116.26	-	-	-	54.59	60.81	-	36.09	4.15
Bihar	1352.16	30.55	-	23.63	62.25	100.69	-	389.08	-
Orissa	421.05	17.28	-	8.41	32.61	76.31	-	95.91	2.18
West Bengal	1106.22	49.37	0.7	4.23	472.34	277.67	-	426.79	-
Arunachal Pradesh	0.61	-	-	-	0.19	0.1	-	0.17	-
Manipur	30.68	-	-	-	2.07	2.02	-	4.66	0.15
Meghalaya	4.98	-	-	-	3.67	0.38	-	1.45	-
Mizoram	0.66	-	-	-	-	0.8	-	1.56	0.15
Nagaland	0.59	-	-	-	-	0.13	-	0.63	-
Sikkim	0.66	-	-	-	-	-	-	0.2	-
Tea Board	35.91	-	-	-	-	-	-	-	15.39
Tripura	14.17	-	-	-	5.74	1.26	-	-	3.89
North	**8050.13**	**26.64**	**-**	**133.4**	**786.54**	**186.05**	**-**	**2493.31**	**-**
Haryana	1254.92	-	-	29.15	49.94	7.08	-	468.49	-
Punjab	2063.69	4.66	-	39.61	92.14	37.71	-	674.49	-
Uttar Pradesh	4568.78	21.47	-	46.25	639.71	137.1	-	1311.02	-
Jammu & Kashmir	85.7	-	-	-	-	1.37	-	29.92	-
Chandigarh	0.49	-	-	0.04	-	-	-	Neg.	-
Delhi	30.85	0.07	-	0.84	0.16	0.47	-	8.97	-
Himachal Pradesh	45.71	0.44	-	17.5	4.59	2.33	-	0.42	-
South	**4003.41**	**319.36**	**73.67**	**105.39**	**440.28**	**973.7**	**15.54**	**1433.27**	**96.04**
Andhra Pradesh	2014.74	171.11	6.66	57.73	257.33	221.16	8.98	697.97	-
Karnataka	**964.78**	**55.52**	**9.15**	**39.01**	**77.01**	**231.99**	**6.5**	**446.31**	**35.6**
Kerala	116.94	14.97	1.07	-	6.12	123.64	-	9.15	52.52
Tamil Nadu	887.93	75.86	55.64	8.65	97.85	389.7	0.07	272.42	7.56
Andaman & Nicobar Islands	0.5	-	-	-	-	0.11	-	0.41	0.08
Lakshdweep	-	-	-	-	-	-	-	-	-
Pondicherry	18.53	1.9	1.16	-	1.96	7.1	-	7.01	0.28
West	**5204.86**	**195.68**	**1.65**	**72.46**	**1675.26**	**406.82**	**1.95**	**2052.84**	**-**
Gujarat	1064.15	140.11	-	36.49	72.42	95.63	-	481.99	-
Madhya Pradesh	1209.87	18.31	-	5.55	742.95	65.26	-	565.84	-
Maharashtra	1893.27	34.94	1.65	17.14	659.88	237.42	1.95	549.99	-
Rajasthan	1031.5	2.17	-	13.28	200	7.6	-	453.18	-
Daman & Diu	0.35	0.08	-	-	-	0.08	-	0.21	-
Dadra & Nagar Haveli	1.23	0.07	-	-	-	0.03	-	0.88	-
Goa	4.49	-	-	-	-	0.79	-	0.76	-
India	**20342.34**	**638.89**	**76.02**	**347.52**	**3535.53**	**2086.74**	**17.5**	**6935.95**	**121.93**

Note : Data is provisional.
Source : Fertiliser Statistics, 1999-2000, The Fertiliser Association of India.

Table-27: State-wise Major Consumers of Pesticides (Tonnes)–2000

States	Quantity	Percentage to Total
Andhra Pradesh	13000	18.51
Uttar Pradesh	11000	15.66
Tamil Nadu	9500	13.53
Maharashtra	6900	9.82
Punjab	6400	9.11
West Bengal	5800	8.26
Haryana	5200	7.47
Gujarat	5100	7.26
Karnataka	**4400**	**6.26**
Rajasthan	2900	4.13
Total	**70200**	**100.00**

Source: Agricultural Research Data Book, 2001.

It should be noted that among the major pesticide consuming states in India, Karnataka's consumption constitutes 6.26 percent during the year 2000. However, in the following tables, it is evident that the compound growth rate in the consumption of pesticides from 1994-95 to 1999-2000 has declined in almost all the states. In the case of Karnataka, the compound growth rate in consumption has declined by 9.15 percent during the reference period. Though pesticide as an agricultural input positively affects the production, decline in consumption is a welcoming sign because, pesticides cause enormous amount of health damage to human beings and animals.

Table- 28:Statewise Consumption of Pesticides (1994-95 to 1999-2000)

States/UTs	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	**CGR**
Andhra Pradesh	9343	10957	8702	7298	4741	4054	-17.81
Assam	432	316	300	284	260	260	-8.68
Arunachal Pradesh	19	22	20	18	18	17	-3.55
Bihar	1462	1383	1039	1150	834	832	-11.40
Gujarat	4985	4560	4545	4642	4803	3646	-3.89
Goa	10	4	2	2	4	4	-12.27
Haryana	5100	5100	5040	5045	5035	5025	-0.32
Himachal Pradesh	280	300	300	200	276	385	2.71
Jammu & Kashmir	50	108	63	78	75	26	-11.18
Karnataka	3640	3924	3665	2962	2600	2484	-9.15
Kerala	1384	1280	1141	602	1161	1069	-6.16
Madhya Pradesh	2771	1748	1159	1641	1643	1528	-7.73
Maharashtra	3647	5097	4567	3649	3468	3614	-3.99
Manipur	25	41	31	20	31	21	-5.95
Meghalaya	17	20	20	8	9	8	-18.32
Mizoram	21	21	18	17	16	19	-3.85
Nagaland	11	9	9	9	9	10	-1.35
Orissa	1580	1293	885	924	942	998	-8.75
Punjab	7300	7200	7300	7150	6760	6972	-1.25
Rajasthan	3308	3210	3075	3211	3465	2547	-2.91
Sikkim	20	26	16	16	15	0.16	-52.14
Tamil Nadu	3394	2080	1851	1809	1730	1685	-11.00
Tripura	12	25	22	19	16	17	0.73
Uttar Pradesh	7970	8110	7859	7444	7419	7459	-1.85
West Bengal	4370	4213	4291	3882	3678	3370	-5.03
Andaman & Nicobar Islands	10	7	9	4	5	5	-14.02
Chandigarh	1	3	3	3	3	4	21.90
Delhi	58	76	61	65	64	62	-0.34
Dadra & Nagar Haveli	5	7	4	4	4	2	-16.38
Daman & Diu	1	1	1	1	1	1	0.00
Lakshadweep	1	1	1	1	1	1	0.00
Pondicherry	130	118	115	81	71	71	-13.06
India	61357	61260	56114	52239	49157	46195.16	-5.96

Source: inidastat.com

Conclusion:

The above analysis of various kinds of agricultural infrastructure reveals that there exists a disparity between different states in terms of level of infrastructure. Since there is a strong empirical evidence to show that the level of infrastructure determines the economic development of a particular region, the regional disparities in the food

production and employment generation that contribute to overall development can be attributed to lack of or adequacy of infrastructural development. Though Karnataka's performance in terms of many of the infrastructural indicators is relatively superior to other states, there exists lot of scope for improving the infrastructural provision in the agricultural sector so that increased food grains production could be realised in the coming years. Since the agricultural sector in the states contributes around 37 percent of the gross domestic product (GDP) and half of the rural population in the state depends on the agricultural sector, infrastructural bottlenecks can be a major constraint in alleviating the overall poverty in the state. Keeping this in mind, the state government has to continue to invest in rural infrastructural facilities. Apart from this, the government should develop necessary institutions to attract private investment in some of the areas where there is a scope for the private sector to play a role.

Having argued for increasing the level of agricultural infrastructure in the state, we need to analyse the infrastructural adequacy or inadequacy in different districts of Karnataka so that one could derive some policy conclusions about which district and infrastructure indicator need immediate attention. The following chapter is based on the assumption that Karnataka, in terms of many of agricultural infrastructure facilities discussed above performs relatively better and therefore, this aspect can be considered as a benchmark for further analysing the level of agricultural infrastructural facilities of the district within the state. In the following chapter, we make an attempt to analyse the regional disparities in the level of infrastructural provision so that some concrete policy conclusions could be arrived at.

CHAPTER 3

INFRASTRUCTURE DEVELOPMENT IN KARNATAKA

As long as all the regions in a particular state develop in a balanced way in terms of agricultural growth, the optimality in resource allocation as well as output could be achieved automatically. It should, however, be noted that there are four major kinds of imbalances that can be caused by asymmetry in the existing level of man-made capital, human capital and the natural capital endowed in each region. This asymmetry in the endowment of infrastructure, in many cases, causes: 1. Inter-Sectoral Imbalance; 2. Inter-regional Imbalances; 3. Intra-sectoral imbalances; and 4. Intra-regional imbalances. But when the regional imbalances in agricultural output crop up, then the decision-makers have to find out a mechanism by which the scarce resources could be allocated efficiently which may be described in pure economic terms as a Pareto optimal allocation. However, an optimum allocation is not an easy task for the policy-makers, in the sense that a resource allocation decision requires both quantifiable and non-quantifiable inputs related to endowment of the human, man-made and the natural capital in a particular region.

In the present chapter, we are investigating an important question namely, how far the infrastructural growth as well as its distribution in different regions of the state has changed between different time periods in Karnataka. In this chapter, we would discuss in detail the methodology used and type of agricultural infrastructural facility taken into account, the type and nature of the data used to derive these indicators, the sources of data, etc. This chapter also deals with the analysis of actual data and identification of backward regions in Karnataka in terms of adequacy/inadequacy of level of agricultural infrastructure. Finally, we would discuss the results of the analysis as well as the policy implications of the results.

Broadly speaking, our present analysis of agricultural infrastructure utilises the methodologies adopted by studies that looked into the linkage between the infrastructural facilities and the regional imbalance. In India, some of the earlier studies looking into identifying the regional imbalances have used various kinds of indicators to classify the backward regions. Venkataraman et al (1985), while analysing the regional imbalances in relation to infrastructural development in the state of Karnataka, used the following indicators at the district level: (a) Number of regulated markets per lakh

hectares of net sown area; (b) Density of registered factories per thousand sq.km. of geographical area; (c) Employment in registered factories as percent to total population; (d) Density of roads in kms. per 100 sq.km of geographical area; (e) Proportion of towns and villages electrified out of the total number of towns and villages; (f) Number of post offices per lakh of population; (g) Number of banking offices per lakh of population; (h) Literacy rate; (I) Number of schools per lakh of population; (j) Number of health units per lakh of population and (k) Number of hospital beds. Using the time series data for the periods 1961 and 1975 and using the population growth as *numeraire*, the author computed the compound growth rate for all the indicators and classified these indicators into three different groups depending on the performance of each indicator. The first group of indicators, according to the authors, are those which recorded compound growth rate of 4 percent during the two time periods used in the analysis. The second group of indicators belonged to those categories which registered a growth rate between 0.45 percent and 4.0 percent and, while those indicators performing negative growth rate have been grouped as third category. Based on the state level analysis, the author investigates further into the performance of the indicators at the district level to identify the micro-level imbalances. Using the state level average in each indicator, the districts are classified, again, into three categories as follows: (1) first group of districts which have more than half of the infrastructural values ***above*** State level; (2) the second group of districts are those which have one-fourth of the indicator values ***above*** State level; and (3) the third type of districts includes those districts which have three-fourth or more number of indicators with the values below the state level.

The Fact Finding Committee on Regional Imbalance in Maharashtra, 1983-84, headed by Dandekar, used the following indicators to assess the regional imbalances in the State of Maharashtra: (a) Percapita domestic product; (b) Percapita consumer expenditure; (c) Percapita domestic product originating in agriculture; (d) Percapita domestic product originating from registered manufacturing sectors; (e) Percentage of urban population; (f) Percentage of workers engaged in activities other than agriculture; (g) Percapita consumption of electricity; (h) Percapita bank credit and bank deposits and credit/deposit ration; (I) Male and female literacy; Percentage of scheduled tribes, scheduled castes, Nav Bhudas and agricultural labour in the population. The study assessed the regional developments in terms of physical achievements in these indicators.

Though the methodology provides lot of insights into the issue of identifying the backward regions, the problem with this methodology is that the selection of indicators is based only on some general criterion that would sometimes result in biased outcomes. Take for instance, the number of km. of railway lines in a particular district. If the percapita length of the railway line in a particular district is greater than that of the other district, it does not mean that it will always result in more benefit to that district alone. Moreover, the list of indicators included in the study may be either too narrow or outmoded compared to the change in the composition of the indicators in the present context. Also, the methodology to develop indicators will change over a period of time that provides lot of sophistication into it. This being the case, any kind of regional imbalance study at present needs to have a new look at the nature of the indicators as well as the methodology to be used.

Table–28 : Gross Cropped Area in Karnataka

					(in hectares)		
District	**1976-77**	**1984-85**	**1988-89**	**1989 -90**	**1991-92**	**1992-93**	**1999-00**
Bagalkot							536289
Bangalore						105724	95509
Bangalore (R)	410709	398737	440249	420592	446496	343003	323152
Belgaum	928885	1024080	1044303	1025571	1038936	986172	988589
Bellary	614442	642093	705969	691082	705800	705151	583616
Bidar	412650	427492	442963	445963	404625	437990	463681
Bijapur	1385285	1388978	1424299	1481008	1553262	1477932	873104
Chamarajanagar							189505
Chikmagalur	258521	270999	303139	315495	325318	340221	321685
Chitradurga	578141	629930	705901	702149	718456	775248	485073
D Kannada	264903	299854	296424	296490	297195	297059	160209
Davanagere							481150
Dharwad	1151649	1280629	1180661	1243862	1378938	1361393	463385
Gadag							446237
Gulbarga	1245813	1275896	1189173	1337758	1313646	1303009	1420149
Hassan	377976	399983	393910	412788	424363	432018	433105
Haveri							464193
Kodagu	151620	148344	151077	150679	149784	151455	143213
Kolar	370423	369040	419713	404360	423661	394232	415689
Koppal							429124
Mandya	333308	301465	317353	326337	328941	324053	297491
Mysore	601379	610131	631410	651029	644482	657059	486268
Raichur	1043173	1159724	1039976	1076939	1091613	1095796	644274
Shimoga	335550	376332	382158	386861	383685	429452	248134
Tumkur	575233	527631	619137	616909	634146	657419	658056
U Kannada	119605	128259	131561	128725	129550	137316	128145
Udupi							132569
State total	**11159265**	**11659597**	**11819376**	**12114597**	**12392897**	**12411702**	**12311594**

Source : 1 Karnataka At a Glance 2000-01
2 Karnataka Statistical Abstract 1976-77

With the above background, in the following section, an attempt is made to analyse different types of agricultural infrastructures at the individual level so that some of the major indicators could be identified for ranking different districts in Karnataka. It should, however, be noted that the nature of indicators that we are going to deal with in this chapter differs from those indicators that we discussed in the previous chapter. This is because of the reason that we could not get the required data on some of the indicators we have used in the previous chapters, especially at the dis-aggregated level for the state of Karnataka. Therefore, we have in this chapter used different kinds of agricultural infrastructural indicators for which secondary data were readily available.

The gross cropped area in the state has constantly increased from 1976-77 to 1992-93, with a slight decline during 1999-2000. It may be noted that the increase in the cross cropped area would play as 'pull' as well as push factor towards infrastructural development. This is because, increasing the gross cropped area requires increased level of rural infrastructure and once the production increases due to increase in the area under crops, absorption of additional production may require additional infrastructural facilities. In the following section, we would analyse various forms of infrastructural facilities developed in different districts in the state.

Table -29: Total Number of Godowns owned, hired-Govt. and Private: 2000-01

									(capacity in MTs)		per 10,000 ha of GCA (1999-00)
Districts	Owned by KFCSC	Capa-city	Govt. Godowns	Capacity	TAPCMS Godowns hired	Capacity	Private Godowns hired	Capacity	Total Godowns	Total Capacity	Total Capacity 2000-01
Bagalkote	0	0	0	0	4	1000	3	750	7	**1750**	32.63
Bangalore										**0**	0.00
Bangalore (R)	7	7500	2	500	2	900	6	2500	17	**11400**	352.78
Belgaum	0	0	5	3150	0	0	1	250	6	**3400**	34.39
Bellary	0	0	1	1000	7	2650	0	0	8	**3650**	62.54
Bidar	2	800	1	350	2	1650	1	600	6	**3400**	73.33
Bijapur	1	300	2	800	1	300	1	200	5	**1600**	18.33
Chamarajanagar	1	300	0	0	1	300	1	300	3	**900**	47.49
Chikmagalur	0	0	2	800	1	600	2	350	5	**1750**	54.40
Chitradurga	0	0	2	460	2	800	0	0	4	**1260**	25.98
D Kannada	0	0	0	0	4	1200	0	0	4	**1200**	74.90
Davanagere	0	0	1	440	6	2130	0	0	7	**2570**	53.41
Dharwad	0	0	1	500	4	1050	0	0	5	**1550**	33.45
Gadag	0	0	0	0	5	1420	2	600	7	**2020**	45.27
Gulbarga	3	900	4	3400	3	2100	1	200	11	**6600**	46.47
Hassan	0	0	0	0	8	3040	1	400	9	**3440**	79.43
Haveri	0	0	1	600	2	540	2	600	5	**1740**	37.48
Kodagu	0	0	0	0	1	300	1	280	2	**580**	40.50
Kolar	0	0	2	900	6	2300	1	250	9	**3450**	82.99
Koppal	0	0	1	500	3	2400	0	0	4	**2900**	67.58
Mandya	0	0	1	2000	0	0	3	1000	4	**3000**	100.84
Mysore	0	0	0	0	3	780	5	2700	8	**3480**	71.57
Raichur	0	0	4	3650	2	500	0	0	6	**4150**	64.41
Shimoga	2	10000	1	400	6	1600	1	300	10	**12300**	495.70
Tumkur	0	0	2	2000	3	900	4	3100	9	**6000**	91.18
U Kannada	1	800	1	1000	2	850	0	0	4	**2650**	206.80
Udupi										**0**	0.00
Total	**16**	**19800**	**33**	**21450**	**76**	**28460**	**36**	**14380**	**161**	**84090**	68.30

Source : Karnataka Food and Civil Supplies Corporation Limited, Bangalore, Karnataka

Table-30: Rural Roads in Karnataka (length in kms.)

District	1976-77	1995-96	1999-00	ACGR
Udupi	na	na	700	0.00
Bidar	595	671	753	1.03
Chamarajanagar		na	927	0.00
Bangalore	-	978	978	0.00
Raichur	2359	1786	996	-3.68
Kodagu	603	990	1167	2.91
Davanagere	na	na	1172	0.00
Bagalkot	na	na	1190	0.00
Koppal	na	na	1251	0.00
D Kannada	1035	1722	1269	0.89
Chikmagalur	741	1253	1335	2.59
Bijapur	1641	1813	1349	-0.85
Shimoga	1458	1586	1367	-0.28
Bangalore (R)	1571	1408	1417	-0.45
Chitradurga	1807	1942	1439	-0.99
Bellary	1022	1030	1750	2.37
Hassan	1560	2040	2052	1.20
Mysore	3045	3053	2074	-1.66
Haveri	na	na	2080	0.00
Tumkur	1181	2080	2203	2.75
Belgaum	1241	1113	2360	2.83
Kolar	1330	2210	2371	2.55
Gadag	na	na	2462	0.00
Dharwad	1820	2763	2788	1.87
Gulbarga	1599	1848	2805	2.47
U Kannada	1326	2176	3344	4.10
Mandya	4117	4519	4549	0.43
State Total	30051	36981	48148	2.07

Source: 1 Karnataka at a Glance 2000-01, 2 Statistical Abstract of Karnataka 1976-77.

The annual compound growth rate of rural road length shows, at the state level, that the road length has increased at the rate of 2.07 percent per annum. While investments on roads in some of the districts have contributed to the positive growth at the state level, that of in some other districts have not contributed so. For instance, investments on roads in Uttar Kannada, Tumkur, Belgaum, and Kolar districts have increased over a period of time, while districts such as Raichur and Mysore have shown a negative growth in investment on roads. One more aspect worth mentioning here is the quality of roads. Even though a considerable amount of investment is made on the roads by certain districts, it does not ensure quality road.

Table-31: Agricultural Implements and Machinery

District	1974-75 *	1987-88	1992-93
Bagalkot	na	na	na
Bangalore	358374	97657	112536
Bangalore (R)	na	676764	813629
Belgaum	554238	700920	820529
Bellary	267952	410800	479266
Bidar	103004	169959	199987
Bijapur	388313	677099	823112
Chamarajanagar	na	na	na
Chikmagalur	196723	329570	388709
Chitradurga	307270	424809	504691
D Kannada	305010	390309	455822
Davanagere	na	na	na
Dharwad	577956	682598	961982
Gadag	na	na	na
Gulbarga	366142	509213	593832
Hassan	296996	558476	607549
Haveri	na	na	na
Kodagu	56769	79573	93588
Kolar	281773	461481	539958
Koppal	na	na	na
Mandya	261789	409513	488052
Mysore	310302	651756	776641
Raichur	279941	417228	488122
Shimoga	345039	494806	586910
Tumkur	317527	649431	777341
U Kannada	144678	210846	242535
Udupi	na	na	na
State Total	**5719796**	**9002808**	**10754791**

Source : 1 Statistical Abstract of Karnataka 1976-77
ADRT report (Assessing the Existing Training and Testing Facilities for Farm Machinery in Kanrataka)
Note : * Includes Plough, carts, Sugarcane crushers, Oil engines with pumpsets for irrigation,
Electric pumpsets for irrigation, Persian wheels for rahats, Tractor including power tiller, Ghanies and Others

The above table shows the growth of total agricultural implements and machinery used in various districts in the state. It should be noted that the total agricultural implements used are increasing over a period of time in the state as a whole. However, we observe that this infrastructural indicator also differ among different districts. With the available information, we could not make any detailed assessment of

Table -32: District-wise Number of Telephone in Use in Karnataka

District	1976-77	1983-84	2001-02
Bagalkot	na	Na	34726
Bangalore	54729	70615	709658
Bangalore (R)	na	na	99518
Belgaum	6653	10209	123337
Bellary	2757	3691	54924
Bidar	678	922	25929
Bijapur	2932	5020	40339
Chamarajanagar	na	na	11671
Chikmagalur	1796	4815	56062
Chitradurga	3059	4733	32093
D Kannada	11577	17238	148364
Davanagere	na	na	40107
Dharwad	8253	11429	78875
Gadag	na	na	25339
Gulbarga	1947	2863	56679
Hassan	1825	3362	64820
Haveri	na	na	26132
Kodagu	1371	3647	38108
Kolar	2020	3520	74970
Koppal	na	na	20801
Mandya	1339	2183	38808
Mysore	7024	11355	119565
Raichur	1878	2550	28442
Shimoga	2553	4137	86775
Tumkur	1737	2817	63152
U Kannada	1985	3500	73383
Udupi	na	na	83978
State Total	**116113**	**168606**	**2256555**

Source: 1 Karnataka At a Glance 2000-01
2 Karnataka Statistical Abstract.

Communication facilities are also playing an indirect but crucial role in enhancing the agricultural growth in regions. There is a controversy whether the telecommunication facilities do really contribute to the growth of agricultural sector. However, well documented evidence show that telecommunication facilities do positively play a role in agricultural growth. In terms of number of telephone used, different districts do have different level of communication facilities. It should be noted that since the government has initiated computerization of rural areas, there exists a need for increasing the current level of telecommunication facilities in different districts of the state.

Table-33 : Sales outlets of Fertilizer, Seeds and Pesticides in Karnataka

					Sales outlets per 10,000 ha of GCA		
District	**Fertilizer**		**Seeds**	**Pesticides**	**Fertilizer**	**Seeds**	**Pesticides**
	1984-85	2000-01	2001-02	1999-2000	2000-01	2001-02	1999-2000
Bagalkot		458			8.54	0.00	0.00
Bangalore		241	176	33	25.23	18.43	3.46
Bangalore (R)	524	380	142	168	11.76	4.39	5.20
Belgaum	797	608	534	1645	6.15	5.40	16.64
Bellary	536	1072	355		18.37	6.08	0.00
Bidar	264	251	86		5.41	1.85	0.00
Bijapur	340	313	295	210	3.58	3.38	2.41
Chamarajanagar		315	50	77	16.62	2.64	4.06
Chikmagalur	391	323	77	199	10.04	2.39	6.19
Chitradurga	450	209	155	151	4.31	3.20	3.11
D Kannada	553	291	20	250	18.16	1.25	15.60
Davanagere		581	132		12.08	2.74	0.00
Dharwad	934	206	555	663	4.45	11.98	14.31
Gadag		186	106	127	4.17	2.38	2.85
Gulbarga	329	729	564	745	5.13	3.97	5.25
Hassan	324	589	107	422	13.60	2.47	9.74
Haveri		284		198	6.12	0.00	4.27
Kodagu	172	194	11		13.55	0.77	0.00
Kolar	403	665	288	216	16.00	6.93	5.20
Koppal		263			6.13	0.00	0.00
Mandya	640	911	152	138	30.62	5.11	4.64
Mysore	768	788	278	209	16.21	5.72	4.30
Raichur	517	531	239	488	8.24	3.71	7.57
Shimoga	457	462	168	279	18.62	6.77	11.24
Tumkur	566	729	113	133	11.08	1.72	2.02
U Kannada	211	237	11	123	18.49	0.86	9.60
Udupi		177	11	165	13.35	0.83	12.45
State Total	9176	11993	4625	6639	9.74	3.76	5.39

Source: Department of Agriculture, Government of Karnataka.

The above table reveals number of sales outlets per 1000 hectares of gross cropped area, for different kinds of inputs such as seeds, fertilizers and pesticides in different districts in the state. It may be observed that different districts have different number of sales outlets and this may result in increased transaction cost of buying input that would ultimately lead to increase the cost of production. Equal distribution of these kinds of sales outlets in different districts would not only reduce the transaction cost but also prevent the farmers from opting for low quality inputs from the private sellers.

Table -34 : Number of Extension Service Centers in Karnataka

				per one lakh ha of GCA
District	**1974-75**	**1984-85**	**2000-01**	**2000-01**
Bagalkot			18	3.36
Bangalore	3	11	17	17.80
Bangalore (R)	8	32	35	10.83
Belgaum	10	60	35	3.54
Bellary	9	30	27	4.63
Bidar	5	20	30	6.47
Bijapur	11	50	18	2.06
Chamarajanagar			16	8.44
Chikmagalur	6	30	32	9.95
Chitradurga	12	35	22	4.54
D Kannada	8	40	17	10.61
Davanagere			24	4.99
Dharwad	17	60	14	3.02
Gadag			11	2.47
Gulbarga	10	44	48	3.38
Hassan	9	30	38	8.77
Haveri			19	4.09
Kodagu	3	10	16	11.17
Kolar	11	40	53	12.75
Koppal			20	4.66
Mandya	7	45	31	10.42
Mysore	11	48	33	6.79
Raichur	9	45	37	5.74
Shimoga	9	35	40	16.12
Tumkur	10	50	50	7.60
U Kannada	11	35	35	27.31
Udupi			9	6.79
State Total	179	750	745	6.05

Note : 1999-00 GCA is used to 2000-01 per lakh ha of GCA
Source : Department of Agriculture

Table-35 : Number of Tractors in different districts in Karnataka

Districts	1974-75	1987-88	1992-93	1998-99	1998-99 *
Bagalkot				0	0.00
Bangalore (U)	1032	831	981	0	0.00
Bangalore (R)	-	925	1091	1597	494.19
Belgaum	561	8085	9541	5575	563.94
Bellary	383	1309	1545	2344	401.63
Bidar	63	354	418	364	78.50
Bijapur	558	2029	2394	2638	302.14
Chamarajnagar				0	0.00
Chikmagalore	322	1067	1259	1439	447.33
Chitradurga	483	2791	3293	5465	1126.63
D Kannada	222	300	354	143	89.26
Davanagere				0	0.00
Dharwad	493	4990	5888	7871	1698.59
Gadag				0	0.00
Gulbarga	170	1025	1209	1533	107.95
Hassan	249	971	1146	976	225.35
Haveri				0	0.00
Kodagu	248	502	592	558	389.63
Kolar	335	1159	1368	2537	610.31
Koppal				0	0.00
Mandya	91	644	760	944	317.32
Mysore	258	484	571	1358	279.27
Raichur	910	2158	2547	2962	459.74
Shimoga	896	2366	2791	3720	1499.19
Tumkur	181	1455	1717	2537	385.53
U Kannada	85	177	209	353	275.47
Udupi				0	0.00
State Total	**7540**	**33622**	**39674**	**44914**	**364.81**

Source : 1 Government of Karnataka, Fourteenth Quinquennial Livestock Census, 1998, Karnataka State, Directorate of Animal Husbandry and Veterinary Sciences Bangalore
(P Thippaiah and R S Deshpande Report 1999).
2 Livestock Census 1972, 1990 and Sixteen Quinquennial Livestock census 1997
3 Statistical Abstract of Karnataka 1976-77

Note : * No. of Tractors per one lakh Ha. of GCA (1998)

Having seen the level of development of various kinds of infrastructural facilities in different districts in the following section, we would analyse the inter-linkage between selected infrastructural facilities and the agricultural development. A district-wise analysis of selected infrastructural facilities is attempted to see the inter-district disparities in the agricultural sector in the State. For carrying out this analysis, we have selected nine important agriculture infrastructural facilities indicated below:

1. Number of Regulated Agricultural Markets in each district (X1);
2. Agricultural Credit Percapita Rural Population (X2);

3. Number of Agricultural Cooperative Societies per lakh of Rural Population (X3);
4. Number of Bank Branches per lakh population lending agricultural credit (X4);
5. Bank Advance per lakh population (X5);
6. Number of Farm Contact Centres (X6);
7. Existence of Rural Development Centres (X7);
8. Existence of Agricultural Research Centres (X8).
9. Existence of Farmers' Training Centres (X9);
10. No. of Fertiliser Sales Outlets (X10);
11. No of Telephones Used in Different Districts (X11);
12. Length of Rural Roads in kms.(X12).

Table-36: Agricultural Indicators in various districts of Karnataka (year 2000)

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12
Bangalore U	8	221.15	4.24	11.33	1194.57	16	*	-	-	458	34726	978
Bangalore R	14	291.48	10.61	5.7	1587.3	35	-	-	$	241	709658	1417
Chitradurga	14	482.31	10.35	7.61	2952.55	22	-	-	$	380	99518	1439
Davangere	13	986.91	13.39	6.98	3338.2	24	*	-	-	608	123337	1172
Kolar	23	471.86	9.85	7.17	919.3	53	**	-	-	1072	54924	2371
Shimoga	19	943.12	14.4	9.33	5286.06	40	*	-	$	251	25929	1349
Tumkur	33	330.63	10.71	7.33	1801.93	50	*	-	$	313	40339	2203
C.R.Nagar	7	293.71	10.29	5.91	1999.1	16	-	-	-	315	11671	927
C.Mangalore	17	2968.43	12.54	11.5	9244.37	32	*	-	-	323	56062	1335
D.Kannada	8	30.66	9.5	15.98	9850.97	17	-	-	-	209	32093	1269
Hassan	22	1024.1	11.22	9.18	4292.52	38	*	-	-	291	148364	2052
Kodagu	6	4501.94	14.47	20.17	12613.1	16	*	@	$	581	40107	1167
Mandya	13	685.91	14.4	7.27	3195.22	31	*	@	$	206	78875	4549
Mysore	14	774.23	11.65	8.95	6282.08	33	*	-	-	186	25339	2074
Udipi	8	367.15	5.76	18.3	7933.53	9	-	-	-	729	56679	700
Bagalkote	20	922.54	16.37	7.26	3465.4	18	-	@	-	589	64820	1190
Belgaum	43	880.86	16.71	7.75	3664.73	35	-	-	$	284	26132	2371
Bijapur	16	551.6	15.71	6.86	2998.78	18	*	@	$	194	38108	1349
Dharwad	17	888.87	21.47	11.16	5715.87	14	-	@	$	665	74970	2788
Gadag	22	870.33	23.65	8.33	4000.19	11	-	-	-	263	20801	2462
Haveri	18	782.58	20.19	6.61	3089.83	19	*	-	-	911	38808	2080
U.Kannada	33	587.23	16.57	12.27	2102.57	35	**	-	$	788	119565	3344
Bellary	20	879.25	10.84	7.75	4077.66	27	*	-	-	531	28442	1750
Bidar	14	815.43	14.69	6.13	4199.09	30	*	-	-	462	86775	753
Gulbarga	29	334.34	9.66	5.44	1160.32	46	*	-	-	729	63152	2805
Koppal	17	466.94	7.94	6.03	2716	20	-	-	-	237	73383	1251
Raichur	15	638.13	7.89	5.52	2482.2	37	*	@	$	177	83978	996
State Average	**17.88**	**835.13**	**12.47**	**10.17**	**4154.18**	**27**	**-**	**-**	**-**	**444.18**	**83576.11**	**1783**

Source: High Power Committee for Redressal of Regional Imbalances, 2002.
*, @, $ -all represent concerned variable existing in a particular district.

It should be noted that the selection of variables is neither complete nor unbiased. However, here we assume that the variables listed above would largely explain the performance of the agricultural sector at the district level. One of the interesting aspects to be noted is that in many of the studies on infrastructure and agricultural development, variables such as road length and railway line percapita are frequently used to measure the agricultural performance. However, the problem with this approach is that mere existence of road or railway lines may not necessarily result in improved performance at the district level. This being the case, we are very particular in selecting those variables that are expected to have some level of correlation with the agricultural performance.

The methodology that we have used to analyse the agricultural infrastructure is simple one. For each infrastructural indicator, we estimated the State average and this is used as a benchmark to compare with the level of that particular infrastructure in a particular district. If the level of infrastructure exceeds the State average, then it is taken that the district performs well in terms of agricultural infrastructure. The methodology that we have used here is based on the assumption that the level of agricultural infrastructure has a strong positive correlation with the level of agricultural productivity. This, as we have discussed in the previous chapter, is a well-established fact. However, the problem with our basic methodology is that while the State average is taken as benchmark, the benchmark would be still inadequate if the State average itself is less than optimum level of infrastructure required to attain maximum level of agricultural benefit. Since we do not know the appropriate level of State average that would result in maximum level of agricultural benefits, the existing level of State average itself is used as a 'second-best' measure of infrastructural development.

Table-37: Performance of the Districts in terms of Agricultural Infrastructure.

	X1	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**X9**	**X10**	**X11**	**X12**
No.of Districts with Above State Performance.	11	10	15	7	7	14	17	6	11	12	7	11
No.of Districts with Below State Performance.	16	17	12	20	20	13	10	21	16	15	20	16

The overall assessment of the performance of the districts in terms of availability of each type of agricultural infrastructure reveals certain interesting results. In the case of number of regulated markets, eleven districts have the regulated markets whose numbers exceed the State average and in the remaining 16 districts, number of regulated markets is found to be less than the State average. As far as percapita rural credit is concerned, it outperforms the State average in 10 districts and the performance is low in 17 districts. Number of district co-operative societies are found to be above State average in 15 districts and below in 12 districts. Two infrastructural indicators, namely, number of bank branches lending agricultural credit and amount of bank advance, perform better only in 7 districts and the performance is poor in 20 districts. It should be noted that existence of farm contact centers is found in 14 districts and no farm contact centre has been established in the remaining 13 districts. The rural development centres are found to prevail only in 6 districts out of the 27 districts in the State. The agricultural research centres have been established in 11 districts while the remaining 16 districts are yet to be provided with this particular facility.

The above discussion reveals only number of districts performing above or below the State average in terms of a particular infrastructural indicator. However, a further analysis is required to understand the performance of each district in terms of specific infrastructural indicators. It should be noted that if a district has relatively more number of indicators performing above the State average, then that district is assumed to perform better in terms of agricultural growth. This requires understanding the distribution of infrastructural indicators performing above State level among various districts. We have assumed that out of all the variables selected, it is assumed that if a district has more than three variables performing above State average then that particular district is supposed to perform better. The following table explains number of districts having number of infrastructural indicators that are performing both above and below State level. It may be noted that 21 districts are having at least four variables performing above State average whereas the remaining 6 districts have got less than four indicators performing so. The situation is better in the case of Kodagu, Dharward and Uttar Kannada districts with eight indicators performing above State level. The situation is worse in Koppal district where no infrastructural indicator performs above State level, followed by C. R. Nagar, Chitradurga and Dakshina Kannada where only two or less than two infrastructural indicator perform well.

Table-38: Performance of infrastructural Indicators in Different Districts in the State

Sl. No.	Districts	Indicators above State level	Indicators below State level
1	Bangalore U	X4, X7, X10	X1, X2, X3, X5, X6, X8, X9, X12
2	Bangalore R	X6,X9, X11	X1, X2, X3, X4, X5, X7, X8, X10, X12
3	Chitradurga	X9, X11	X1, X2, X3, X4, X5, X6, X7, X8, X10, X12
4	Davangere	X3, X4, X7, X10, X11	X1, X2, X5, X6, X8, X9, X12
5	Kolar	X1, X6, X7, X10, X12	X2, X3, X4, X5, X8, X9, X11
6	Shimoga	X1, X5, X6, X7, X9	X2, X3, X4, X8, X10, X11, X12
7	Tumkur	X1, X3, X6, X7, X9, X12	X2, X4, X5, X8, X10, X11
8	C.R.Nagar	X3	X1, X2, X4, X5, X6, X7, X8, X9, X10, X11, X12
9	C.Mangalore	X2, X3, X4, X5, X6, X7	X1, X8, X9, X10, X11, X12
10	D.Kannada	X4, X5	X1, X2, X3, X6, X7, X8, X9, X10, X11, X12
11	Hassan	X1, X2, X5, X6, X7, X11, X12	X3, X4, X8, X9, X10
12	Kodagu	X2, X3, X4, X5, X7, X8, X9, X10	X1, X2, X11, X12
13	Mandya	X3, X7, X8, X9, X12	X1, X2, X4, X5, X6, X10, X11
14	Mysore	X4, X5, X6, X7, X12	X1, X2, X3, X8, X9, X10, X11
15	Udipi	X1, X2, X3, X5, X10	X4, X6, X7, X8, X9, X11, X12
16	Bagalkote	X1, X2, X3, X8	X4, X5, X6, X7, X11, X12
17	Belgaum	X1, X2, X3, X6, X9, X10, X12	X4, X5, X7, X8, X11
18	Bijapur	X3, X7, X8, X9	X1, X2, X4, X5, X6, X7, X10, X11, X12
19	Dharwad	X2, X3, X4, X5, X8, X9, X10, X12	X1, X6, X7, X11
20	Gadag	X1, X2, X3, X12	X4, X5, X6, X7, X8, X9, X10
21	Haveri	X1, X3, X7, X10, X12	X2, X4, X5, X6, X8, X9, X11
22	U.Kannada	X1, X3,X4, X6, X7, X9, X10, X11	X2, X5, X8, X12
23	Bellary	X1, X2, X6, X7, X10	X3, X4, X5, X8, X9, X11, X12
24	Bidar	X3, X5, X6, X7, X10	X1, X2, X4, X8, X9, X11, X12
25	Gulbarga	X1, X6, X7, X10, X11, X12	X2, X3, X4, X5, X8, X9
26	Koppal		X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12
27	Raichur	X7, X8, X9, X11	X1, X2, X3, X4, X5, X6, X10, X12

Source: Computed from the secondary sources.

Ranking of Districts:

So far, we have discussed only about the level and the distribution of indicators at the district level in the State. But one of the major problems with our analysis is that different kinds of indicators, as we have already seen, have different level of correlation with the agricultural development and therefore, the weightage of a particular variable plays an important role. In other words, existence of a relatively less important indicator will not lead to enhance agricultural growth if another indicator that has strong correlation with the development does not exists in a particular district. Also, an indicator that has a strong correlation with the level of agricultural development in a particular district will not have such a level of correlation in another districts depending on various other factors. However, some kind of benchmark has to be used to rank the districts on the basis of the level of agricultural infrastructure that a particular district possess. This will facilitate us to understand which are the districts that require immediate attention in terms of provision of agricultural infrastructure in near future.

Based on our analysis of the data, we rank the districts in terms of level of infrastructural facilities available. The following table shows the ranks of all the districts of State of Karnataka in terms of the level of agricultural infrastructure. The districts are ranked in such as way that the district that carries first rank is the district which is best performing in terms of agricultural infrastructure and the district with the last rank the district whose performance is very poor. Here also, the ranks of the districts do not reveal anything concretely about the relative performance of the districts. To understand this, we used a crude method to classify the districts so as to make certain policy decisions regarding the required level of agricultural infrastructure. All the districts are classified into three major categories depending on their ranks. The districts are classified into three different categories: the districts with first 9 ranks are classified as Category-1, districts with ranks between 10 and 18 are classified as Category-2, and the districts with ranks between 19 and 27 are treated as Category-3 districts.

Table-39: Infrastructural Development Indices

Sl. No.	District	Rank of the District.
1	Bangalore U	23
2	Bangalore R	22
3	Chitradurga	26
4	Davangere	16
5	Kolar	17
6	Shimoga	11
7	Tumkur	9
8	C.R.Nagar	25
9	C.Mangalore	5
10	D.Kannada	24
11	Hassan	6
12	Kodagu	1
13	Mandya	15
14	Mysore	10
15	Udipi	7
16	Bagalkote	8
17	Belgaum	4
18	Bijapur	14
19	Dharwad	3
20	Gadag	18
21	Haveri	19
22	U.Kannada	2
23	Bellary	13
24	Bidar	12
25	Gulbarga	20
26	Koppal	27
27	Raichur	21

Based on this classification, we ascertain that the Category –3 districts namely, Koppal, Gulbarga, Raichur, Haveri, D.Kannada, C.R.Nagar, Chitradurga, Bangalore Urban and Bangalore Rural are the districts that require immediate attention in the area of agricultural infrastructural facilities. It should, however, be noted that some of the districts belonging to this category such as Bangalore Urban, Bangalore, Rural, etc, are highly urbanised areas and the role of agricultural sector in these sectors is very limited. Hence, we need to carefully interpret the results. In addition to the remaining districts in Category-1, many of the districts in Category-2 are those districts where agricultural and allied activities are predominant. Therefore, focusing on the agricultural infrastructural development in these districts would be a worthwhile attempt.

CHAPTER 4

CONCLUSIONS

Though Karnataka State has achieved an impressive growth rate in the overall infrastructural development compared to other states in the country, the agricultural infrastructure development is not evenly distributed within the State. Assuming that the level of agricultural growth rate has a positive strong correlation with the overall development in general and the agricultural development in particular, the unequal distribution of infrastructure would result in regional imbalances affecting the welfare of the individuals. This provides a strong case for increasing the level of agricultural infrastructure in some of the districts that we have identified as lacking adequate level of infrastructure. One of the limitations of our study is that the methodology that we have used has not suggested any optimum level of infrastructural facilities required in the agricultural sector in the State. However, the methodology that we have used provided some useful results to understand which are the districts that should be created with agricultural infrastructure on a priority basis. Another issue with our methodology is that selection of variables for the analysis might have been biased but we are satisfied that we have chosen appropriate variables for our analysis. Moreover, as we have already seen, mere existence of infrastructural indicators may not ensure agricultural growth even if we assume that there exists a strong correlation between level of infrastructure and agricultural output. To understand the relationship between the level of infrastructure and the agricultural output, many authors regress the agricultural output against various kinds of variables including infrastructural indicators. This method has also lot of problems. All that we suggest here is that in future, the casual relationship between the level of infrastructure and the agricultural output should be properly established using appropriate methodology.

Principles for Infrastructure Policy:

In the following, we make some policy recommendations for better provision of the agricultural infrastructural facilities.

• **Focus on broader and long-term sustainable infrastructure.**

Provide a longer-term view of the requirements for a healthy and prosperous agriculture sectoral developments. It should be noted that infrastructure quality should be one of the main criteria that should ensure sustainability of infrastructural development and use. There exists a lot of scope for integrating various kinds of infrastructural facilities that would ensure the economies of scale in the agricultural in the coming years.

• **Understanding new operating environment.**

Our agricultural sector operates today in a new and evolving business and social environment. It is a competitive, global and rapidly changing with enormous implications for the place and role of the agricultural sector in the overall economic development. In the context of globalization of the economies including agriculture based economies, there is a need for reorienting the present attitude of various organisations involved in providing infrastructure. This means that the inadequacy of infrastructural facilities reduces the comparative advantages of the states and regions thereby affecting the potential for overall development and this transfers a considerable amount of benefits to the those areas that are relatively better equipped with infrastructural facilities, leading to regional disparities. Coordinated effort with long term perspectives would enhance better understanding of the issue in future.

• **Recognise role of private sector**

It should be noted that the private sector plays a major role in providing various kinds basic infrastructural facilities, in the context of globalisation. However, privatisation of entire gamut of provision of agricultural infrastructure may not be possible because of the 'public good' nature of many of these facilities. This warrants for identification of those areas where the private sector has comparative advantage and allowing the private sector to play a role in these areas.

• **Exploit the unique public sector role in agricultural research and extension.**

In advanced developed countries, the private sector is playing an ever-larger role in agricultural research and information provision. Limited public sector research funding thus needs to be devoted to fundamental scientific discovery and questions that the

private sector has no incentive to pursue, but that could lead to the improve the performance of the agricultural sector.

- **Anticipate future infrastructure needs.**

Building new and different capacities for accomplishing priorities requires a long-term view with a process for anticipating change. In the agriculture sector and allied activities, constant changes are taking place and the infrastructural facilities once made may not be relevant and adequate as far the changed circumstances are concerned.

- **Science oriented decision on infrastructural provision.**

Regardless of good intentions, no authorized program, no mandate, no request or emergency need can be carried out unless the appropriate research base, scientists, laboratories, methods, data and information, institutions, and technologies are available. Lot of developments are taking place on the scientific side of the agricultural development such as increased use of bio-technology, etc and the infrastructural investment should be based on these kinds of scientific developments.

- **Recognize the importance of competition in the market for research.**

Maintaining competitive research funding would result in quality output achieved in a cost-effective manner. But at the same time, one has to ensure that the benefits of these kinds of efforts reach the real beneficiaries. This can be ensured by proper monitoring and regulation by the government agencies involved.

- **Recognize the importance of collaboration.**

Collaborations involving public agencies, private companies, universities, and consumers are an important means for meeting the interests of various groups while advancing the public good. Gross fertilization of policy-making by innovative ideas and knowledge in the filed of infrastructural development provision will lead to better serve the beneficiaries with these facilities in future.

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