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Prefeasibility Report of setting up MRI scan centres on PPP mode in Medical Colleges of Belgaum, Bidar, Hassan, Mandya, Raichur and Shimoga districts

Karnataka Infrastructure Development Department Project

Submitted by

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Submitted to

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Executive Summary

Dependence on medical equipment for diagnosis and management is increasing by the day to provide timely, accurate, and precise therapeutic and surgical service delivery. Investing in high-end technology is a must not only to strengthen and raise the quality of the existing healthcare delivery system to keep pace with national & global standards but also to address future requirements of the medical field.

Magnetic Resonance Imaging (MRI) is one of the most important non-invasive diagnostic tools in today's medicine; this diagnostic technique gives a picture of the inside of the body without using X-rays or other potentially harmful radiation. MRI scan is a value addition to tertiary care hospital enhancing its service capabilities of quick & timely diagnosis and improved patient care.

The availability of advanced imaging tools like CT and MRI scan is almost nonexistent in public hospitals of Karnataka. Private sector, due to the heavy investments involved in such projects, operates MRI centres only in big & medium cities and high growth economic regions so as to have high number of referring physicians and patients with paying capacity. This leads to asymmetrical distribution of healthcare services making it inaccessible for all. As a result, major section of district population is forced to travel long distances to avail these services at private centers. The service charges of these private centers are very high and patients pay out of pocket resulting in making these facilities literally out-of-bounds for the lower strata of the economy.

The Government of Karnataka is commitment to improve the health and well being of the people. However, the cost to deliver healthcare has been rising exponentially and the government is confronted by fiscal constraints that forces it to carefully prioritize and restrict public expenditures. Moreover previous Indian experience of installing and running a MRI scan centre in public hospital showed that the operational inefficiencies and down time of equipment increased the unit MRI cost as compared to the private facility. All these factors make it imperative to increase the medical capacity of the state healthcare delivery system with provision of MRI centre on Public-Private Partnerships (PPPs).

This project aims at setting up MRI centres in six medical college hospitals of different districts on PPP mode. The selected institutions for this project are:

- BIMS, Belgaum
- BRIMS, Bidar
- HIMS, Hassan
- MIMS, Mandya
- RIMS, Raichur
- SIMS, Shimoga

The other two medical colleges KIMS, Hubli and VIMS, Bellary might be considered for MRI centres on PPP in future.

IMaCS conducted thorough assessment study which included visits to chosen institutions, consultations with their directors & HODs of radiology department, collection and analysis of state health statistics & institutional performance data to review state's challenges and needs in healthcare sector. Inputs of few local private service providers, key national private players of this sector involved in PPP projects and MRI machine manufacturers were also taken to capture their problems, interest, expectations and comfort level with PPP projects in imaging services. An analysis of existing imaging diagnostic centres in India on PPP mode was also undertaken along with literature review of international PPP experiences to come up with the most appropriate PPP model for this project. This was followed by financial analysis of the proposed model to check its commercial viability and rationalization of the use of PPP modalities in this sector.

The proposed project will be offered on Build, Own, Operate and Transfer mode (BOOT) to the successful bidder, the bid variable being the cost at which a MRI scan is provided. Project agreement can either be between two parties' namely private service provider and state government or between three parties with equipment manufacturer be the third one. IMaCS recommends a tri partite agreement as this would encourage equipment manufacturers to be involved in the process there by reducing the cost of procuring, installing and managing the machine. The service provider will be responsible for operating the centre, providing the service and adhering to the laws and regulations that govern the process. The equipment manufacturer/authorized dealer and service provider can agree on the revenue sharing/costing of the equipment between them. The government shall bear the cost of utilities required for providing the service.

Financial analysis of the project was done based on total cost concept (TCO) which is the total cost of the ownership. This analysis assumes 3100 scans in the first year at 85% operating efficiency of MRI machine. Government will ensure 10 patients per day to the centre on monthly average basis.

IMaCS considered two scenarios for this project. In first scenario government provides land to private player while rest all including building construction will be undertaken by private player to make the centre operational. Pre tax project IRR for this scenario comes 12% with bid variable of Rs. 3050 for the first year. In the second scenario government provides 'ready to move in' infrastructure to private player. Pre tax project IRR for this scenario comes 12% with bid variable of Rs. 2950 for the first year. So the project is very much commercially viable for the private player at CGHS rates. Moreover GOK's intense focus on providing quality healthcare to the state population, its proactive approach on PPP model and increasing per capita income make Karnataka an ideal place for investment in this segment.

This project shall be verified for its success and ability to meet the specified objectives at the end of every year. Upon successful achievement of the objectives, the project may be replicated across the state following the same model or modifying it as per the requirement.

The provision of this service would certainly impact the health of 22.48% population of Karnataka due to timely & accurate diagnosis and reduction in their opportunity cost of getting the healthcare services. More lives could be saved in cases of accidental and neuro emergencies.

Chapter 1 – Introduction

1.1.Project idea

1.1.1. Basis for selection of this project

The public healthcare service delivery in Karnataka follows the national pattern and consists of different levels of public healthcare institutions, starting from the bottom of the pyramid of healthcare facilities and going to the top, an integrated; step up referral system with a network of sub-centers, primary health centers, community health centers, taluka hospitals, district hospitals, and medical college hospitals. Patients are provided advanced level of curative and diagnostic services as they move up the hierarchy. Medical college hospitals serve two purposes, first they train all cadres of future medical workforce and secondly they provide the best of curative and diagnostic services to the public.

The Government of Karnataka in its commitment to improve the health and well being of the people has provided extensive resources to the primary and secondary level public health facilities, however wide gaps exist between the desired and the actual level of services provided to the people at tertiary level, one of them is the access to advanced imaging services. The availability of advanced imaging tools like CT and MRI scan is almost nonexistent in public hospitals of the state[1]. Private sector, due to the heavy investments involved in such projects, operates MRI centres only in big & medium cities and high growth economic regions so as to have high number of referring physicians and patients with paying capacity. This leads to asymmetrical distribution of healthcare services making it inaccessible for all. As a result, major section of district population is forced to travel long distances to avail these services at private centers. The service charges of these private centers are very high and patients pay out of pocket resulting in making these facilities literally out-of-bounds for the lower strata of the economy.

Like GOI, GOK strives to shape, strengthen, support and sustain a health system where every citizen has access to readily available, qualitatively appropriate and adequately wide ranging health services at affordable costs. GOK shares the vision articulated in GOI's XIth five year plan which includes:

1. To transform public health care into an accountable, **accessible, and affordable system** of quality services.
2. Public provisioning of quality health care to enable access to affordable and reliable heath services, especially in the context of **preventing the non-poor from entering into poverty or in terms of reducing the suffering of those who are already below the poverty line.**

[1] CT scan is available only at Mecgann Hosp Shimoga and MRI scan only at K R Hospital Mysore. List of public hospitals in Karnataka is provided in Annexure 1.

In order to bridge the gaps in the availability and accessibility of advanced imaging services, state authorities chose this project. The project aims at installing and operating MRI machines in six medical colleges on PPP mode.

1.1.2. Why MRI scan centre?

GOK has initiated the process of providing CT scan on PPP mode to government medical colleges of Belgaum, Shimoga, Mandya, Bider, Raichur and Hassan. The purpose of this initiative was two folds:

- Facility up gradation as per MCI guidelines
- Provision of latest technology to the district population

Magnetic resonance imaging (MRI) is one of the latest technological enhanced imaging tool which uses electromagnetic energy to achieve a "3D" view of internal tissues. It provides quick and simple diagnoses of a wide range of ailments, from soft tissue ailments (tear, hemorrhage) to tumors, from specific part to whole body while avoiding the extra pain and risk of exploratory surgery to achieve the same findings. Using high-speed computers, magnetic resonance imaging (MRI) is adapted for medical purposes, offering better discrimination of soft tissue than x-ray CAT and is now widely used for noninvasive imaging throughout the body. This can be used to obtain information on how the organs within the body function as well as their structural condition

Using MRI scans, physicians can diagnose or monitor treatments for a variety of medical conditions, including:

- Abnormalities of the brain and spinal cord
- Tumors, cysts, and other abnormalities in various parts of the body
- Injuries or abnormalities of the joints, world over MRI are emerging as a standard of clinical care especially for musculoskeletal imaging.
- Certain types of heart problems
- Diseases of the liver and other abdominal organs
- Causes of pelvic pain in women (e.g. fibroids, endometriosis)
- Suspected uterine abnormalities in women undergoing evaluation for infertility

MRI does not use ionizing radiation (high-energy radiation that can potentially cause damage to DNA, like the x-rays). There are no known harmful side effects associated with temporary exposure to the strong magnetic field used by MRI scanners. Hence, MRI scan is really a value addition to tertiary care hospital enhancing its service capabilities of quick & timely diagnosis and improved patient care.

Besides this, Karnataka is facing acute shortage of radiologists, in order to fill the gap GoK is planning to start PG courses in radiology in its medical colleges. As per Medical Council of India (MCI) norms it is preferable for medical colleges to have MRI scan machines in their hospitals, and it is mandatory for conducting PG courses in Radiology and Radio Diagnosis. Out of the ten-government run,

only BMC&RI, Bengaluru, and MMC&RI Mysore medical colleges have MRI machines installed and operational. In MMC&RI, the MRI setup is being operated on PPP mode since last year. So in order to enable more medical colleges to start PG courses in radiology, provision of MRI scan was thought of.

1.1.3. Why PPP for this project?

In the section 5.6 of the Karnataka Integrated State Health Policy 2004, Karnataka government has proactively identified the potential role of private sector in the healthcare delivery to the public.

Few goals declared in the policy also highlight the GOK's intent for PPP:

1. To establish **equity in delivery of quality health care**.
2. To **encourage greater public private partnership** in provision of quality health care in order to better serve the underserved areas.
3. To **strengthen health infrastructure**.

This planned strategy of having PPP is most suitable for this project as state faces following challenges in making the MRI scans available at medical college hospitals:

1. GOK is evolving its role from that of provider to that of a regulator to ensure fair and transparent healthcare delivery to its citizens. This transformation requires the government to not only provide a transparent governance system but also partner with private organizations.
2. MRI being a capital and operation cost intensive equipment, offering the service on state government funds puts additional strain on the public exchequer operating within a limited fiscal space.
3. Relative to private facilities there is a larger "down time" of equipments in public hospitals which results in fewer operational hours as well poor functional status of equipments. This forces many patients to be transferred to either higher-level institutions of other states or private imaging centre.
4. Poor follow up and / or financial shortages of the government agencies results in inadequate preventive maintenance and insurance of machines, affects the efficiency and life of the machine.
5. The is a human resource constraint in the state of Karnataka to operate the centre, besides this current staff is inadequately trained.
6. Delay in reporting of problems in the hard & soft healthcare infrastructure lead to bigger and un-reparable problems.

A study conducted by Varshney in 2004[2] not only endorses above stated factors but also throws following key points:

[2] Varshney A; Concept paper on Technology in Health (to NCMH 2004)

- The time from ordering to actual commissioning of MRI, CT scan at the public hospital was four times that of comparable private facilities. Delays occurred at every stage in the ordering and delivery process at the public hospital.
- Suppliers pointed out problems of much longer clearance time for bills and corruption in public sector, resulting in poor after sales service.
- It was found that in private sector, the MRI unit conducted 7500 scans per year while being operational for a total of 360 days per year, in contrast, the public sector MRI facility was used for only 740 scans, and the facility was operational only 300 days per year.
- Operational inefficiencies and down time of equipment in public hospital increased the unit cost of MRI scan. Study data revealed that per MRI scan cost in private sector was starkly lower than the public facility.
- Public sector MRI facilities are located in areas outside major cities and hence the utilization is low thereby contributing to long idle times for equipments and a resulting wastage of resources.

Another study on medical equipment use pattern in the public and private sector in India[3] revealed both quantitatively and qualitatively that medical equipments are utilized better in private sector diagnostic centres as compared to the public sector. It was proved that private facilities offer early investigation, quick reporting and minimum patient visits, thereby increasing the patient satisfaction and reducing their discomfort. The percentage utilization in relation to breakeven numbers for MRI is 7% in public and 120% in private diagnostic centres.

PPPs combine the varied skills and resources of partners in innovative ways and allow for the sharing of benefits, risks and responsibilities. So, the government looks increasingly to PPP as a model to:

1. Provide MRI scan and its effective operation by tapping the expertise of the private sector.
2. Mobilize private capital to speed up the delivery of infrastructure and services and eliminate subsidies.
3. Enable efficient use of MRI scan by improving the identification of long-term risks and their allocation, while maintaining affordable tariffs.
4. Provide higher quality of services.
5. Ongoing training programs for interns and technicians.
6. Access specialized skills.
7. Access best practices.
8. Enable regular maintenance and upgrades.

[3] Varshney Anil: Medical Equipment use pattern in the public and private sectors in India: Policy implications

1.1.4. Objectives of the project

This project has been selected with following specific objectives in view:

- To provide cost effective MRI services to the public
- To enhance the service capabilities of medical college hospitals
- To enable Radiology students to undergo training on MRI
- To enhance and widen the training capabilities of medical college hospitals for knowledge and skill up-gradation of radio technicians
- Provide services to large number of underserved population at their nearest possible location
- To improve quality medical care penetration in the state

1.2 Approach & Methodology, studies, surveys including data collection, analysis

A primary research was carried out to,

- Study and understand the operations of the selected institutions of the state and identify their needs
- Assess the availability of MRI for the district population with the private facilities
- Assess the business environment in terms of market dynamics, pricing competition, regulations
- Discussions with key stakeholders in the location, to ascertain the market opportunities in the selected regions and the expectations of clientele
- A detailed sensitivity analysis on the base case projections with respect to the key drivers affecting revenue, streams of business and capital cost.

Based on the sensitivity analysis, the ideal capital structure for the MRI scan centre recommended.

Secondary research

We supplemented the primary survey with secondary research focused on similar PPP models across the country, operating models of MRI centres and pricing of services.

Chapter 2 - Sector Profile

2.1.Industry Overview

2.1.1. Brief Introduction

Technology has touched every aspect of health care and it is more apparent in the field of diagnosis of the disease. Dependence on medical equipment for diagnosis and management is increasing by the day to provide timely, accurate, and precise therapeutic and surgical service delivery. With rapidly advancing technology, digitalization, increasing computing powers and technological devices, technology is becoming a necessity for early diagnosis, intervention, and prolonging and improving the quality of life. Investing in high-end technology is a must not only to strengthen and raise the quality of the existing healthcare delivery system to keep pace with national & global standards but also to address future requirements of the medical field.

Magnetic Resonance Imaging (MRI) is one of the most important non-invasive diagnostic tools in today's medicine; this diagnostic technique gives a picture of the inside of the body without using X-rays or other potentially harmful radiation. The technique of magnetic resonance imaging has proven to be invaluable for the diagnosis of a broad range of conditions in all parts of the body, including neurological and behavioral disorders, musculoskeletal injuries, cancer, heart and vascular diseases. So MRI scan is really a value addition to tertiary care hospital enhancing its service capabilities of quick & timely diagnosis and improved patient care.

MRI has been a boon especially for the sports persons since it can give clear pictures of soft-tissue structures near and around bones, it is often the best option for spine and joint problems which helps in early diagnosis of sports related injuries, especially those affecting the knee, shoulder, pelvis, and hip, elbow and wrist. The images allow the physicians to see even the very small tears and injuries to ligaments and muscles.

The medical use of magnetic resonance imaging has developed rapidly. The first MRI equipment in health was available at the beginning of the 1980s. In 2002, approximately 22 000 MRI cameras were in use worldwide, and more than 60 million MRI examinations were performed[4].

In India, a task force was created in 1991 by GOI to estimate MRI machine requirements for the nation. At that point of time it was found that only four machines were available against the anticipated requirement of eleven machines in India. However the latest data of MRI machines sales is very

[4] http://inventors.about.com/od/mstartinventions/a/MRI.htm

encouraging for this category of diagnostic equipment. Last year, as per the industry estimation, around 400 – 500 MRI machines were sold throughout India.[5]

2.1.2. Factors that affect diagnostics business

The healthcare infrastructure requirements in India for high-end diagnostic facilities have shown a marked increase due to following gamut of factors:

i) Direct causes-

1. Increasing disease burden of communicable and non communicable disease
2. Government's focus on universal healthcare coverage to all communities
3. Private healthcare provider's focus on medical tourism
4. Availability of refurbished MRI machines in India at comparatively lower cost making it affordable for smaller institutions and diagnostic centers
5. Competitive healthcare market where institutions strive to gain technological edge to gain more market share. Medical institutions seek to adopt the latest innovations in a bid to attract leading medical professionals who might choose to practice elsewhere or with competitors
6. Competitive availability of renowned and reliable companies provide sale and services in India
7. Nature of training provided in medical institutions becoming more diagnostic service intensive
8. Increased awareness among customers and increased cases against doctors under "Consumer Protection Act" has forced super specialists like neuro surgeons and physicians to practice "Defensive practice", this generates more demand for these high end tests
9. Increasing trend of tele-radiology and telemedicine making it possible to run an imaging centre even in the absence of in-house radiologist
10. Increasing spirit of entrepreneurship among radiologists and easy availability of loans for new start ups

ii) Indirect causes-

1. Increasing demands of increasing population
2. Changing demographics and epidemiological trends (aging populations and more chronic diseases)
3. High economic growth
4. Increasing reach of health insurance
5. Increasing urbanization
6. Increasing demand of quality medical care with cutting edge diagnostic technology.

The global MRI systems market is boosted by technological advancements and the increasing number of MRI applications such as identification of multiple sclerosis. The global MRI market is

[5] IMaCS research based on interaction with equipment manufacturers

expected to grow from $4,000 million in 2011 to $4,760 million in 2016, at an estimated CAGR of 3.55% from 2011 to 2016. Closed MRI systems commanded the largest share within the MRI market, mainly due to the high clinical value delivered by the systems.

Globally MRI is the second most used imaging procedure after the X-ray. The recent growth trends in India indicates that the private imaging centers are gaining momentum and most public sector healthcare services are focusing on outsourcing imaging diagnostics.

2.1.3. Leading business in the industry

The global market for MRI is highly consolidated with majority of the market being held by a few major players. GE Healthcare (U.K.), Philips (The Netherlands), and Siemens (Germany) together constitute most of the market with Siemens being the market leader; there is an increasing penetration of Japanese players such as Toshiba (Japan) and Hitachi (Japan).

Indian MRI market is also dominated by the aforementioned MNCs. Lately Sanrad, India's major medical imaging equipment company, launched Mitsubishi Corporation Japan into the market as the 4th major player offering both basic as well as high end variants in new 1.5T MRI models.

2.2 Regional profile

As such no authentic data is available on MRI scan utilization in Karnataka. However as far as state's performance in healthcare and creating conducive environment for business growth is concerned, Karnataka has always been at the forefront of it.

In December 2007, Bangalore ranked 2nd among the 593 districts in the country in terms of existence of health facilities. Bangalore rural district stood at an impressive 67. Ten districts in Karnataka have below-100 ranking as shown in the table below:

District	Rank
Belgaum	211
Bellary	247
Bidar	243
Bijapur	302
Chikmagalur	52
Chitradurga	135
Dakshina Kannada	47
Davangaere	114
Dharwad	112
Gadag	194
Gulbarga	333
Hassan	39

Haveri	146
Kodagu	72
Kolar	81
Koppal	339
Mandya	95
Mysore	80
Raichur	355
Shimoga	46
Tumkur	101
Udupi	35
Uttara Kannada	99

Table 2.1: Ranking of districts of Karnataka on the basis of existence of Health Facilities

According to McKinsey survey report, commissioned by the Confederation of Indian Industry in March 2011, Karnataka's GDP grew at 8.7% between 2005 and 2010. The report predicts South India could spearhead the country's growth over the next few years with its GDP projected to hit $500 billion by 2016 and close to $650 billion by 2020.

GOK's intense focus on providing quality healthcare to the state population, its proactive approach on PPP model and increasing per capita income make Karnataka an ideal place for investment in this segment.

2.3 Key Issues

The key issues in setting up MRI scan centre are:

1. High cost of equipments
2. Rapidly changing imaging technology which makes new models obsolete quickly
3. Requires big physical infrastructure setup
4. Costly maintenance of equipments
5. Limited availability of skilled manpower for both operation and maintenance
6. High cost of associated employee salary
7. Power supply, procurement of supplies adds to cost
8. Long breakeven period
9. Heavy reliance on referrals from local doctors, hence the need for effort on "Business development" which further increases the cost and the time to reach breakeven point. As per a study, the share of total expenditures of diagnostic service providers on business development may be as high as 30% for high end diagnostics such as MRI and CT scans.[6]
10. Excessive competition initiates "MRI cost war" in the market which puts pressure on profit margins

[6] Varshney A. Concept paper on Technology in Health (to NCMH 2004)

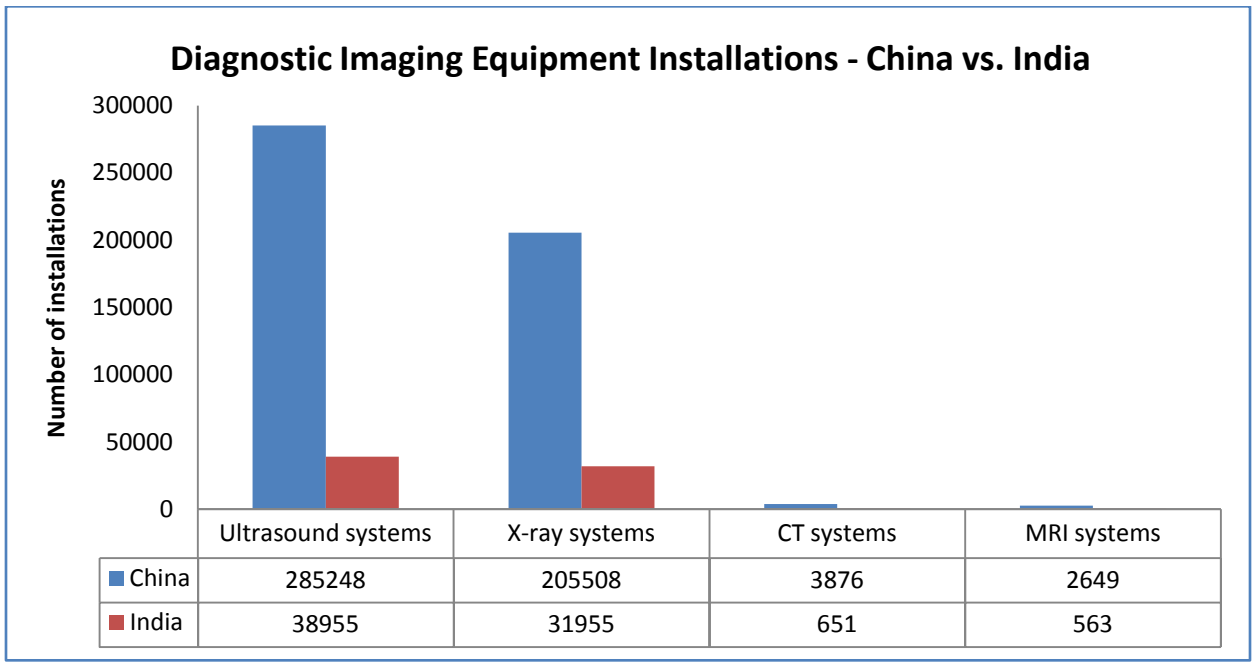
11. Poor physical infrastructure in the existing healthcare and diagnostic centers make it difficult to get necessary clearances / licenses to start the centre

Chapter 3 - Market Assessment

3.1.Industry Outlook

MRI system utilization is high in developed countries whilst it is on the increase in developing nations. However India has critically low MRI-to-patient ratios. When compared to the standard of care in Japan and the US the need for a broader penetration of MRI systems is evident.

One study estimated 133 MRI centres in 2004 which translated into .00133 per million populations.[7] In 2010, another study[8] projected the availability of 0.49 MRI scan machine per million people in India. This study compared the availability of diagnostic imaging equipment in China & India and provided data which is depicted in following graph and table;



	Ultrasound systems	X-ray systems	CT systems	MRI systems
China	285248	205508	3876	2649
India	38955	31955	651	563

Figure 3.1: Diagnostic imaging equipment installations, China vs. India, 2000-2009

Source: *Figure 1. Diagnostic imaging equipment installations, emerging economies, 2000-2009 Vittal.B; Access all areas: Diagnostic Imaging in Emerging Economies, March 2010*

[7] Ajay Mahal; Appropriate Policies for Medical Device Technology: The case of India
[8] Vittal.B; Access all areas: Diagnostic Imaging in Emerging Economies, March 2010

Diagnostic Imaging Equipment	China	India
Ultrasound systems	219.42	33.87
X-ray systems	158.08	27.79
CT systems	2.98	0.57
MRI systems	2.04	0.49
Overall diagnostic imaging equipments	382.52	62.72

Table 3.1: Diagnostic imaging equipment, availability per million populations, India and China, 2009

Source: *Table 2. Diagnostic imaging equipment installations, emerging economies, 2000-2009 Vittal.B; Access all areas: Diagnostic Imaging in Emerging Economies, March 2010*

From above graph and table we infer that India, with the availability of less than one MRI system per million people, was even lagging behind from its neighboring Asian country.

The Current Trends

The last few years had seen a trend that smaller institutes/diagnostic centers and hospitals were opting more and more for refurbished MRI purchase because of the availability of reliable companies who sell and service the machines in satisfactory manner. This, in turn, has assisted upcoming radiologists the ability to own a high field strength MRI system to establish themselves in a competitive field against established institutes. The availability of high field strength machines at competitive prices opened new opportunities for neurosurgeons and physicians practicing in smaller towns to have access to these advanced machines at convenient nearby locations and even in-house.

However at the current scenario a new MRI machine is preferred over a refurbished one to take advantage of the latest technology offering, and to ensure provide better safety, lesser maintenance and higher image resolution for as long as 10 years of operations.

Another welcome development in the field has been the acceptance of tele-radiology as a standard and dependable reporting tool, availability of high-speed internet and broadband facility almost throughout the country has greatly facilitated this application. Availability of a radiologist is no longer a binding criterion for opening up of new centers and many options are now available for getting remote reporting facility on the machine through reporting centers managed by either individuals or group of doctors.

The Future trends of clinical usages of MRI

MRI applications are no longer limited to anatomic imaging but are also widely utilized for observing and analyzing a greater range of physiological, metabolic, and molecular functions in the body. This will promote new ways of using MRI for patient treatment, for example, MRI used during radiation therapy or chemotherapy will allow the physician to determine if a tumor is being treated successfully. MRI will be used in conjunction with other imaging modalities to aid in improved methods of treatment. Developments over the last 30 years of MRI also suggest that the strength of the magnets

used for these devices will continue to increase. Anatomy-specific MR devices will also grow in utilization and may result in MR equipment cited in a variety of practice areas.

Thus, the MRI market in India has the required potential to grow and is poised to improve the efficiency of diagnostic capabilities of the hospitals.

3.2. Opportunities and demand projections

IMaCS research predicts that from the base year of 2011 the Indian healthcare sector is expected to grow at a CAGR of 30% till 2016. The diagnostic services sector is expected to grow at a CAGR of 28% and imaging/radiology segment at a CAGR of 27% till 2016. There is a significant opportunity for PPP in public sector for setting up imaging centres since most of the large public hospitals are ill-equipped. The estimate of market opportunity for the next five years would be around $100 - 150 million. (Rs 500 – 750 crore).

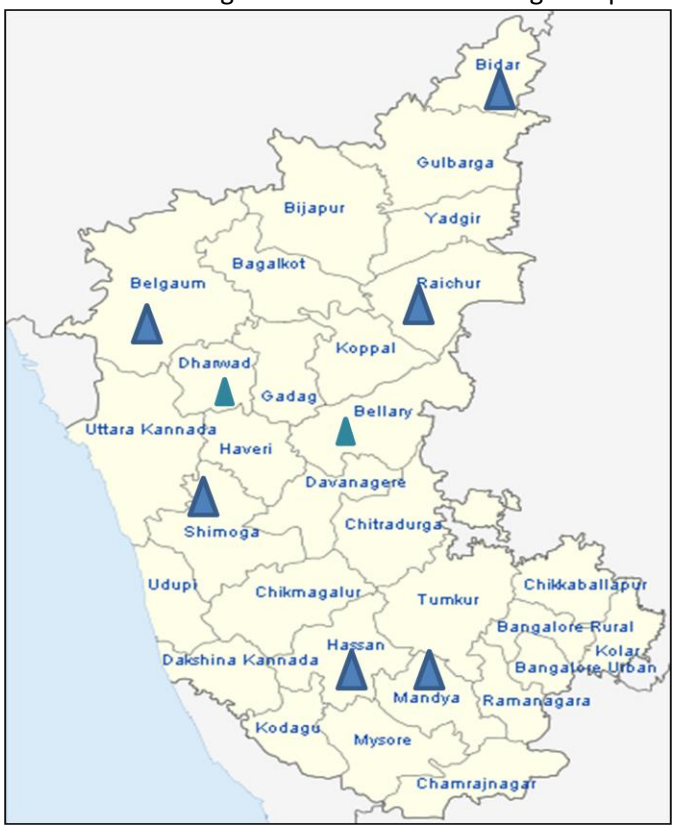
Equipment manufacturers also predict that the Indian market for diagnostic imaging systems will see a strong growth rate in the coming years. It also envisages the market to reach almost $830 million by 2016. Strong growth is expected in the low-end and mid-range systems purchased by small hospitals and facilities in rural areas that did not have imaging capability previously. The sales of latest superconducting MRIs have almost become 70 per cent compared to refurbished ones and this has provided more impetus to the growth of this industry.

Chapter 4 - Project

4.1 Description of the Project

GOK is planning to provide the services of MRI scan in the government medical college hospitals of 6 districts. The selected institutions for this project are:

- BIMS, Belgaum
- BRIMS, Bidar
- HIMS, Hassan
- MIMS, Mandya
- RIMS, Raichur
- SIMS, Shimoga



Selection of these institutions was done by the Principal Secretary DME, GoK[9]. The other two medical colleges KIMS, Hubli, VIMS, Bellary might be considered for MRI centres on PPP in future.

At inception each medical college hospital will have one MRI scan. As demand increases in future, this project will have phased expansions in consultation with the state authorities. Currently this facility is not available in the above said hospitals.

4.2 Components of the project

The project will have one component namely “MRI centre” where MR diagnostic service will be provided by the private partner. The government will provide the land in the premises of medical college hospital and the partner will be required to construct the building to house the MRI equipment, and operate the MRI centre. If the medical college has suitable building for housing the MRI service setup, the private partner shall undertake the renovation of the building to house the MRI centre. The associate components of parking lot and open space for ambulance movement will provided as a part of the existing hospital infrastructure.

[9] Letter issued is provided in Annexure 3

4.3 Description of the site

A. Belgaum Institute of Medical Sciences

Belgaum Institute of Medical Sciences (BIMS), located at the heart of the Belgaum city (Karnataka), came into being in 2006. The college is affiliated to Rajiv Gandhi University of Health Sciences (RGUHS) and approved by Medical Council of India (MCI), New Delhi. BIMS conducts an undergraduate course in the field of medical science, that is, Bachelor of Medicine and Bachelor of Surgery (MBBS), currently it has all basic clinical specialties but no super specialty. BIMS has a trauma centre where on an average 10-15 general trauma cases per day are serviced and out of which 3-4 are neurology cases.

- ***Address:*** Belgaum District Hospital, Belgaum
- ***Phone:*** 0831-2421464
- ***Email :*** mrcsrims@rediffmail.com

i. ***Belgaum city:*** It is the fourth largest city in the state of Karnataka, after Bangalore, Mysore, and Hubli-Dharwad, Belgaum which borders the states of Maharashtra and Goa. Belgaum is also the headquarters for the Belgaum revenue division, comprising Bagalkot, Belgaum, Bijapur, Dharwad - Hubli, Gadag, Haveri, and Uttara Kannada.

ii. ***Demographic profile:*** The district has a population of 47.8 Lakh persons as per 2011 census and the district population has gone up by 13.38 percent compared to 2001 population. A demographic profile of Belgaum is as below,

Total population	4,778,439
Male	2,427,104
Female	2,351,335
Population growth	13.38%
Density/Km^2	356
Proportion to Karnataka population	7.82%
Sex ratio	969
Average Literacy	73.94
Male Literacy	82.90
Female Literacy	64.74
Total Child Population (0-6 years)	605,524
Child Proportion (0-6 years)	12.67%

Source: http://www.census2011.co.in/census/district/244-belgaum.html

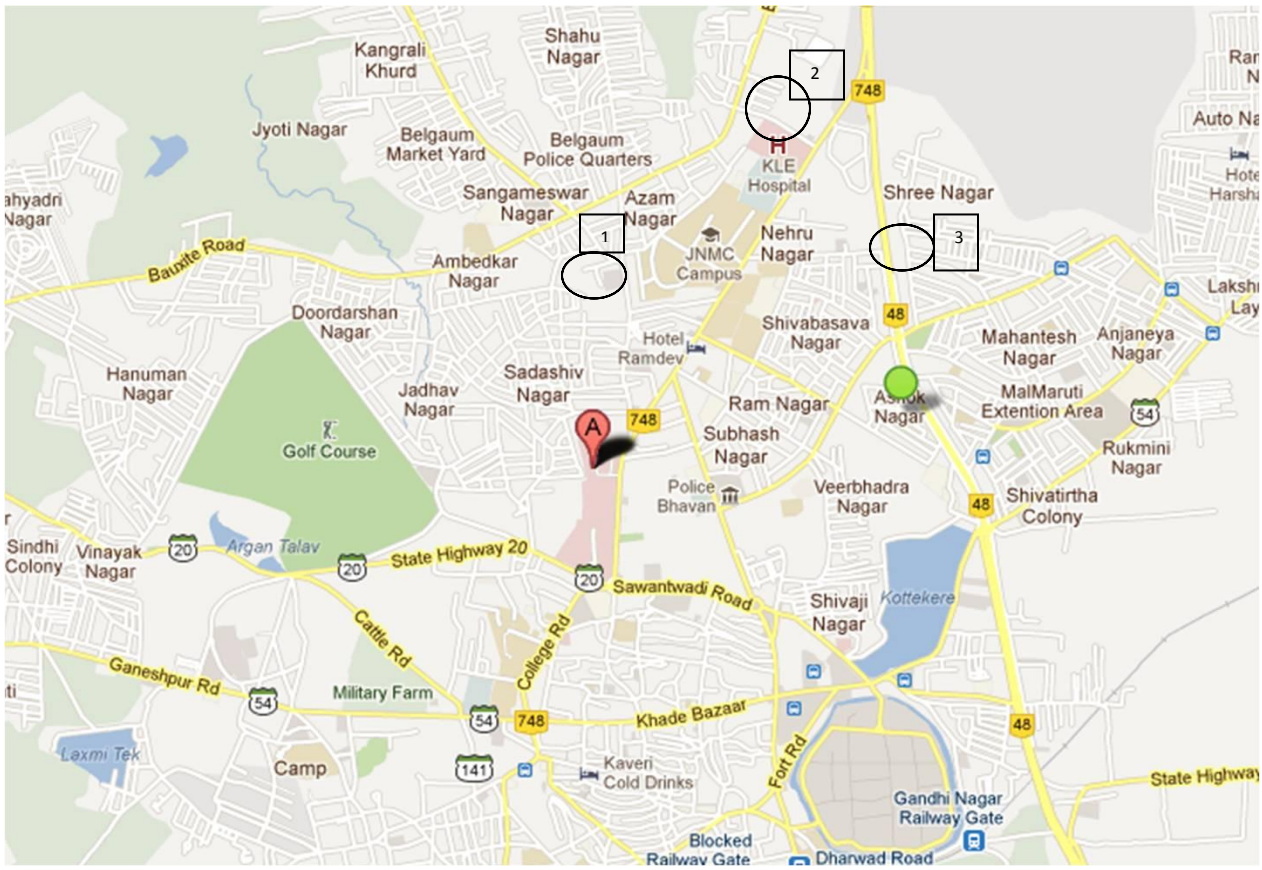
iii. ***Health Facilities:*** Apart from government medical college cum hospitals, Belgaum district houses the K.L.E Hospital of Belgaum, the Second Largest Hospital in Asia that provides all the modern facilities and treatment, and recently, a Cancer Research Center has been inaugurated

at K.L.E Belgaum. The district also houses A.M.Shaikh's Homeopathy and Medical College, which with its service and infrastructure ranks third in India. Besides these, there are many other reputed Doctors and Health Institutions serving people. Belgaum district has 3-4 neurologists and one cancer specialist.

Important Health Facility Centers

a. KLE's Dr Prabhakar Kore Hospital & Medical Research Centre , Belgaum (marked no. 2 on map)
b. KLE's Vishwanth Katti Dental Hospital & Research Centre , Belgaum
c. The Cancer Hospital , Belgaum (marked no 3 on map)
d. Other private hospitals

At present there are three CT scan and two MRI scan facilities are present in the Belgaum city. One MRI scan is with the KLE hospital which is around 1.5 km away and another is in a private imaging centre which is half a kilometer away from the BIMS.



B. *Bidar Institute of Medical Sciences*

Bidar Institute of Medical Sciences (BRIMS), located at the center of Bidar city (Karnataka), was established on 22 January, 2005. However the year of inception of college was 2007. The college is affiliated to Rajiv Gandhi University of Health Sciences (RGUHS). The institute is an autonomous institute of Government of Karnataka. BRIMS conducts an undergraduate course in the field of medical science, that is, Bachelor of Medicine and Bachelor of Surgery (MBBS) and paramedical courses. Currently this institute has all the basic clinical specialties but no super specialty. Hospital does not have separate trauma centre but on an average 15-20 trauma cases come daily in the emergency. Any patient with head injury or serious injury is being referred to Hyderabad.

- ***Address:*** Udgir Road, Bidar
- ***Phone:*** 08482-228366, 228356
- ***Email :*** brims_principal@rediffmail.com
- ***Website :*** www.brims-bidar.in

i. ***Bidar district:*** Bidar is predominantly a rural district located in the northeastern corner of the state, near the borders with Andhra Pradesh to the east and Maharashtra to the north and west. Gulbarga district lies to the south. The historic city of Bidar is the administrative centre of the district. The Bidar is 120 km from Andhra Pradesh's capital Hyderabad.

ii. ***Demographic profile:*** District has a population of 17 Lakh persons as per 2011 census and it has gone up by 13.16 percent compared to 2001 population. Following table gives the demographic details of Bidar district:

Total population	1,700,018
Male	870,850
Female	829,168
Population growth	13.16%
Density/Km^2	312
Proportion to Karnataka population	2.78%
Sex ratio	952
Average Literacy	71.01
Male Literacy	79.94
Female Literacy	61.66
Total Child Population (0-6 years)	216,885
Child Proportion (0-6 years)	12.76%

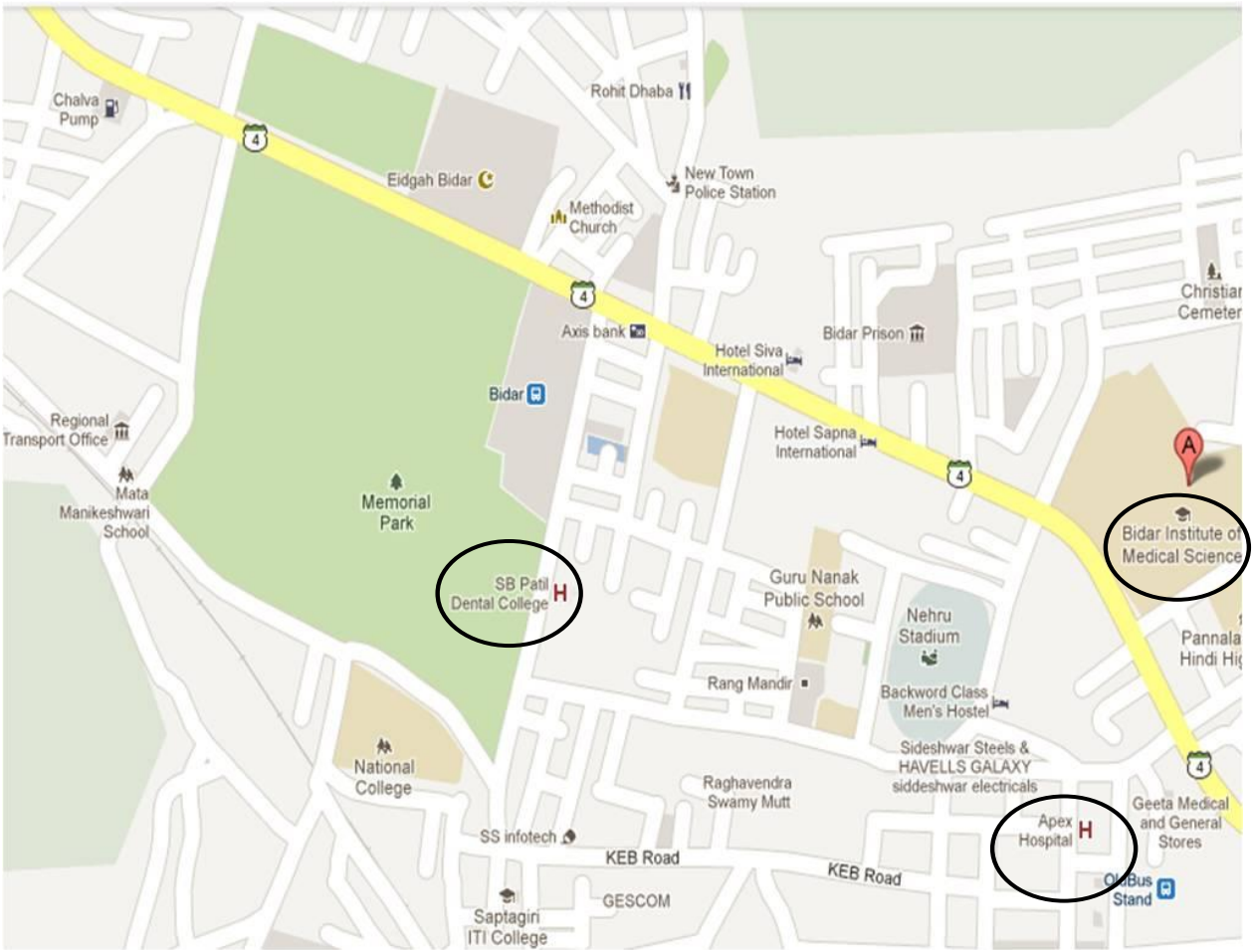
Source: http://www.census2011.co.in/census/district/246-bidar.html

iii. ***Health Facilities:*** Some of the important healthcare facilities in the Bidar city are following:

1. Apex Hospital

2. Guru Nanak Hospital
3. SB Patil Dental College &Hospital
4. Dr. Prabhu Nursing Home , Bidar
5. Mathu Shree Nursing Home , Bidar

Overall one urologist is present in the city at present. Information collected from the medical circle is that a new multispecialty private hospital is coming up in the city which will provide services of neurosurgeon and other super specialists. Similarly one radiologist is planning to open the diagnostic centre in the city with CT and MRI scan facilities. Currently two CT scan facilities are available in the private sector. Both these centers are at 15-20 minutes walking distance from the BRIMS.



C. Hassan Institute of Medical Sciences Hassan

Hassan Institute of Medical Sciences (HIMS), started in 2006 by Government of Karnataka, is one of the reputed medical colleges in Karnataka. The college is affiliated to Rajiv Gandhi University of Health Sciences (RGUHS). HIMS conducts an undergraduate course in the field of medical science, that

is, Bachelor of Medicine and Bachelor of Surgery (MBBS). Currently this institute has all the basic clinical specialties but no super specialty. Institution has more than 30 acres of land out of which around 10 acre is available for further extension.

- ***Address:*** Hassan Institute of Medical Sciences, Sri Chamaranjendra Hospital, HASSAN - 573 201
- ***Phone:*** 08172-231699, 250330
- ***Email :*** info@hims-hassan.org, directorhims@yahoo.com
- ***Website :*** www.hims-hassan.org

iv. ***Hassan district:*** District Hassan is located in the South-Western corner of the state It is surrounded by Chikmagalur district to the North-West, Chitradurga district to the North, Tumkur district to the East, Mandya district to the South-East, Mysore to the South, Kodagu district to the South-West and Dakshina Kannada district to the West. Majority of the district population (78.77%) resides in rural areas.

v. ***Demographic profile:*** District has a population of 17.76 Lakh persons as per 2011 census and it has gone up by 3.17 percent compared to 2001 population. Following table gives the demographic details of Hassan district:

Total population	1,776,221
Male	885,807
Female	890,414
Population growth	3.17%
Density/Km^2	261
Proportion to Karnataka population	2.91%
Sex ratio	1005
Average Literacy	75.89%
Male Literacy	83.55%
Female Literacy	68.30%
Total Child Population (0-6 years)	155,579
Child Proportion (0-6 years)	8.76%

Source: http://www.census2011.co.in/census/district/257-hassan.html

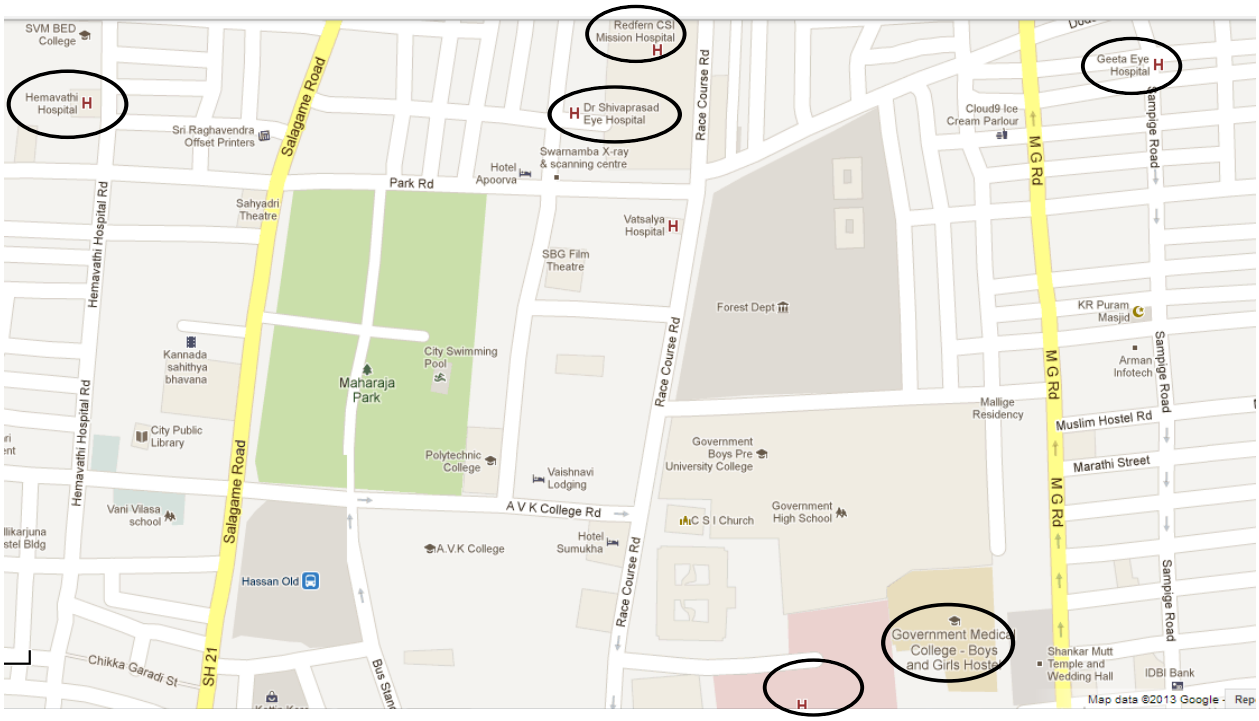
vi. ***Health Facilities:*** The district health department provides services through network of 8 Government Allopathic Hospitals with 1383 beds, 69 Indian System of Medicine Hospitals with 119 beds, 56 Private Hospitals (including nursing home) with 811 beds, 15 Community Health Centre with 450 beds, 99 Primary Health Centre with 515 beds, 55 Primary Health Units, 10 number of '108' ambulances, 178 Dispensaries, 18 family welfare centre and 378 Sub-Centre. Hassan town has a district hospital with 500 beds[10].

[10] http://www.hassan.nic.in/htmls/dc/disastermgmt/Hassan_DDMP.pdf

Some of the important healthcare facilities in the Hassan city are following:

1. Government Hospital Hassan
2. Mangala Hospital
3. Swarnamba X-ray and scanning centre
4. Vatsalya Hospital
5. Redfern CSI Mission Hospital
6. HSM Hospital
7. Dr. Shivaprasad Eye Hospital
8. Jan Kalyan Trust
9. Hemavathi Hospital

Overall three CT and one MRI scan machines are available in Hassan. CT scans are in private hospitals while MRI scan is in standalone private diagnostic centre. Information collected from the medical circle revealed that one super specialist in urology is based in the city while super specialists in neurology, neuro-surgery and cardiology visit private hospitals of the city frequently from Mysore or Bangalore city.



D. Mandya Institute of Medical Sciences Mandya

Mandya Institute of Medical Sciences (MIMS), Mandya was established in 2006. The college is affiliated to Rajiv Gandhi University of Health Sciences (RGUHS) and approved by Medical Council of

India (MCI), New Delhi. MIMS conducts an undergraduate course in the field of medical science, that is, Bachelor of Medicine and Bachelor of Surgery (MBBS), currently it has all basic clinical specialties but no super specialty.

- ***Address:*** Bangalore-Mysore Road, Mandya, Karnataka, India - 571401
- ***Phone:*** 08232 - 222086, 231197, 401198, 231001
- ***Email :*** mimsmandya@gmail.com

i. ***Mandya city:*** It is situated on Bangalore-Mysore State Highway 17, at 40 km from Mysore and 100 km from Bangalore. This city is the headquarters of Mandya district which came into existence on 1st July 1939. Mandya District is one of the most agriculturally prosperous districts in Karnataka where Sugarcane & Paddy are grown in abundance. District is covered by four districts of the state, on the north by Tumkur & Hassan, Mysore on the South, Bangalore (Rural) towards East and Hassan & Mysore towards west.

ii. ***Demographic profile:*** The district has a population of 18 Lakh persons as per 2011 census and the district population has gone up by 2.55 percent compared to 2001 population. A demographic profile of Mandya district is as below,

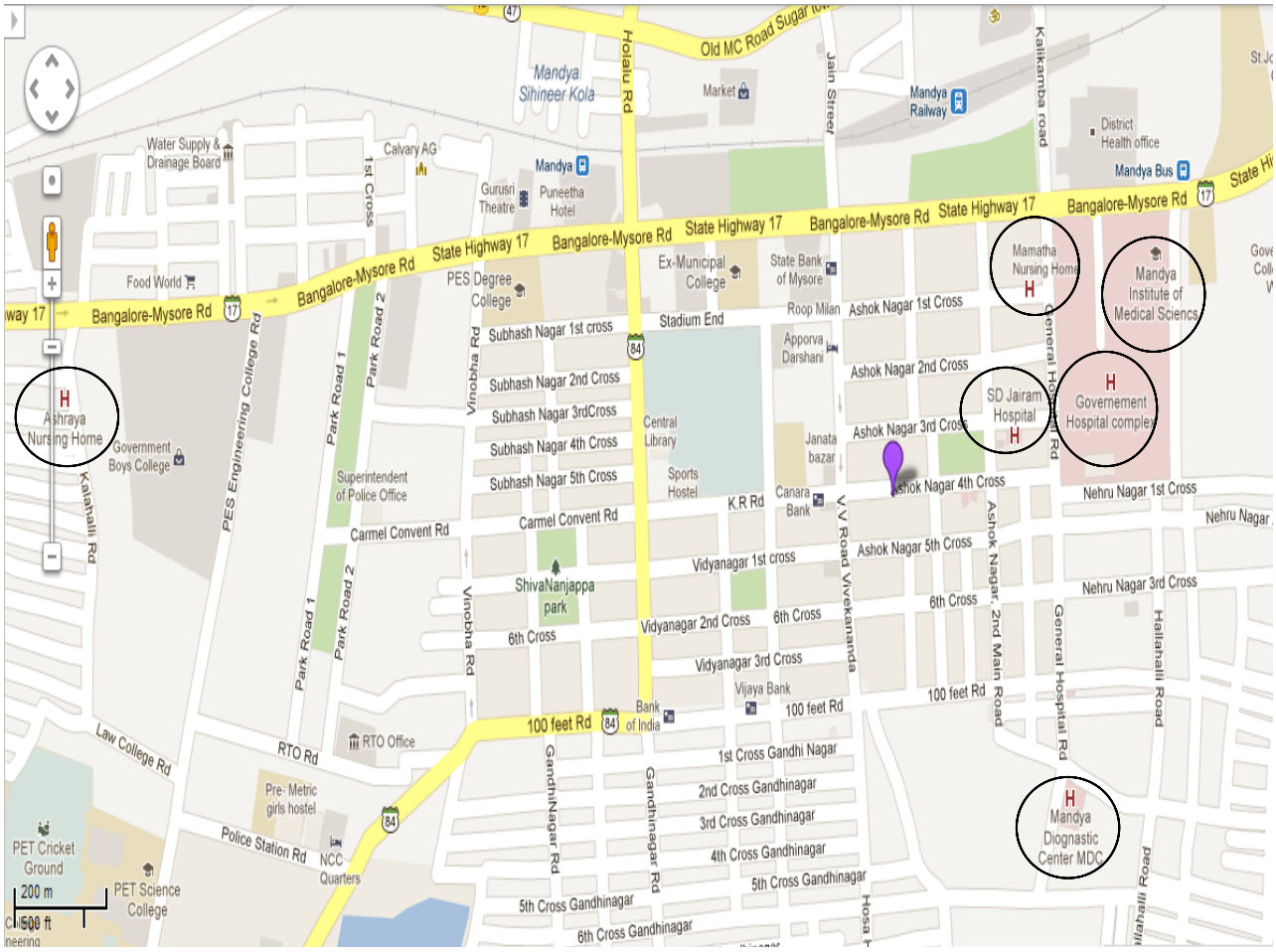
Total population	1,808,680
Male	909,441
Female	899,239
Population growth	2.55%
Density/Km^2	365
Proportion to Karnataka population	2.96%
Sex ratio	989
Average Literacy	70.14
Male Literacy	78.14
Female Literacy	62.10
Total Child Population (0-6 years)	162,147
Child Proportion (0-6 years)	8.96%

Source: http://www.census2011.co.in/census/district/262-mandya.html

iii. ***Health Facilities:*** Apart from government medical college cum hospitals, Mandya district has following important Health Facility Centers

a. Archana Hospital – Mandya
b. Ashraya Maternity Home
c. Kaveri Nursing Home – Malavalli
d. Mamta Nursing Home
e. Mandya ENT Care and Hospital
f. Matha Nursing Home

g. Nandini Nursing Home
h. Sanjo Hospital
i. Santhathi Infertility and Maternity Centre
j. Sri Adichunchanagiri Hospital and Research Centre
k. Sri Venkateshwara Nursing Home
l. Surabhi Hospital – Mandya
m. Suraksha Nursing Home – Malavalli
n. Vaatsalya Hospital - Malavalli



E. Raichur Institute of Medical Sciences Raichur

Raichur Institute of Medical Sciences, Raichur (RIMS) came into being in 2007. The college is affiliated to Rajiv Gandhi University of Health Sciences (RGUHS) and approved by Medical Council of India (MCI), New Delhi. The institute is managed by State Government of Karnataka. MIMS conducts an undergraduate course in the field of medical science, that is, Bachelor of Medicine and Bachelor of Surgery (MBBS).

- ***Address:*** Hyderabad Road, Raichur
- ***Phone:*** 08532-235488
- ***Email :*** info@rims-raichur.com
- ***Website:*** http://www.rims-raichur.com

i. ***Raichur district****:* The district is bounded on the North by the district of Gulberga, on the West by the districts of Bijapur and Dharwar, on the East by the district of Mababoob Nagar of Andhra Pradesh, and on the South are the districts of Kurnool also of Andhra Pradesh and Bellary. It is located 409 km from the state capital, Bangalore

ii. ***Demographic profile****:* District population has gone up by 15.27 percent compared to 2001 population. Following table gives the demographic details of the district:

Total population	1,924,773
Male	966,493
Female	958,280
Population growth	15.27%
Density/Km^2	228
Proportion to Karnataka population	3.15%
Sex ratio	992
Average Literacy	60.46
Male Literacy	71.35
Female Literacy	49.56
Total Child Population (0-6 years)	272,703
Child Proportion (0-6 years)	14.17%

Source: http://www.census2011.co.in/census/district/264-raichur.html

iii. ***Health Facilities:*** Some of the hospitals and nursing homes in the Raichur city are following:

1. Government Hospital
2. M.K. Bhandari Hospital
3. Chavadki Hospital
4. Rajiv Gandhi Super Speciality Hospital
5. Sri Lakshmi narayan Nursing home
6. Gokul Maternity Nursing Home

F. Shimoga Institute of Medical Sciences Shimoga

Shimoga Institute of Medical Sciences, Shimoga (SIMS) situated at a prime location in Shimoga city, came into being in 2005. However the year of inception of college was 2007. The college is affiliated to Rajiv Gandhi University of Health Sciences (RGUHS) and approved by Medical Council of India (MCI), New Delhi. SIMS conducts an undergraduate course in the field of medical science, that is, Bachelor of Medicine and Bachelor of Surgery (MBBS). Currently institution is having all the basic clinical specialties but no super specialty.

- ***Address:*** District McGann Hospital Compound Sagar Road, Opp. Police Ground, Shimoga
- ***Phone:*** 08182-229933, 229963, 255655
- ***Email :***drshankarg@yahoo.in
- ***Website:***http://www.karnataka.gov.in/sims

i. ***Shimoga districts**:* Shimoga district is located in the central part of the state of Karnataka. It is bounded by Haveri District to the northeast, Davanagere District to the east, Chikmagalur District to the southeast, Udupi District to the southwest, and Uttara Kannada to the northwest.

ii. ***Demographic profile**:* District population has gone up by 6.88 percent compared to 2001 population. Following table gives the demographic details of the district:

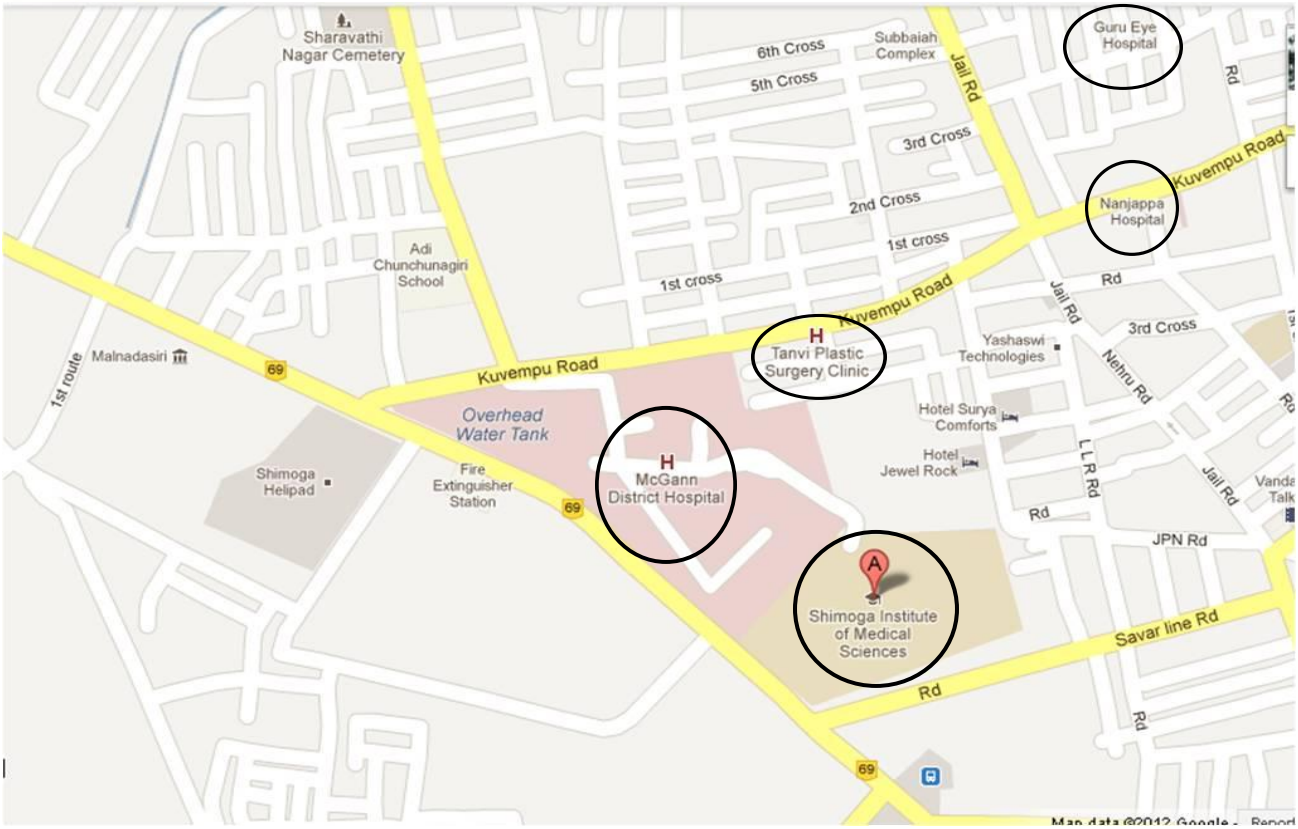
Total population	1,755,512
Male	879,817
Female	875,695
Population growth	6.88%
Density/Km^2	207
Proportion to Karnataka population	2.87%
Sex ratio	995
Average Literacy	80.50
Male Literacy	86.11
Female Literacy	74.89
Total Child Population (0-6 years)	176,904
Child Proportion (0-6 years)	10.08%

Source: http://www.census2011.co.in/census/district/266-shimoga.html

iii. ***Health Facilities**:* Some of the hospitals and nursing homes in the Shimoga city are following :

a. Guru Eye Hospital
b. Nanjappa Hospital
c. McGann Hospital
d. Mallard cancer Hospital

Overall one neurosurgeon, 2 urologists and 3 neurologists are practicing in the city. Currently there are 3 CT and 2 MRI scan centers are available in private sectors.



4.4 As Is Analysis

A. Belgaum Institute of Medical Sciences

Type of Hospital	Upgraded District Hospital
Sanctioned Bed Strength	Proposed - 1000 Beds Current – 740 Beds

Departments and Specialties Available			
1	Medicine	9	ENT
2	T.B. & Chest	10	Ophthalmology
3	Psychiatry	11	OBG
4	Skin	12	Radiology
5	Pediatrics	13	Anaesthesia
6	Dental	14	Dialysis
7	Surgery	15	Physiotherapy
8	Orthopaedic	16	Medical Records

BIMS HOSPITAL, RADIOLOGY DEPARTMENT EQUIPMENTS

Sr. No.	Name of the Particulars	Quantity
1	300 MA X - Ray Machine	1
2	Eltop portable X - ray machine 15 MA (IBMH)	1
3	160 MA SIEMENS X- ray machine surgical block	1
4	60 MA mobile X -ray vipro IGE (07)	1
5	500 MA Siemens X - ray machine IITV flouro 3000R	1
6	C-arm Intensifier Siemens	1
7	Fuji computed radiography	1
8	Philips 800 MA X -ray unit	1
9	Philips 300 MA X ray unit	1
10	Allengers 60 MA mobile X ray unit	1
	List of Ultrasound Machines	
1	Accuson X-300 colour Doppler & ultrasound machine	1
2	Siemens Sonoline curvilinear and sector probs	1
3	Metrose portable ultrasound unit	1
4	Aloka SSD 1100, curvilinear and TVS probes	1
5	Accuson X-premium with 3D & 4D probes Ultrasound unit	1
6	Philips i22 Ultrasound colour Doppler System	1

Institution's utilization data for previous years was collected while contemplating this project. This data which is relevant to MRI project has been tabulated below:

GOVERNMENT OF KARNATAKA						
MEDICAL RECORDS DEPARTMENT, B.I.M.S. HOSPITAL, BELGAUM.						
COMPARATIVE STATEMENT OF HOSPITAL STATISTICS FOR THE LAST 5 YEARS						
Total No. of OPDs	**YEAR**	**2008**	**2009**	**2010**	**2011**	**2012 (Till February)**
	NEW	173464	182869	187938	180114	29633
	OLD	157621	150111	162970	182998	27535
	TOTAL	332030	333365	350980	363112	57168
Daily Average		909.6	913.3	961.39	994.82	952.8
Total No. of IP treated		28382	31730	37249	34913	5571
Daily Average		78	86.9	102.0	95.65	92.85
Total No. of Deaths		1431	1567	1729	1503	247
Daily Average		04	4.2	4.73	4.11	4.11

Total No. of USG	8190	1264.9	14203	13082	2182
Daily Average	22.4	34.6	38.91	35.84	36.36
Total No. Of Operations Major	5604	5495	9745	6530	1195
Daily Average	15.2	15.05	18.47	17.89	19.91
Minor	7577	7272	9520	7862	1246
Daily Average	21	19.9	26.08	21.5	20.76
Total NO. of X-rays	30127	36612	39671	34798	5967
Daily Average	82.5	100.3	108.6	95.33	99.45
Total No. of ECGs	6400	4150	4303	4586	695
Daily Average	17.5	11.36	11.78	12.56	11.58
Total MLCs	5056	6257	6815	6357	1032
Daily Average	14	17	18.6	17.41	17.2
Total No. of PMs	669	706	745	745	123
Daily Average	02	02	2.0	2.04	2.05
IPD	-	-	-	-	264
Daily Average	-	-	-	-	4.4
Patients with Road Traffic Accidents				1214	
Patients reported in casualty (OPD+IPD)				37206	

B. Bidar Institute of Medical Sciences

Type of Hospital	Teaching Hospital
Sanctioned Bed Strength	Proposed –700 Beds Current – 500 Beds

Departments and Specialties Available			
1	Medicine	8	Skin & VD
2	Surgery	9	Psychiatrics
3	OBG	10	Dental
4	Paediatrics	11	Casualty

5	Orthopaedics	12	Pulmonary Medicine
6	ENT	13	ART Center
7	Ophthalmology		

Institution's utilization data for previous years was collected while contemplating this project. This data which is relevant to MRI project has been tabulated below

GOVERNMENT OF KARNATAKA					
MEDICAL RECORDS DEPARTMENT, B.R.I.M.S. HOSPITAL, BIDAR.					
COMPARATIVE STATEMENT OF HOSPITAL STATISTICS FOR YEAR 2007 TO 2011					
	2007	**2008**	**2009**	**2010**	**2011**
Total number of OPD	287359	333155	387357	385767	373007
Casualty	17596	23975	32795	33666	37206
Total number of IPD	21897	22979	30375	29265	30829
Number of Deaths	624	660	711	700	790
Number of Births	3949	4454	5950	6102	6258
Number of PM conducted	209	259	311	334	327
Major Operations	1997	2471	2989	3069	3226
Minor Operations	697	676	671	2482	4797
Lab Investigations		131065	209443	258284	296506
Radiology Investigations		8429	15642	17249	18604
RTA cases	1421	1346	1700	1639	1824
Assault Cases	923	909	1005	1106	1214
Fall Cases	254	284	350	291	373
Crush Injury Cases	34	61	53	24	23
Train Accident cases	12	6	1	4	4
Alcohol Accident Cases	218	209	164	216	241
Blunt Injury	116	127	169	144	214

C. Hassan Institute of Medical Sciences, Hassan

Type of Hospital	Teaching Hospital
Sanctioned Bed Strength	1300 Beds

Departments and Specialties Available			
	Medicine		Psychiatry
2	General Surgery	8	T.B. & Chest
3	ENT	9	Dermatology

4	OBG & Gynae Skin	10	Orthopaedic
5	Ophthalmology Pediatrics	11	Pediatric
6	Radiology		

HIMS HOSPITAL, RADIOLOGY DEPARTMENT EQUIPMENTS

Sr. No.	Name of the Particulars	Quantity
1	300 MA X - Ray Machine	1
2	Portable X - ray machine 100 MA	5
3	500 MA X- ray machine	2
4	600 MA X -ray machine (Not working)	1
	List of Ultrasound Machines	
1	USG machines	3
2	Colour Doppler & ultrasound machine (in pipeline)	1
3	Foetal Doppler	1
	List of Endoscopes	
1	Colonoscope	1
2	Sigmoidoscope	1
3	Laparoscope	1

Institution's utilization data for previous years was collected while contemplating this project. This data which is relevant to MRI project has been tabulated below:

GOVERNMENT OF KARNATAKA					
MEDICAL RECORDS DEPARTMENT, H.I.M.S. HOSPITAL, HASSAN					
COMPARATIVE STATEMENT OF HOSPITAL STATISTICS FOR THE LAST 5 YEARS					
Parameter	**2008**	**2009**	**2010**	**2011**	**2012**
Total No. of OPDs	380736	509321	516228	526595	463071
Daily Average	1228	1643	1665	1699	1494
Total No. of IPD	26151	35338	31910	36635	37005
Daily Average	72	97	87	100	101
Total No. of patients in emergency (OPD+IPD)	7864	8936	8648	9153	9639
Daily Average	22	24	24	25	26
Total No. of Deaths	654	463	574	518	533
Daily Average	2	1	2	1	1

Total No. Of Operations Major	5944	6061	6217	5472	6073
Daily Average	16	17	17	15	17
Total No. Of Operations Minor	3681	4116	4538	5146	5631
Daily Average	10	11	12	14	15
Total No. of USG	13138	17525	15670	3866	6775
Daily Average	44	58	52	13	23
Total No. of X-rays	27329	29158	29194	26650	17951
Daily Average	91	97	97	89	60
Total No. of ECGs	10950	12775	13879	14608	15331
Daily Average	37	43	46	49	51
Total Patients with Road Traffic Accidents	1018	1314	1436	1518	1739
Total MLCs	2311	2416	2349	2516	2934
Daily Average	8	8	8	8	10
Total No. of Postmortems	488	421	562	610	603
Daily Average	2	1	2	2	2

D. Mandya Institute of Medical Sciences Mandya

Type of Hospital	Teaching Hospital of MIMS
Available Bed Strength	500 Beds

Departments and Specialties Available			
1	General Medicine	7	ENT
2	Psychiatry	8	Ophthalmology
3	Dermatology	9	Obstetrics & Gynaecology
4	Pediatrics	10	Anaesthesiology
5	Dental	11	Orthopedic
6	General Surgery	12	Casualty & Emergency

Institution's utilization data for previous years was collected while contemplating this project. This data which is relevant to MRI project has been tabulated below:

GOVERNMENT OF KARNATAKA					
M.I.M.S. HOSPITAL, Mandya					
COMPARATIVE STATEMENT OF HOSPITAL STATISTICS FOR THE LAST 5 YEARS					
Parameter	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**
Total Out Patient (OPD)	264961	270955	372297	393576	376630
Total In Patient (IPD)	23368	24942	27146	28802	29183
Total Surgeries	3461	4741	4663	5974	5805
X-Rays Examination					
	2007	**2008**	**2009**	**2010**	**2011**
Out Patient Department		17510	20078	22339	25868
In Patient Department		7086	6785	6088	6441
Total No. of X-Rays		24596	26863	28427	32309
Clinical Biochemistry Laboratory					
	2007	**2008**	**2009**	**2010**	**2011**
Out Patient Department	32478	40429	51948	58363	69606
In Patient Department	17487	21766	27972	31454	37483
Total No. of investigations	49965	62195	79920	89817	107089
Daily Average	137	170	219	246	293
Laboratory Investigations					
	2007	**2008**	**2009**	**2010**	**2011**
Hematology	66392	116245	86630		
Clinical Pathology	32565	42921	29830		
Cytology	1377	1358	1525		
Histopathology	1268	1040	1042		
Total No. of investigations	101602	161564	119027		
Microbiological Investigations					
Parameter	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**
Serology	12338	12713	15587	17557	19472
Parasitology	9783	5728	6162	1525	3234
Mycology	237	356	317	763	354
Bacteriology	265	616	630	2399	889

Type of Hospital	Teaching Hospital
Sanctioned Bed Strength	Proposed - 850 Beds Current - 500 Beds

Departments and Specialties Available			
1	Medicine	6	Orthopaedics
2	Paediatrics	7	OB &Gynaecology
3	Psychiatry	8	ENT
4	Skin	9	Ophthalmology
5	Surgery	10	Dental

RIMS HOSPITAL, RADIOLOGY DEPARTMENT EQUIPMENTS

Sl. No	Particulars of Machines	Capacity MA/KBP	Date of Supply	Working or Not
1	X-Ray Plats Siemens	500 MA	17/10/1991	Working
2	X-Ray Plats Siemens	100 MA	03-04-1991	Working
3	X-Ray Plats Allengers	60 MA	31/03/2006	Working
4	X-Ray Plats Wipro GE	50 MA	24/02/1981	Not Working
5	X-Ray Plats Portable	15 MA	NA	Working
6	Ultrasound RT3200 Wipro GE	2 Probes	25/06/1994	Working

Institution's utilization data for previous years was collected while contemplating this project. This data which is relevant to MRI project has been tabulated below:

GOVERNMENT OF KARNATAKA				
MEDICAL RECORDS DEPARTMENT, R.I.M.S. HOSPITAL, RAICHUR.				
COMPARATIVE STATEMENT OF HOSPITAL STATISTICS FOR YEAR 2009 TO 2012(TILL MARCH)				
	2009	2010	2011	2012 (Till March)
Total number of OPD	286571	256536	250769	81350
Casualty	12485	12485	16865	4386
Total number of IPD	12485	12485	16865	4386

Total Surgeries	6176	5488	7540	1726
Radiology Investigations	26652	31070	35901	-
RTA cases	949	901	988	190
Assault Cases	792	676	935	195
Fall Cases	228	12	10	5
Head Injury Cases	23	2	7	0
Train Accident cases	4	0	0	0
Threshe Accident Cases	0	0	17	0
Blunt Injury	5	0	0	0
Lab Investigations	-	447643	170604	88528

G. Shimoga Institute of Medical Sciences Shimoga

Type of Hospital	Teaching Hospital
Sanctioned Bed Strength	Proposed - 1000 Beds Current - 650 Beds

Institution's utilization data for previous years was collected while contemplating this project. This data which is relevant to MRI project has been tabulated below:

Total Number of Patients	**Year 2009**	**Year 2010**	**Year 2011**
Total No. of OP	306777	298961	280186
Total No. of IP	58380	51256	45140
Total No. of Deaths	1290	1363	1236
Total No. of Deliveres	9394	8775	8772
No. of Ultra Sound Scan	9381	9308	7088
Major Operations	8848	7523	6853
Minor Operations	1024	3245	13217
Total No. of X-Rays	27752	27093	30011
Total No. of ECGs	7551	6683	6333
Total No. of MLCs	10531	10054	11382
Total No. of PMs	576	587	634
Casualty	23228	40210	24897
Laboratory	249388	230836	125087

VOLUME OF PATIENTS WITH NEUROLOGICAL DISORDERS, ACCIDENTAL INJURIES AND CANCER

District specific data on number of treated patients with Neurological disorders, Accidental Injuries and Cancer is not available. However, state data collected from public health institutions is available with Bureau of Health Intelligence Karnataka; this data is presented in graphical form.

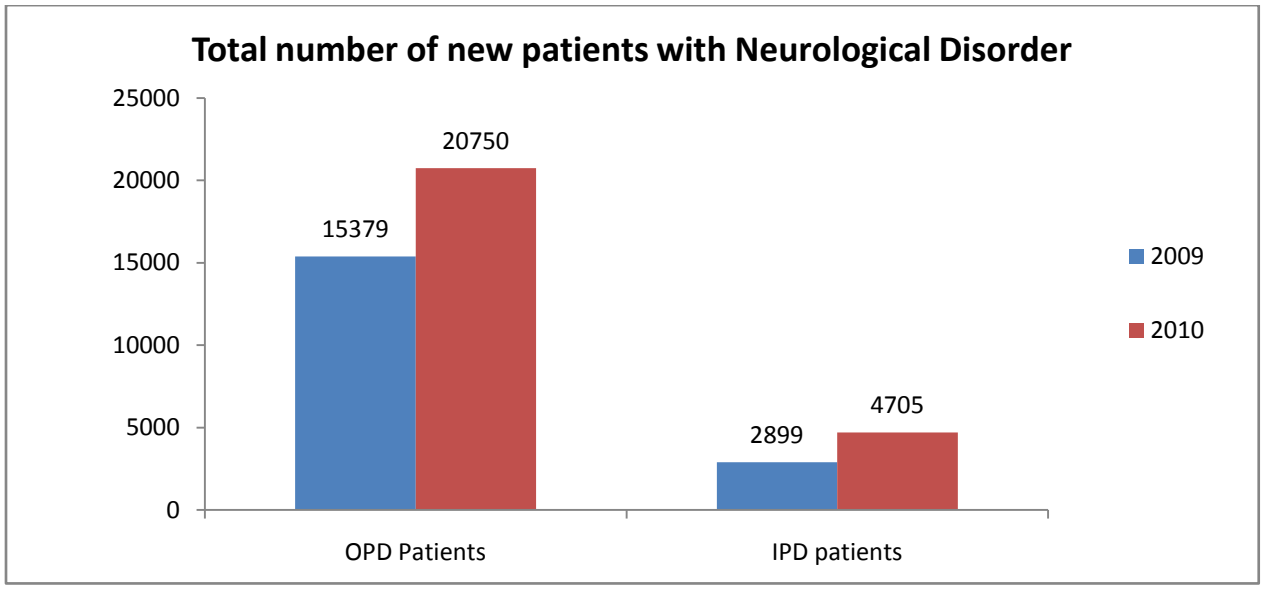


Figure 4.1: Total number of new patients with Neurological Disorder in Karnataka

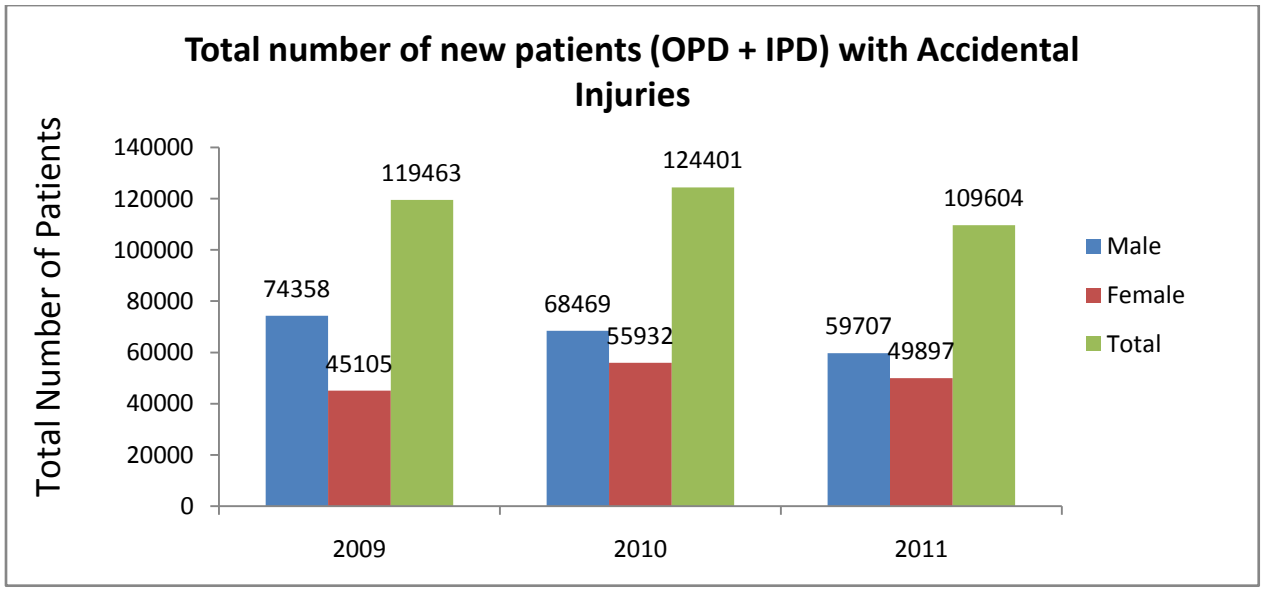


Figure 4.2: Total number of new patients (OPD + IPD) with Accidental Injuries in Karnataka

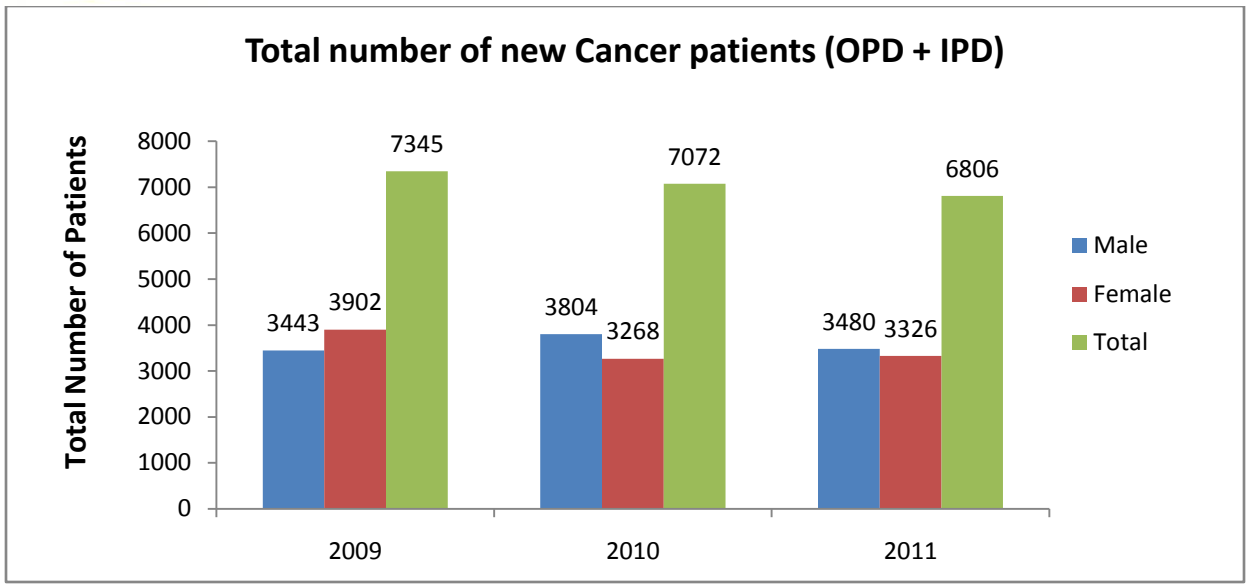


Figure 4.3: Total number of new Cancer patients (OPD + IPD) in Karnataka

***Every new registration is considered as new case.**

Most of these patients suffering from acute diseases require the services of an MRI to assess their health and to assist their treatment.

4.5 Interaction with stakeholders

For primary information, IMaCS visited above locations and interacted with radiologists and medical directors of the institutions about the requirements of advanced imaging device, availability of the infrastructure / land and feasibility of MRI scan centre with in the premises of the medical college hospital. IMaCS also interviewed few private imaging centers already operating MRI scans on PPP at few locations in India to capture their views. The key points captured are as below:

Key Take-away from the interaction with Head of Institutions:

1. There is need for setting up high end imaging facilities in Medical College Hospital for the following reasons
    a. Current need for MRI is being served by the high cost private facility and KLE hospital.
    b. Lack of adequate diagnostic facilities in the hospital leads to underutilization of the clinical services provided by the facility, due to this the interns and junior doctors do not get sufficient clinical exposure.
    c. It is desirable for post graduation course in radiology as there is acute dearth of radiologists in the state.

d. Technology aids enhance clinical care and leading doctors are preferring private sector for the innovative technology they bring to the hospital and service. This assists the doctors in swifter & accurate diagnosis and treatment of patients.
e. Government hospitals have huge footfalls, which justify investment in technology there. Even if the Government is willing, they have neither the skill sets nor the funds to invest in technology.

2. Government of Karnataka is in the process of providing CT scan on PPP mode in these hospitals, while it is operational in Shimoga, the process is yet to complete in other medical colleges.
3. The medical colleges welcomed the idea of providing MRI services in the hospital, and the concerted view was that it should be on PPP mode as the government does not have the requisite technical manpower to operate this.

Key Take-away from the interaction with Private Service providers:

1. The private sector agrees to the existence of potential for PPP in the healthcare diagnostic sector. However, private players are not comfortable with the long drawn processes involved with government projects
2. Private players are keen to opt for PPP model in big cities where there are multiple referral doctors and where penetrating the market is strategically or economically gainful.
3. The private sector called for effective processes and systems to be put in place both during the formulation of the PPP and operationalisation of the contract.
4. The private institutes are of the opinion that the operating efficiency of diagnostic equipments in government hospitals is very limited.
5. The private sector was wary of the assurance of being preferred provider of service in a PPP contract as the government doctors may prefer to the prevalent “cut practice” of private imaging centers for them. As a result, the project breakeven takes longer than running a private standalone unit.
6. The private sector expects the government to ensure footfalls to generate adequate revenues to support the operation and enjoy optimal profits.
7. The private sector also asked for clean and conducive environment for operating the MRI centre on PPP, they opined that private customers may not prefer the centre if the surroundings are not kept clean and tidy.
8. A participatory approach is required from the hospital hosting the PPP centre and immediate relief for day to day operational issues was sought for.
9. The private sector wanted to be free of any political and preferential treatment obligations while delivering the PPP service as this would compromise their service quality.
10. The private sector observes that PPP is attractive in metros for land at prime locations becomes available to the private party which otherwise is not available even at high costs; however, this is not an attractive option for tier II & tier III cities where land near / in front of the institution is available.

Inputs from the equipment manufacturer partnering a PPP:

1. Equipment manufacturers are keen to collaborate with the government in PPP projects but preferred a service provider to be included in the contract. The service provider will be responsible for the service delivery and the equipment manufacturer will be responsible for installation and maintenance
2. The Terms of Reference of the project have to be clear on the project outcomes, the risk sharing, the roles and responsibility of each partner and the default conditions
3. The private partners expect a minimum load to be provided by the government to generate adequate revenues to support the operation and enjoy optimal profits
4. The cost of construction of infrastructure or renovation should be considered

4.6 Selection of MRI machine model and planning consideration

The selection of MRI model should be done based on the requirements of the facility at the same time planning for the future requirements. Model specification should be based on the available super specialties / specialties, available skill set of technical manpower.

4.6.1 Selection of MRI machine model

Three MRI formats are currently in use and the most prevalent is the “closed or bore format”, the magnetic field generated by a bore format MRI resembles a lozenge shape for which the magnetic field is primarily horizontal. The second most prevalent format is “open style” which often consists of magnetic fields generated from above and below the patient scanning area. Magnetic fields of open format magnets are more vertical in orientation and may present particular challenges with respect to occupancies and equipment located above and below the MRI scanning room. “Stand up” format magnets are essentially open magnets, turned on their side, the gross shape of the magnetic field generated by a stand up format magnet will be more similar to that of a bore format magnet, with a greater horizontal component. It is important to note that the magnetic field for all MRI scanners, irrespective of strength or format, is a three-dimensional volume and requires appropriate site design considerations.

Based on the strength of the magnet, currently two kinds of MRI machines namely 1.5T and 3.0T are in vogue. The advantages and disadvantages of different varieties of MRI machines are given in the following table:

MRI machine	Advantages	Disadvantages
Closed	Produce high-quality images	The enclosed tunnel often causes anxiety especially to claustrophobic patients
Open	Good for patients who are claustrophobic, over sized, or handicapped	Imaging strength is not quite as strong as the traditional tunnel type MRI
Sitting	Patient scanned in the Standing or sitting position. This allows the radiologist to interpret the patients images more precisely as they were taken in the natural - weight bearing position that was initially causing the severity of the patients symptoms .	Imaging strength of the Open-Upright MRI is not quite as strong as the traditional tunnel type MRI
1.5T MRI scanner	Greater image quality	Comparatively longer scan time from 3.0T MRI scanner
3.0T MRI scanner	Best for visualizing very fine details, fast scan time	Costlier than 1.5T MRI scanner

Today many diagnostic centers and imaging institutes seek a high-field MR system that's comprehensive, affordable and intuitive, the challenge is to select a machine that doesn't compromise on anatomical capabilities or image quality. However after interaction with various industry experts and service providers IMaCS recommends 1.5T MRI machine which is a high-field MR system that is capable of performing brain, neck, spine, breast, musculoskeletal, abdominal and vascular exams, with very good anatomical capabilities and image quality. It should be also able to perform angiography studies for stroke, brain—including Diffusion/MR Spectroscopy for tumors—and all routine spine and joint examinations. However very high-end cases like cardiac and real time functional MRI cannot be done, but a diagnostic centre's routine work on brain, spine, breast and joints can be done on this machine. With high cost effectiveness, shorter scan times for procedures, fewer coil changes, less time training staff and smaller footprint leading to power savings the 1.5 T machine is an ideal choice for a entry level yet comprehensive MRI machine.

4.6.2 Planning considerations

Magnetic Resonance Imaging (MRI) uses strong magnetic fields to induce resonance at the nuclear (atomic) level. As the orientation of the magnetic field is manipulated and atoms are knocked off-axis, they emit faint radio frequency energy as they return to their polar orientation. These emissions are measured and allow a computer image to be created by the analysis of the frequencies emitted by resonating atoms comprising cell structures. The image is electronically enhanced, recorded on video, stored on tape or optical disk and reproduced as a laser image.

Unlike conventional X-ray and X-ray-based imaging technologies, such as Computed Tomography (CT), MRI acquires images without the use of ionizing radiation. The magnetic fields generated by contemporary clinical MRI equipment are tens of thousands of times greater than the Earth's own magnetic field as we experience it. To generate such powerful magnetic fields for clinical imaging, electromagnets are used which generate the magnetic field from electricity passing through a magnetic coil. Most electromagnetic clinical MRIs use coils which are bathed in cryogenic liquid (typically liquid helium) to make them superconducting. These unique properties of Magnetic Resonance Imaging result in a number of distinct planning, seating and operational challenges.

Ideally Magnetic Resonance Imaging should be a part of the Medical Imaging Unit of an institution having other associated and complimentary imaging modalities like X-ray, CT scan etc. for following reasons:

a. It decreases the overall cost of installing all imaging devices in the institution. These imaging devices demand specific infrastructural requirements for patient and staff safety. So grouping them at one place will decrease the overall cost. Moreover, this arrangement permits economies of shared facilities, functions and staff
b. MRI is a costly investigation that should be used where it has distinct advantage over other imaging devices. Irrational use of this modality will increase the treatment cost of the patient without any added benefit by substituting cheaper investigations by more expensive ones.

Ideally while setting up a MRI scan centres in teaching hospital certain considerations are to be kept in mind;

1) Location at ground floor with proximity to OPD, IPD and casualty
2) Patient and staff comfort & safety
3) Work flow in the department
4) Radio frequency shielding and passive magnetic shielding for radiation protection
5) Voltage regulation equipment is required
6) Environmental issues like room humidity and temperature of the MRI machine room
7) Teaching facilities require more technical support space
8) Seismic provision applicable to that geographical location

4.7 Best case studies for similar projects in India

In India currently various MRI scans in public facilities are running on PPP mode, the states where MRI is given on PPP are,

i. Andhra Pradesh
ii. Gujarat
iii. Karnataka
iv. Madhya Pradesh
v. West Bengal
vi. Rajasthan
vii. Delhi
viii. Uttara Pradesh
ix. Uttarakhand
x. Himachal Pradesh (in pipeline)

Few case studies have been tabulated state wise in the following table:

Selected PPP projects in MRI scan facility in India						
	Rajasthan	***Andhra Pradesh***	***Bihar***	***Uttarakhand***	***Karnataka***	***New Delhi***
Name of the Hospital and Location	Sawai Man Singh Hospital, Jaipur	Four teaching hospitals located in Vishakhapatnam, Kakinada, Kurnool and Warangal	Regional Diagnostic Centers in Ara, Gaya, Bhagalpur, Munger, Muzaffarpur, Motihari, Purnea, Saharsa and Chapra. **(Total 9 RDCs)** Government Medical College Hospitals –	Doon Hospital Dehradun	Krishna Rajendra (KR) Hospital attached to the Mysore Medical College and Research Institute (MMCRI)	Sports Injury Centre (SIC), Vardhman Mahavir Medical College & Safdarjung Hospital

			PMCH, NMCH, SKMCH, DMCH, ANMMCH, JLMNCH **(Total 6 MCHs)**			
Type of hospital	Government-run tertiary care hospital and medical college	Teaching hospitals	Regional Diagnostic Centers and Government Medical College Hospitals	District Hospital	Medical College Hospital	Tertiary care hospital
PPP type / scope	Install, operate and maintain	Design, Finance, Build, Operate and Transfer	To operate, maintain and report 24-hours	Operation & Maintenance of 1.5T MRI machine	Install, operate and maintain	Install, operate and maintain
Year of award	2006	2010	in the process of being set up	2009	2011	2010
Project Duration	7 years	7 years	10 years	5 years		10 years
Private provider	Vardhaman Medicare Private Limited	Wipro GE Healthcare Pvt. Limited And Medall Healthcare Private Limited	M/s Softline, New Delhi and M/s Doyen Diagnostics, Kolkata	Mahajan Imaging Pvt. Ltd. New Delhi	Bangalore-based Wipro-GE and Chennai based Medall companies	Mahajan Imaging Pvt. Ltd. New Delhi
Services provided	Magnetic Resonance Imaging (MRI) and Computerized Tomography (CT) scan facilities to patients at low rates within the hospital premises		Pathology- Bio-Chemistry, Radiology – Digital x-ray, CT scan, MRI, ECG, Mammography.	Magnetic Resonance Imaging (MRI)	Magnetic Resonance Imaging (MRI)	Magnetic Resonance Imaging (MRI), Computerized Tomography (CT) scan and X-ray facilities to patients at low rates within the hospital premises

Project cost	Monthly rent Rs. 5000, payment of electricity and water connections, staff salaries, security and maintenance of premises	Rs. 25 crores (VGF to the tune of Rs. 2.8 crores provided by the government)		6.78 crores by government and 1.75 crores by the PPP partner		Revenue sharing based PPP model
Link	1		2	3	4 + Information collected through personal interview at the location	Information collected through personal interview at the location

1. http://ppphealth.org/index.php?option=com_content&view=article&id=137&Itemid=525
2. http://health.bih.nic.in/Docs/HD-BestPractices-PPP-Initiatives.pdf
3. http://cell.upppc.org/index.php?option=com_content&view=article&id=54:doon-mri-ppp&catid=60:project-monitoring&Itemid=46
4. http://www.mysoretrendz.com/News/newsdetail.aspx?id=19816&y=8/31/2011

4.8 Case Study of imaging centre on PPP mode in Netaji Subhash Chandra Bose (NSCB) Medical College and Hospital at Jabalpur

Netaji Subhash Chandra Bose (NSCB) Medical College and Hospital at Jabalpur in Madhya Pradesh (MP) is the second largest medical college hospital in the state. It was not equipped with CT and MR facilities till 2007 to aid diagnosis. In the absence of these facilities doctors were compelled to send trauma and emergency patients to private centres for scans. Even the private imaging centres in Jabalpur did not have advanced imaging facilities; they either had a very basic 0.2 Tesla MRI or single slice CT or old axial CT. Moreover due to the poor road conditions and distance of these centres from NSCB Medical College and Hospital, many critical patients succumbed during the transportation of the patient. So many times doctors preferred doing conservative treatment rather than sending patient for scanning. As a result, no surgical procedure could be planned, and treatment was delayed due to lack of proper diagnosis, often leading to severe irreversible disability in patients.

In 2007 MCI regulations made it compulsory for Medical College Hospitals offering PG in radio diagnosis to have CT scan, desirably a MRI scan. State government, because of funds crunch, opted for installing these equipments on PPP mode in the hospital. A proper tender process was undertaken to choose private partners. Finally a tripartite agreement was inked between the Government of MP, Wipro GE and Sanya Hospitals & Diagnostic Centre to set up an imaging centre located in a building adjacent to the medical college hospital and within the premises of the hospital campus. While the Government provided rent-free land to set up the centre, Sanya Diagnostics invested capital to construct the building and install the equipment. GE Capital funded Sanya for procuring the equipments from Wipro GE. The centre, spread over 3,000 square feet, was commissioned in November 2007. Wipro GE installed 1.5 Tesla MRI and 16 slice CT in the centre which is manned by a posse of 20 local radiologists, radiographers and staff trained by Sanya. It is operational 24X7.

The centre provides services to both public and private patients. 40 percent of its patient volume comes from the medical college hospital and the rest comes from the private sector. Sanya has tied up with 10 hospitals in Jabalpur for regular referrals. Separate tariff systems have been devised for patients (both BPL and affording) referred by the medical college hospital and patients from outside. For BPL and affording patients sent by NSCB Medical College and Hospital, the charges are reduced by 40 and 30 per cent, respectively. For BPL patients sent by the medical college, the Government reimburses the service provider. The centre receives around 800 patients per month for CT and around 400 for MR. The turnaround time for CT is one hour for non-emergency patients and immediate for emergency patients. For MR, the turnaround time is four hours for non-emergency patients and immediate for emergency patients.

This PPP experience has been very good and satisfying for the medical college hospital administration. It would have been very stressful for the institute to run this centre 24x7 due to dearth of trained manpower, fund crunch, lack of technical knowledge to handle and maintain high end diagnostic equipments.

Now patients no longer have to bear the inconvenience of venturing outside the campus for imaging. Secondly it has reduced the treatment cost of patients by a significant 30-50 per cent. CT and MR are also helping medical students in their learning and their thesis research. Now more lives are being saved as doctors can clearly see diagnostic details that could only be assumed earlier.

This PPP model is still evolving and some teething problems are still being worked upon. For instance, there has been delayed reimbursement from the government for BPL patients due to red tape. Government and private players are continuously making efforts to make it user-friendly and hassle free.

4.9 Project Design

Type of Agreement

The project is being designed to be offered on Build, Own, Operate and Transfer (BOOT) mode to the successful bidder, the bid variable being the cost at which an MRI is provided. The project can be designed on two types of agreements,

1. Agreement between a private service provider and the government, where the service provider is in charge of procuring and managing the equipment, and providing the service
2. A tri partite agreement between the government, equipment manufacturer/ authorized dealer, and service provider - The service provider will be responsible for procuring the machine from the manufacturer/authorized dealer and delivering the service, and the manufacturer/authorized dealer will be responsible for the maintenance and upkeep of the machine.

It is preferable to go in for a tri partite agreement as this would encourage equipment manufacturers to be involved in the process there by reducing the cost of procuring, installing and managing the machine. This service provider will be responsible for operating the centre, providing the service and adhering to the laws and regulations that govern the process. The equipment manufacturer/authorized dealer and service provider can agree on the revenue sharing/costing of the equipment between them.

The primary roles and responsibilities of the three parties involved are as follows,

Roles and Responsibilities of the Government/Medical College

1. To provide the land (if available the building) for operating the MRI centre
2. Ensuring access to water and electricity
3. Providing laboratory, diagnostic and ambulatory support whenever required
4. Providing a conducive organizational atmosphere for the set up to operate
5. Ensuring minimum number of MRI cases per month

Roles and Responsibility of the Service Provider

1. Manning and operating the MRI centre 24X7 as per the terms of reference
2. Constructing/renovating the building to house the MRI centre within the agreed duration as per the TOR
3. Maintaining the supply chain of consumables
4. Recruiting, training and retaining of man power for the centre
5. Adhering to the applicable laws and regulations considering an MRI centre
6. Reporting as per the expected norms of the terms of reference
7. Coordinating with the medical hospital for delivering the services

8. To maintain the MRI equipment in operable condition 95% of the time
9. To provide the requisite assistance to the Medical College students and staff for conducting research, and teaching process without compromising the economic viability and technical quality of the service process

Roles and Responsibility of the Equipment Manufacturer/Authorized Dealer

1. To provide the MRI equipment as per the Terms of Reference
2. To provide appropriate support and service for maintenance of the MRI machine
3. To upgrade the equipment as per the requirement and agreement with the government and service provider

Contract Period

It is proposed that the MRI centre is provided on contract for a period of 10 years, following which it will be rebidded. The reasons for selecting 10 years as optimum concession period are following;

1. Life of a new MRI scan machine, if maintained well, is maximum 10 years.
2. Rapid Technological changes happening in the current era are making existing diagnostic technology obsolete in 3-5 years. So better MRI machines / newer radio-diagnostic tools will render current machines undesirable and non operational in coming 10 years.
3. Of the total capital investment of 6.32 crores, 90 percent is pertaining to the machinery. This percentage increases to 98% for scenario 2 of the proposed project model given ahead.

Cost of Service

The government shall bear the cost of utilities required for providing the service. The service provider shall charge the government a fixed amount towards each MRI provided, this shall be the bid variable during the process for finalizing the service provider and equipment manufacturer/authorized dealer. The government shall revise the service cost every two years as per the prevailing cost of inflation and service delivery.

It is to be noted that the service provider would have to collect user charges from the patients undergoing MRI treatment/diagnosis. The amount collected from the patients shall be deposited in a designated bank account and the government shall reimburse the service provider separately every month in proportion to the service provided.

The equipment manufacturer/authorized dealer and service provider can agree on the revenue sharing/costing of the equipment between them.

Chapter 5 - Project Financials

IMaCS follows the total cost concept termed TCO i.e. Total Cost of Ownership while making the financial projections rather than taking into account only the purchase price.

5.1.Cost Estimation for Scenario 1

5.1.1. Capital Investment for Scenario 1

	COST HEADS	RATE	PRODUCT
1	**Cost of ready building [@1500/sq ft]**	1500	**5,277,780**
2	**Cost of Renovation (ACs, Furniture etc.)**		**942,119**
3	**Cost of the MRI machine with 5 years of AMC**		**55,000,000**
4	**Cost of Teleradiology facility**		**1,800,000**
5	**Cost of Generator**		**175,000**
6	**Add for Contingencies**		**100,000**
	Total Capital Cost		**63,294,899**

5.1.2. Manpower cost for Scenario 1

Manpower	Experience	Required number	Pay/resource/month	Per annum pay
Jr. Radiologist (MBBS, MD or MBBS, DMRD)	1 yr / 2 yr	2	150000	36,00,000
MRI Technician	3 yrs	2	20000	4,80,000
Staff Nurses	3 yrs	2	13000	3,12,000
Attendant	2 yrs	2	5000	1,20,000
Ward Boys	2 yrs	2	3500	84,000
Cleaning staff	2 yrs	2	2000	48,000
Total manpower cost per annum				**46,44,000**

5.1.3. Supplies for Scenario 1

	EXPENDITURE HEAD	UNIT	PER ANNUM EXPENDITURE
1	"Contrast material" Supplies	On actual	-
2	MRI films [@ Rs. 100 / film]	100	310,000*
3	Linen and Laundry Supplies		6,000
4	Housekeeping Supplies		10,000
5	Fuel for generator**		100.800
6	Printing and Stationary [@ Rs. 5 / scan]*	5	15,500
	Total		**442,300**

Calculations based on the assumptions for "MRI scans per day"

***** Calculations based on the assumptions that per month diesel consumption is 150 liters and per liter fuel cost is Rs. 56.***

5.1.4. Purchased services for Scenario 1

	EXPENDITURE HEAD	UNIT	PER ANNUM EXPENDITURE
1	Water*		6,552
2	Power**		354,000
3	Telephones [@ Rs. 350 / month]	350	4,200
4	Internet [@ Rs. 700 / month]	700	8,400
	Total		**373,152**

** Calculations based on the assumptions that water usage in toilet per patient including staff is 20 liters and drinking water usage per patient including staff is 6 liters. Per liter unit cost of water including 20% of sanitary charge is .072 Rs per liter[11].*

*** Calculations based on the assumptions that per month power utilization is 2500 units. Fixed cost for 100KV high tension power connection is Rs. 17000 and per unit power consumption cost is Rs. 5[12].*

5.1.5. Administrative costs for Scenario 1

	EXPENDITURE HEAD	UNIT	PER ANNUM EXPENDITURE
1	Maintenance cost of Building	Rs. per Annum	100,000
2	Maintenance cost of non medical Equipments	Rs. per Annum	20,000
	Total		**120,000**

5.1.6. Insurance cost for Scenario 1

	EXPENDITURE HEAD	UNIT	PER ANNUM EXPENDITURE
1	Insurance cost of the MRI scan centre	Rs. per Annum	500,000
	Total		**500,000**

[11] http://bwssb.org
[12] http://www.kerc.org

5.2.Tariff Revenue Stream for Scenario 1

5.2.1. Assumptions for the project model for Scenario 1

		per day (on monthly average basis)	No. of operating days
Minimum Referral Assurance	Yes	10	310
	Number	**Unit**	
Projection Period	**10**	years	
Population Increase	**1.50%**	%	

Population Projections	FY 12	FY 13	FY 14	FY 15	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22
Belgaum	4,778,439	4,850,116	4,922,867	4,996,710	5,071,661	5,147,736	5,224,952	5,303,326	5,382,876	5,463,619	5,545,574
Bidar	1,700,018	1,725,518	1,751,401	1,777,672	1,804,337	1,831,402	1,858,873	1,886,756	1,915,058	1,943,784	1,972,940
Hassan	1,776,221	1,802,864	1,829,907	1,857,356	1,885,216	1,913,494	1,942,197	1,971,330	2,000,900	2,030,913	2,061,377
Mandya	1,808,680	1,835,810	1,863,347	1,891,298	1,919,667	1,948,462	1,977,689	2,007,354	2,037,465	2,068,027	2,099,047
Raichur	1,924,773	1,953,645	1,982,949	2,012,694	2,042,884	2,073,527	2,104,630	2,136,200	2,168,243	2,200,766	2,233,778
Shimoga	1,755,512	1,781,845	1,808,572	1,835,701	1,863,236	1,891,185	1,919,553	1,948,346	1,977,571	2,007,235	2,037,343

Projections for Procedure Volume	Project Year									
	1	2	3	4	5	6	7	8	9	10
3100 scans in the base year and then onwards 10% increase per annum*	3100	3410	3751	4126	4539	4993	5492	6041	6645	7310

Assumption based on operational statistics of Mysore MRI centre running on PPP mode in Mysore Medical College

Capacity Limitations	Parameter	Unit
Working days per annum	310	days in year
Working hours per day	11	hrs
Time per procedure (25 minutes i.e. .42 hour)	0.42	hrs
Operating Efficiency	0.85	%
Total number of annual procedures / machine / annum on working days (round off figure)	6901	Number

Emergency cases @ 10% of the total annual procedures	690	Number
Total number of annual procedures / machine / annum (round off figure)	7591	Number
Max No. of MRI scans / day / machine	24	Number

Frequency of Service Rate Escalation - once every	**1**	years
Escalation Rate for Services	**5%**	%

Contingency as % of the operating cost (excluding insurance cost)	**2%**	%
Decrease in insurance cost per annum (due to depreciation of assets)	**10%**	%

Annual Escalation of Manpower expenditure	**5%**	%
Annual Escalation of Expenditure (other than Manpower)	**5%**	%
AMC for initial five years is bundled with the purchasing cost of the machine. For 6th year it will be 500000 and then onwards will increase 5% per annum.		

5.2.2. Cash Flow for Scenario 1

	0	1	2	3	4	5	6	7	8	9	10
INVESTMENT											
Capital investment by Operator		**632.95**									
Per MRI Cost											
Bid Variable		**3050**	**3,203**	**3,363**	**3,531**	**3,707**	**3,893**	**4,087**	**4,292**	**4,506**	**4,732**
OPERATING REVENUE		**Project Year**									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Population Projections for Belgaum	4,778,439	4,850,116	4,922,867	4,996,710	5,071,661	5,147,736	5,224,952	5,303,326	5,382,876	5,463,619	5,545,574
Procedure volume per annum		**3100**	**3410**	**3751**	**4126**	**4539**	**4993**	**5492**	**6041**	**6645**	**7310**
MRI per Day		**10**	**11**	**12**	**13**	**15**	**16**	**18**	**19**	**21**	**24**
If Min Referral Assurance is Yes											
TOTAL OPERATING REVENUE		**95**	**109**	**126**	**146**	**168**	**194**	**224**	**259**	**299**	**346**
OPERATING EXPENDITURE											
Manpower		46.44	48.76	51.20	53.76	56.45	59.27	62.23	65.35	68.61	72.04
Supplies		4.42	4.64	4.88	5.12	5.38	5.64	5.93	6.22	6.53	6.86
Purchased Services		3.73	3.92	4.11	4.32	4.54	4.76	5.00	5.25	5.51	5.79

Administrative Cost		1.20	1.26	1.32	1.39	1.46	6.53	6.86	7.20	7.56	7.94
Contingency		1.12	1.17	1.23	1.29	1.36	1.52	1.60	1.68	1.76	1.85
Insurance cost		5.00	4.50	4.05	3.65	3.28	2.95	2.66	2.39	2.15	1.94
TOTAL OPERATING EXPENDITURE		**62**	**64**	**67**	**70**	**72**	**81**	**84**	**88**	**92**	**96**
NET CASH FLOW - (SURPLUS / -DEFICIT)		**-600**	**45**	**59**	**76**	**96**	**114**	**140**	**171**	**207**	**249**
PRE-TAX PROJECT IRR (10 years)		**12%**									

It is to be noted that the cost of MRI service Rs 3050/- is the amount reimbursed by the government to the service provider, the amount which the service provider collects from the patients may vary from time to time depending on the policy decision of the government. The amount collected from the patients shall be deposited in a designated bank account and the government shall reimburse the service provider separately every month in proportion to the service provided.

5.3.Cost Estimation for Scenario 2

Another scenario of this project will be with one added assumption that Government will provide sufficient space with "ready to move in" infrastructure for the project. Private partner will renovate it, install the MRI machine and make it operational as per the contract specifications. Rest of the project structure remains the same.

The project financials for this scenario will be,

5.3.1. Capital Investment for scenario 2

	COST HEADS	RATE	PRODUCT
1	**Cost of ready building**		**Nil**
2	**Cost of Renovation (ACs, Furniture etc.)**		**942,119**
3	**Cost of the MRI machine with 5 years of AMC**		**55,000,000**
4	**Cost of Teleradiology facility**		**1,800,000**
5	**Cost of Generator**		**175,000**
5	**Add for Contingencies**		**100,000**
	Total Capital Cost		**58,017,119**

5.3.2. Manpower cost for scenario 2

Manpower	Experience	Required number	Pay/resource/month	Per annum pay
Jr. Radiologist (MBBS, MD or MBBS, DMRD)	1 yr / 2 yr	2	150000	3600000
MRI Technician	3 yrs	2	20000	480000

Staff Nurses	3 yrs	2	13000	312000
Attendant	2 yrs	2	5000	120000
Ward Boys	2 yrs	2	3500	84000
Cleaning staff	2 yrs	2	2000	48000
Total manpower cost per annum				**4644000**

5.3.3. Supplies for scenario 2

	EXPENDITURE HEAD	UNIT	PER ANNUM EXPENDITURE
1	"Contrast material" Supplies	On actual	-
2	MRI films [@ Rs. 100 / film]	100	310,000*
3	Linen and Laundry Supplies		6,000
4	Housekeeping Supplies		10,000
5	Fuel for generator**		100,800
6	Printing and Stationary [@ Rs. 5 / scan]*	5	15,500
	Total		**442,300**

Calculations based on the assumptions for "MRI scans per day"

***** Calculations based on the assumptions that per month diesel consumption is 150 liters and per liter fuel cost is Rs. 56.***

5.3.4. Purchased services for scenario 2

	EXPENDITURE HEAD	UNIT	PER ANNUM EXPENDITURE
1	Water*		6,552
2	Power**		354,000
3	Telephones [@ Rs. 350 / month]	350	4,200
4	Internet [@ Rs. 700 / month]	700	8,400
	Total		**373,152**

* ***Calculations based on the assumptions that water usage in toilet per patient including staff is 20 liters and drinking water usage per patient including staff is 6 liters. Per liter unit cost of water including 20% of sanitary charge is .072 Rs per liter.***

** ***Calculations based on the assumptions that per month power utilization is 2500 units. Fixed cost for 100KV high tension power connection is Rs. 17000 and per unit power consumption cost is Rs. 5.***

5.3.5. Administrative costs for scenario 2

	EXPENDITURE HEAD	UNIT	PER ANNUM EXPENDITURE
1	Maintenance cost of Building	Rs. per Annum	100,000
2	Maintenance cost of non medical Equipments	Rs. per Annum	20,000
	Total		**120,000**

5.3.6. Insurance cost for scenario 2

	EXPENDITURE HEAD	UNIT	PER ANNUM EXPENDITURE
1	Insurance cost of the MRI scan centre	Rs. per Annum	500,000
	Total		**500,000**

5.3.7. Assumptions for scenario 2

		per day (on monthly average basis)	No. of operating days
Minimum Referral Assurance	Yes	10	310
	Number	**Unit**	
Projection Period	**10**	years	
Population Increase	**1.50%**	%	

Population Projections	FY 12	FY 13	FY 14	FY 15	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22
Belgaum	4,778,439	4,850,116	4,922,867	4,996,710	5,071,661	5,147,736	5,224,952	5,303,326	5,382,876	5,463,619	5,545,574
Bidar	1,700,018	1,725,518	1,751,401	1,777,672	1,804,337	1,831,402	1,858,873	1,886,756	1,915,058	1,943,784	1,972,940
Hassan	1,776,221	1,802,864	1,829,907	1,857,356	1,885,216	1,913,494	1,942,197	1,971,330	2,000,900	2,030,913	2,061,377
Mandya	1,808,680	1,835,810	1,863,347	1,891,298	1,919,667	1,948,462	1,977,689	2,007,354	2,037,465	2,068,027	2,099,047
Raichur	1,924,773	1,953,645	1,982,949	2,012,694	2,042,884	2,073,527	2,104,630	2,136,200	2,168,243	2,200,766	2,233,778
Shimoga	1,755,512	1,781,845	1,808,572	1,835,701	1,863,236	1,891,185	1,919,553	1,948,346	1,977,571	2,007,235	2,037,343

Projections for Procedure Volume	Project Year									
	1	2	3	4	5	6	7	8	9	10
3100 scans in the base year and then onwards 10% increase per annum*	3100	3410	3751	4126	4539	4993	5492	6041	6645	7310

Assumption based on operational statistics of Mysore MRI centre running on PPP mode in Mysore Medical College

Capacity Limitations	Parameter	Unit
Working days per annum	310	days in year
Working hours per day	11	hrs
Time per procedure (25 minutes i.e. .42 hour)	0.42	hrs
Operating Efficiency	0.85	%
Total number of annual procedures / machine / annum on working days (round off figure)	6901	Number
Emergency cases @ 10% of the total annual procedures	690	Number
Total number of annual procedures / machine / annum (round off figure)	7591	Number
Max No. of MRI scans / day / machine	24	Number

Frequency of Escalation - once every	**1**	years
Escalation Rate for Services	**5%**	%

Contingency as % of the operating cost (excluding insurance cost)	**2%**	%
Decrease in insurance cost per annum (due to depreciation of assets)	**10%**	%

Annual Escalation of Manpower expenditure	**5%**	%
Annual Escalation of Expenditure (other than Manpower)	**5%**	%
AMC for initial five years is bundled with the purchasing cost of the machine. For 6th year it will be 500000 and then onwards will increase 5% per annum.		

5.3.8. Cash flow for scenario 2

	0	1	2	3	4	5	6	7	8	9	10
INVESTMENT											
Capital investment by Operator		**580.17**									
Per MRI Cost											
Bid Variable		**2950**	**3,098**	**3,252**	**3,415**	**3,586**	**3,765**	**3,953**	**4,151**	**4,358**	**4,576**
OPERATING REVENUE		**Project Year**									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Population Projections for Belgaum	4,778,439	4,850,116	4,922,867	4,996,710	5,071,661	5,147,736	5,224,952	5,303,326	5,382,876	5,463,619	5,545,574
Procedure volume per annum		**3100**	**3410**	**3751**	**4126**	**4539**	**4993**	**5492**	**6041**	**6645**	**7310**
MRI per Day		**10**	**11**	**12**	**13**	**15**	**16**	**18**	**19**	**21**	**24**
If Min Referral Assurance is Yes											
TOTAL OPERATING REVENUE		**91**	**106**	**122**	**141**	**163**	**188**	**217**	**251**	**290**	**335**
OPERATING EXPENDITURE											
Manpower		46.44	48.76	51.20	53.76	56.45	59.27	62.23	65.35	68.61	72.04
Supplies		4.42	4.64	4.88	5.12	5.38	5.64	5.93	6.22	6.53	6.86
Purchased Survices		3.73	3.92	4.11	4.32	4.54	4.76	5.00	5.25	5.51	5.79
Administrative Cost		1.20	1.26	1.32	1.39	1.46	6.53	6.86	7.20	7.56	7.94
Contingency		1.12	1.17	1.23	1.29	1.36	1.52	1.60	1.68	1.76	1.85
Insurance cost		5.00	4.50	4.05	3.65	3.28	2.95	2.66	2.39	2.15	1.94
TOTAL OPERATING EXPENDITURE		**62**	**64**	**67**	**70**	**72**	**81**	**84**	**88**	**92**	**96**
NET CASH FLOW - (SURPLUS / -DEFICIT)		**-551**	**41**	**55**	**71**	**90**	**107**	**133**	**163**	**197**	**238**
PRE-TAX PROJECT IRR (10 years)		**12%**									

It is to be noted that the cost of MRI service Rs 2950/- is the amount reimbursed by the government to the service provider, the amount which the service provider collects from the patients may vary from time to time depending on the policy decision of the government. The amount collected from the patients shall be deposited in a designated bank account and the government shall reimburse the service provider separately every month in proportion to the service provided.

5.4.Annuity Demand Sensitivity analysis

The cost of MRI scan is inversely proportional to the number of scans performed in the centre. So sensitivity analysis has been done by simulating the above model at different demands level to find out the corresponding annuity keeping the IRR at 12%. This has been tabulated below;

Demand level (Number of scans)	Annuity (Per MRI scan cost in Rs.)	
	Scenario 1	Scenario 2
1600	4600	4300
1900	4300	4100
2200	4050	3800
2500	3650	3500
2800	3350	3200
3100	3050	2950
3400	2800	2650

IMaCS recommends that the detailed annuity and demand supply analysis should be done at the transaction advisory level.

5.5.Scenario Analysis using economic criteria

In order to make healthcare services available to all and fill gaps in health infrastructure, GoK plans to rope in private player for providing MRI Scan services to the population. So effectively GoK will be the client for the private player who will reimburse him as per the volume of patients serviced per month. Whether these patients will be charged or not, if charged then will it be as per the prevailing market rates or at some concessional rates, how much concession will be given to patients, whether to make any distinction between BPL and APL category patients etc. all these issues are political sensitive and needs to be decided by the government of Karnataka. Above scenarios are based on the premise that service provision and thus the reimbursement of private player will not be affected by economical strata of patients.

However the social sector has some peculiarities which require special mention. Health services are vulnerable to segmentation between rich and poor. As a result the public sector ends up providing subsidized services to the poor whereas the private sector providing the paid services to the rich who can afford them. So government, in order to judicially use its limited financial resources, may need to allocate the budget to financially support only the poor patients while providing the facility to others at concessional rate. Above mentioned project scenarios are analyzed in this section to know the financial implications on GoK if this strategy is adopted to implement health PPPs.

Projections of total and BPL population for the six districts chosen for this project are given in the annexure. Analysis of this data reveals that proportion of BPL population in the chosen districts is 75% or more. Based on this it is assumed that of the total patient load in the MRI scan centre, 75% are from BPL category that will not pay anything for the service while 25% are from APL category that will pay for MRI scan as per the cost decided by the state government. For computation purposes it is assumed that per MRI cost for APL patient will be as calculated above.

Using the economic criteria, the two project scenarios have been compared in the following table;

<table>
<tr><th rowspan="2"></th><th rowspan="2">Scenario 1</th><th rowspan="2">Scenario 2</th><th colspan="4">Scenario analysis using economic criteria</th></tr>
<tr><th colspan="2">Scenario 1</th><th colspan="2">Scenario 2</th></tr>
<tr><td rowspan="3">Characteristic Feature</td><td rowspan="3">• GoK provides land
• Patients not differentiated into BPL and APL category</td><td rowspan="3">• GoK provides land and ‘ready to move in’ infrastructure
• Patients not differentiated into BPL and APL category</td><td colspan="2">• GoK provides land
• Patients differentiated into BPL / APL category
• 75% of total patients are from BPL category which will get services free of cost</td><td colspan="2">• GoK provides land and ‘ready to move in’ infrastructure
• Patients differentiated into BPL / APL category
• 75% of total patients are from BPL category which will get services free of cost</td></tr>
<tr><td colspan="2">• 25% of total patients are from APL category which will pay for services at the rates decided by GoK</td><td colspan="2">• 25% of total patients are from APL category which will pay for services at the rates decided by GoK</td></tr>
<tr><td rowspan="2">Number of MRI scans in first year</td><td rowspan="2">3100</td><td rowspan="2">3100</td><td>BPL Patients</td><td>2325</td><td>BPL Patients</td><td>2325</td></tr>
<tr><td>APL Patients</td><td>775</td><td>APL Patients</td><td>775</td></tr>
<tr><td>Per MRI cost as per project financials</td><td>3050</td><td>2950</td><td colspan="2">3050</td><td colspan="2">2950</td></tr>
</table>

	Scenario 1	Scenario 2	Scenario analysis using economic criteria	
			Scenario 1	Scenario 2
Minimum Financial Burden on GoK in the first year assuming 3100 annual MRI scans (in Lakh Rs.)	94.55	91.45	70.91	68.59

So the minimum annual financial burden of GoK in the first year of operations will be Rs 70.91 lakh for first scenario while Rs. 68.59 lakh for second scenario.

5.6.Ranking of Project based on commercial viability

Based on the financial calculations the Pre-Tax IRR for both the scenarios is 12% with bid variable 3050 and 2950 respectively, hence the project is very much commercially viable for the private player. The above mentioned per MRI cost is less than the prevalent MRI scan costs of private diagnostic centers in these locations.

Private Player can increase the IRR further by negotiating the insurance cost of the project with insurance companies and maintenance cost of MRI machine with equipment manufacturer.

Chapter 6 – Policy, Statutory and Legal Framework

Policy Framework: - Section 5.6 of the Karnataka Integrated State Health Policy 2004, provides the framework for PPP in healthcare sector. This section, under the heading 'Public, private and voluntary sector partnerships' states that

"The state Policy recognizes the role of the voluntary and private sectors in public health care. Though already existing in an adhoc and often informal manner, public, private and voluntary partnerships will be further developed in a planned, systematic manner in order to develop in spirit and practice for better health care and also for optimal utilization of health resources. District and Taluk health action networks and issue-based networks will be encouraged with active participation from the public sector in such voluntary sector initiatives. ***Participation of voluntary and private sector will be enhanced through outsourcing certain services, in infrastructure maintenance and investments in health services".***

Statutory and Legal Framework: - The MRI unit shall be governed by all existing bio medical, statutory and legal laws governing an imaging centre. The MRI centre along with the hospital or independently as the case and situation may apply shall get itself certified for/obtain the following certificates,

1. Building Permit
2. No objection certificate from Chief Fire Officer
3. Indian Medical Council Act and Code of Medical Ethics, 2002
4. Drugs and Cosmetics Act, 1940
5. License under Bio-medical Management and handling Rules, 1998
6. Right to Information Act
7. Consumer Protection Act, 1986

The service provider shall be responsible for procurement and management of all statutory and legal requirements for the MRI centre.

Chapter 7 - Indicative Environmental & Social Impacts

7.1.Environmental Impacts

MRI does not use ionizing radiations, which are potentially harmful for the environment; so, there is no known environmental impact associated with temporary exposure to the strong magnetic field used by MRI scanners.

7.2.Social Impacts

MRI service will be accessible to all the citizens irrespective of his/her region, urban/rural location, gender, social and economic groupings. This will also bring equity in healthcare services which also encompass disadvantaged groups (Scheduled Castles and Tribes) and vulnerable groups (street children, elderly). Other social impacts of this project are;

- The six selected districts have a total population of 13,743,643 which is 22.48% of the Karnataka population. This project will provide benefit to more than 1/5 of the Karnataka population.
- Improved utilization of public healthcare facilities
- Timely diagnosis leads to better treatment and better medical results.
- This initiative will also help state government to achieve its goal of prevention of physical disability by its early detection and intervention. This will bring major gains in terms of human well-being, development and economic productivity.
- Patients will get access to high-end diagnostic imaging facility within the MCH premises saving the travel time of going to another public health facility / private facility; this reduces the out of pocket medical expenses. This way this project will help state government in mitigating the adverse effect of escalating prices of diagnostics on state population.
- Society will get the best of public and private services at one place i.e. private sectors quality and efficiency at public rates thus reducing their economic cost of availing the healthcare services.
- Enhanced patient as well as doctor satisfaction
- Employment for the trained manpower required for operating the centre
- Streamlined operation and efficient work culture of private partner will impact the public healthcare functioning in the long run.

7.3.Mitigation Measures

MRI scan is very safe non invasive diagnostic tool. However, very strong magnetic field generated during the course of the scan might affect other medical and non medical equipments of the hospital near to the MRI centre. In order to mitigate it following measures should be followed

1. MRI scan centre must be located and designed as per the manufacturer's specific layout guidelines.
2. New machines should be purchased instead of refurbished one
3. Machine should always be under CMC for regular maintenance.

Chapter 8 – Operating Framework

8.1.Project Structure at a Glance

Sl No	Parameter	Description
1	PPP Model	Build, Own, Operate and Transfer (BOOT)
2	Concession Period	10 years
3	Concession Component	1. Right to operate 1.5T MRI machine 2. Building and utilities provision at the concerned Medical college 3. Reimbursement for patients referred from the Government hospital 4. Referral facility from all government hospital 5. Can serve private patients at rates fixed by government
4	Government Support	1. Space and building (if available) 2. Assurance for minimum number of patients per day
5	Project Benefits	1. Provision of MRI service in Medical college 2. Economic benefits to the patients 3. Immediate and quick service to the patients 4. Assistance in diagnostic and therapeutic service 5. Infrastructural asset required for starting radio diagnosis course at the medical college 6. Private sector efficiency in operation and maintenance
6	Operation and Maintenance	1. Operation of the MRI machine and conduct MRI procedures 2. Ensure the machine 98% machine uptime 3. Operates on two shifts from 8AM to 2PM and 2PM to 8PM, available on call from 8PM to 8AM 4. Service provider to address all maintenance related issues 5. Provide requisite reports as agreed in the TOR
7	User Charges Involved	1. User charges collected as per government norms and deposition with the government 2. The MRI centre is free to serve private patients at the price prescribed by the government
8	Inventory Management	1. Procure and manage all consumables and inventory required 2. Maintain optimum inventory and ensure nil stock out
9	Revenue Management	1. The MRI centre will be reimbursed at an agreed rate by the Government every month as per the number of cases

8.2.Risks & Mitigation

In PPP arrangements, risks are inherent in the project due to the varied pursuits and value systems of the two sectors involved in the contract. The private sector is predisposed to prioritizing shareholder return and taking measured risks, whereas regulations and authorities, political opinion and the achievement of societal goals influence the public sector. Additional problems arise because public taxpayers may not welcome the idea of PPPs due to a perceived lack of transparency in the private sector. Full disclosure may also be an issue for the private sector who has an interest in protecting proprietary information to ensure their competitiveness.

Following are the perceived risks involved in developing a MRI scan centre

1. Construction / implementation risk arising from
    a. Delay in project clearance
    b. Contractor default
    c. Construction cost overrun
2. Market risk arising from
    a. Insufficient demand
    b. Impractical user levies
3. Finance risk arising from
    a. Inflation
    b. Change in interest rates
    c. Increase in taxes
4. Operation and maintenance risks arising from
    a. Termination of contract
    b. Technology risk
    c. Manpower risk
5. Legal risks arising from
    a. Changes in law
    b. Changes in lease rights

The emphasis is on optimal allocation of risk or risk transfer. This can “incentivize” partners to ensure that objectives of the agreement are met. Risk transfer has the opportunity to be extremely beneficial to the public sector but if not appropriately managed insufficient risk is transferred to the private sector. Governments cannot allow essential services such as healthcare to fail, so the ability of the public sector to transfer risk to the private sector becomes nonexistent and therefore no longer a benefit of partnership. For example under the Private Financing Initiative (PFI) in the UK, some failed partnerships have required the government to step in and subsidize a service and yet the core essence of the PFI contract is that the private sector should take on appropriate risk in return for the appropriate reward.

Risk Mitigation Strategies

Sl No	Category	Risk	Risk Incurred by	Mitigation Strategy
1.1	Implementation Risk	Delay in project clearance	Partner	1. Government to provide all clearances for initiation of the project within 60 days of selection of partner from competitive bid process 2. The partner has the right to terminate the contract with three months prior notice if the government fails to honour the commitments
1.2		Contractor Default	Government	1. Only organisations with prior experience in operating an MRI centre are qualified for bidding 2. It is preferred that the partner/service provider has experience in PPP projects, qualifying marks shall be provided for such bidders; if the bidder has experience in operating MRI on PPP then they shall be provided additional qualifying marks 3. Government to retain the earnest money in case the private partner defaults before signing the contract 4. Client default payment clause to be inserted as a part of the contract 5. The government has the right to terminate the contract with one-month notice if the service provider is not adhering with the Terms of Reference mutually agreed. 6. The government shall give two warning notices and provide adequate time for rectification before sending a notice for termination of services. The termination notice shall be given only by the Director of Medical Education or by the Secretary Medical education. 7. The service provider shall not sub-let the premises or service to any other party without the prior permission of the

				government. The government has the rights to terminate the contract in the event of any such activity with a 15 day notice, and take control of the premises, equipment and accounts during the period and afterwards till the case is resolved
1.3		Construction/Renovation cost/time overrun	Partner/Government	1. Land/Building shall be recognized for this purpose prior to the issue of RFP 2. Building to be provided to the partner wherever available 3. Land/Building shall be handed over within 30 days of signing of the contract, in as is where is condition 4. Private players shall be invited to inspect the land/building during the bidding stage to assess the time taken to commence the operation 5. Time frame to be agreed upon to commence operations, failing which the service provider has to pay liquidate damages as mentioned in the TOR
1.4		Non availability of Medical and technical personnel to operate the centre	Partner/Government	1. The service provider shall provide a list of manpower already under employment during the bidding stage 2. The centre to be staffed within the operation commencement time frame assured to the government, failing which the service provider has to pay liquidated damages as mentioned in the TOR
2.1	Market Risk	Insufficient demand	Partner	1. The government shall ensure minimum number of cases per month to the service provider 2. If the minimum number of services is not attained, the government shall reimburse the amount equivalent to the number assured 3. The service provider is free to service patients referred from private institutions, but shall not levy charges more than what agreed for government hospital patients 4. The government shall not install or operate any MRI equipment in the hospital campus where the partner has

				installed their equipment in a manner that will directly or indirectly compete with the bidder
2.2		Impractical user levies	Government/Partner	1. The service shall be competitively priced by the government, it shall be lower than the prevailing market rate at the time of fixing the rate
3.1	Finance Risk	Inflation risk	Partner	1. The government shall revise the reimbursement rate for MRI every two years 2. The effective increase per MRI shall not be higher than 10% of the previous amout
3.2		Change of interest rates/tax rates	Partner	The partner has to bear any changes in interest rates and tax rates by the state/central government
3.3		Exchange rate fluctuation	Partner	The partner has to bear the exchange rate fluctuation during the procurement process
4.1	Operation and Maintenance	Technology obsolescence	Government	1. The initial contract is for a period of 10 years, beyond which it will be rebidded. The MRI machine should be replaced to meet the latest technology specification at that point of time 2. The service provider shall equip the MRI machine with accessories to conduct special procedures as and when requested by and as per the terms agreed with the government
4.2		Man power retention	Government	1. The service provider shall employ manpower as agreed with the government 2. The service provider shall frame effective human resource policies for the training and retaining manpower at the centre, there shall be defined plans for replacement of trained manpower. 3. The centre shall not be deficit of the number of employees agreed for not more than one week at a stretch 4. Should employees go on leave, fall sick or leave the organisation the service provider has to ensure the replacement within a week 5. The service provider shall adequately train its manpower

				annually 6. All new recruits by the service provider shall be trained by the service provider for a period agreed with the government in an established set up
4.3	Operation and Maintenance	Utilities	Private	1. The government shall provide the electrical and water supply free of cost 2. The service has to maintain power stabilizing equipments as required
4.4		Process adequacy and Quality of Service	Government	1. The service provider shall maintain detailed books of records of, a. Medical records b. Consumables – in stock, out of stock, consumption pattern – as per the existing government guidelines c. All expenditure involved in the day to day operation of the hospital as per the existing government guidelines d. Maintain and display quality indicators as per the machine standards e. Display MIS of the centre 2. The MRI unit shall maintain and adhere to detailed Standard Operating Procedures for, a. Service delivery b. Patient handling c. Documentation management d. Emergency and Disaster management e. Bio Medical waste management f. Ethical treatment and management of patients g. Cleaning and sterilisation h. Any other process deemed necessary by the H&FW department 3. The MRI centre stand alone or along with the district hospital shall get itself ISO 9001:2008 certified within one

				year of commencement of operation and the cost of certification shall be borne by the government. 4. The service provider shall produce a report to the Director of the Medical on the operation of the MRI centre every month. The report shall contain, a. Staff attendance report b. Number and variety of MRI tests conducted on Outpatients/In patients/Private patients c. Expenditure statement for consumables, separately for Inpatient, outpatient, special clinics 5. This monthly report upon scrutiny by the Director of the Directorate of Medical Education and the state nodal officer for the project 6. The MRI centre shall be subjected to six monthly stock audit, monthly accounts audit and weekly visual inspection cum audit.
4.5	Operation and Maintenance	Equipment Maintenance	Government	1. The service provider and the equipment manufacturer need to produce a defined maintenance contract document at the time of contract award 2. The cost of any maintenance of the machine has to be borne by the service provider 3. Insurance cost of the machine shall be borne by the service provider, the government is not liable for any damage caused to the machine either during operation or during the idle period 4. The service provider shall maintain 95% uptime during a month 5. All service issues shall be attended to within 24 hours of intimation by the equipment manufacturer 6. If there is a equipment downtime period of more than 72 hours at a stretch, the service provider has to arrange for

				MRI service to be provided from an alternate centre at the same cost, while bearing the cost of transportation of patients
5.1	Legal risk	Changes in Policy	Private	1. The government shall be cognizant of the impact of any policy change that may adversely affect the contract (this is apart from the issues relating to taxes, inflation changes, change of interest rates, exchange rate fluctuation which have been discussed above) 2. The government shall insulate the contract from any such policy changes, or see to that the partners are adequately compensated for losses incurred because of policy change
5.2	Legal risk	Adherence to legal and regulatory compliances	Government	1. The private partner is responsible for adherence legal and regulatory compliances 2. Any loss arising from inadequate compliance to legal and regulatory norms are to be borne by the private partner 3. The partner shall get the process/centre ISO 9001:2008 certified to adhere to all process in place
5.3		Medico legal risk	Government/Private	1. The medico legal risk is shared between the Government, the service provider and the equipment manufacturer on a case to case basis
5.4		MRI Employee legal risk	Private	1. The service provider is absolutely responsible for any legal risk arising out of employee disputes 2. Employees of the service providers cannot claim themselves as employees of the government and are not liable for any facilities and perks provided to government employees

Chapter 9 – Way Ahead

Currently the project plan is to set up a MRI centres in the proposed six medical colleges Karnataka – BIMS, Belgaum, BRIMS, Bidar, HIMS, Hassan, MIMS, Mandya, RIMS, Raichur, and SIMS, Shimoga.

Way forward to implement this project is to first go for its feasibility study in which all the parameters described in this report will be dealt in more detail and Project financial model will be fine tuned.

Post feasibility study these projects should be implemented as planned. Once implemented the success of the project can be measured in terms of the impact of service delivery, availability of universal access, assistance in treatment and benefits accrued to the society. Other medical colleges and districts hospitals of qualifying size and volume can adopt this model in future.

This model shall be showcased during the GIM meeting as a flagship project for investors. This also exhibits the forward marching initiatives of the Government of Karnataka in engaging with the industry both in economic and social fronts.

Chapter 10 – Annexure

Annexure 1: List of public hospitals in Karnataka

Sr.No.	District Hosp/Gen Hospitals
1	K.C.G. Hosp Malleshwaram
2	Gen Hosp Jayanagar
3	HSIS Goshia Hosp
4	E.D. Hosp Bangalore
5	Lep Hosp Bangalore
6	T.B. Hosp Bangalore
7	District Hosp Tumkur
8	Dist Hosp Chitradurga
9	Mecgann Hosp Shimoga
10	SNR District Hosp Kolar
11	District Hosp Hassan
12	District Hosp Chickmangalur
13	District Hosp Madikeri
14	District Hosp Mandya
15	District Hosp Udupi
16	District Hosp Chamarajanagar
17	E.D. Hosp Mysore
18	District Hosp Dharwad
19	District Hosp Bidar
20	District Hosp Bagalkote
21	District Hosp Karwar
22	District Hosp Haveri
23	District Hosp Koppal
24	District Hosp Gadag
25	District Hosp Raichur
26	District Wenlock Hosp Mangalore
27	District Hosp Belgaum
28	District Hosp Bellary
29	District Hosp Gulbarga
30	District Hosp Bijapur
31	District Hosp Davangere
32	K R Hospital Mysore

Source: ***http://stg2.kar.nic.in/healthnew/Contact_No.aspx***

	Hospital with CT scan facility		***Hospital with MRI facility***

Annexure 2: Functional area requirement for MRI centre

	Component	NO.	MINIMUM FUNCTIONAL AREA	PRODUCT	REMARKS
			Sq. Meters	Sq. Meters	
Reception area					
1	Waiting area	1	20	20	with some area earmarked for trolley/wheelchairs
2	Reception	1	9	9	
3	Public Toilets	2	4	8	Male and Female
Patient area					
4	Sub waiting area	1	5	5	
5	Patient Preparation Room	1	9	9	with PMG points
6	Room for patient preparation for contrast	1	9	9	with PMG points
7	MRI scanning room	1	45	45	
8	Control room	1	11	11	
9	System component room	1	18	18	
10	Viewing and reporting room	1	11	11	
11	Pt. stretcher holding bay	1	5.0	5	
12	Patient toilets	1	4	4	
13	Crash cart alcove	1	2	2	
Support area					
14	Gas / Cryogen storage room	1	5	5	
15	PACS - quality control area	1	7.5	7.5	
16	PACS - archival storage area	1	7.5	7.5	
17	Film processing room	1	7.5	7.5	
18	Equipment storage room	1	11	11	
19	Linen storage alcove	1	2	2	
20	Clean supply room	1	4	4	
21	Soiled Utility room	1	4	4	
22	Janitor's Room	1	9	9	
23	Viewing and consultation room (Teaching)	1	11	11	
Staff and administrative area					
24	Radiologist Office	1	9	9	
25	Chief Technician's Office	1	9	9	
26	Administrator office	1	9	9	
27	PACS administrator's office	1	9	9	
28	Nursing personnel office	1	9	9	
29	Registrar / interns office	1	9	9	

30	Record Room	1	13.5	13.5	
31	Locker/ Change Room For Staff	2	9	18	
32	General store	1	9	9	
33	Staff Toilets	2	4.0	8	Male and Female
	Total area in sq. meters			**327**	**Sq Mt**
	Total area in sq. feets			**3518.52**	**Sq Ft**

Annexure 3: Renovation cost of MRI centre

Sr. No.	Name of Area	Equipment	Number	Rate	Product
1	**Patient Preparation Room**				
		Bedstead with Mattress (Fowler)	1	20000	20000
		Foot Steps Under Table	1	500	500
		Locker Bed Side with Stainless Steel top	1	2000	2000
		Examination Tray General with Equipment Set	1	1000	1000
		Crash cart	1	20000	20000
		X ray view box	1	1000	1000
		Instrument Trays	1	1000	1000
		Cylinder Oxygen on Trolley	1	5000	5000
		Stool Revolving, with Stainless Steel Top	1	2000	2000
		Suction Machine	1	10000	10000
		Light Examination (Spot)	1	2500	2500
		Curtain Screen Frame, 4 Fold or on ceiling	1	2000	2000
		Cabinet, Office (MS)	1	8000	8000
		Chair, Office	2	5000	10000
		Wall Board - White Board	1	4000	4000
		Name Plate on Door	1	2000	2000
		Wall Clock	1	500	500
		Waste Bin (MS)	1	250	250
		Garbage Bin (SS)	1	250	250
2	**Film Viewing Room**				
		Table, as per design	1	10000	10000
		Digital PACs Monitor	1	25000	25000
		X-ray Film Scanner (Optional)	1	10000	10000
		X-ray film Printer (Optional)	1	10000	10000
		X-ray Viewing Box, 4 – 12 Panels, as per design	1	3500	3500
		Chair, Office Revolving	1	5000	5000
		Chair, Visitor	2	600	1200
		Book Case (MS)	1	5000	5000
		Cabinet, Office (MS)	1	8000	8000
		Computer Work Station	1	15000	15000

		Telephone Instrument	1	5000	5000
		Pen Stand, Table Top	1	250	250
		Wall Board - White Board	1	4000	4000
		Wall Board - Pin Board	1	2000	2000
		Name Plate on Door	1	2000	2000
		Wall Clock	1	500	500
		Waste Bin (MS)	1	250	250
		Garbage Bin (SS)	1	250	250
3	**Radiology Office**				0
		Table Office	1	5000	5000
		Table Side, for Office Table	1	2000	2000
		Chair Office	1	5000	5000
		Chair Visitor	2	600	1200
		Computer work station	1	15000	15000
		Cabinet, Office (MS)	1	8000	8000
		Wall Board - White Board	1	4000	4000
		Wall Board - Pin Board	1	2000	2000
		Telephone Instrument	1	5000	5000
		Pen Stand Table Top	1	250	250
		Writing Stand Table Top	1	250	250
		Name Plate on Door	1	2000	2000
		Wall Clock	1	500	500
		Waste Bin (MS)	1	250	250
4	**MRI Examination Room**				0
		MRI Machine, as selected	1		0
		RF Cage, as per design	1		0
		Name Plate on Door	1	2000	2000
5	**MRI Machine Room**				0
		MRI Equipment Electrical Panels, set of	1	100000	100000
		UPS Equipment with Panel, set of	1	100000	100000
		Helium Chiller	1		0
		Chair, Office	1	5000	5000
		Waste Bin (MS)	1	250	250
6	**MRI Control Room**				0
		MRI Equipment's Control Panel with Table	1	10000	10000
		Daylight Film Processor	1		0
		X-Ray Viewing Box	2	4000	8000
		Computer Work Station	1	15000	15000

		Table, Office	1	5000	5000
		Table Side, for Office Table	1	4000	4000
		Chair, Office	2	600	1200
		Wall Board - White Board	1	4000	4000
		Telephone Instrument	1	5000	5000
		Name Plate on Door	1	2000	2000
		Wall Clock	1	500	500
		Waste Bin (MS)	1	250	250
		Garbage Bin (SS)	1	250	250
7	**Reception**				
		Waiting chairs	20	600	12000
		Office chair	1	5000	5000
		Reception workstation	1	10000	10000
		Cabinet, Office (MS)	1	8000	8000
		Computer Work Station	1	15000	15000
		Telephone Instrument	1	5000	5000
		Pen Stand, Table Top	1	250	250
		Wall Board - White Board	1	4000	4000
		Wall Board - Pin Board	1	2000	2000
		Name Plate on Door	1	2000	2000
		Wall Clock	1	500	500
		Waste Bin (MS)	1	250	250
		Garbage Bin (SS)	1	250	250
		Stretcher Trolley	1	15000	15000
		Wheel chair	1	8000	8000
8	**Others**				
		Fans	6	2000	12000
		Computer + Printer	1	35000	35000
		Air Conditioner 1.5 tonnes	4	25000	100000
9	**Bio Medical Equipments**				
	1	Stethoscope	1	1000	1000
	2	Spyghmomanometer	1	1000	1000
	3	Weighing Scale	1	500	500
		Sub total			748600
		Wall Painting			193518.6
		Total renovation cost			**942118.6**

Annexure 4: Project approval letter by Principal Secretary, DME – Government of Karnataka

GOVERNMENT OF KARNATAKA

No. HFW/54 /PSME 2012 — Karnataka Government Secretariat, Vidhana Soudha, Bangalore, dated: 14.03.2012.

From:
The Principal Secretary to Government,
Health and Family Welfare Department,
(Medical Education)
Bangalore.

To
The Director, Mandya Institute of Medical Sciences, Mandya.
The Director, Hassan Institute of Medical Sciences, Hassan.
The Director, Shimoga Institute of Medical Sciences, Shimoga.
The Director, Raichur Institute of Medical Sciences, Raichur.
The Director, Bidar Institute of Medical Sciences, Bidar.
The Director, Belgaum Institute of Medical Sciences, Belgau.

Sir,

ICRA Management Consulting Services Limited (IMaCS), has been selected as consultant for Institutional strengthening and PPP mainstreaming of Health and Family Welfare and Medical education department. We have identified establishment of MRI scan centres in the six new medical colleges of Karnataka as the PPP project. IMaCS would be conducting the prefeasibility study for the above project, and hence I request you to provide all necessary information as required by the consultants.

Yours faithfully,
Sd/-
(K.H. GOPALAKRISHNE GOWDA)
Principal Secretary to Government,
Health and Family Welfare Department
(Medical Education).

Copy to: (1) The Secretary to Govt., Infrastructure Development Dept., Vikasa Soudha, Bangalore
(2) The Director of Medical Education, Bangalore.
(3) Deputy Secretary to Government, HFW(Medical Education)
(4) Under Secretary to Govt., HFW (Medical Education A/B).
for information.

Principal Secretary to Government,
Health and Family Welfare Department
(Medical Education).

Annexure 5: District wise population projections until 2018

District	Population Growth Rate	2012	2013	2014	2015	2016	2017	2018	2013-2018 Growth Rate	2013 - 2018 %
Belgaum	1.0126	4,838,647	4,899,614	4,961,349	5,023,862	5,087,163	5,151,261	5,216,167	0.0646	1.0646
Bidar	1.0124	1,721,098	1,742,440	1,764,046	1,785,920	1,808,066	1,830,486	1,853,184	0.0636	1.0636
Hassan	1.0031	1,781,727	1,787,251	1,792,791	1,798,349	1,803,924	1,809,516	1,815,125	0.0156	1.0156
Mandya	1.0025	1,813,202	1,817,735	1,822,279	1,826,835	1,831,402	1,835,980	1,840,570	0.0126	1.0126
Raichur	1.0143	1,952,297	1,980,215	2,008,532	2,037,254	2,066,387	2,095,936	2,125,908	0.0736	1.0736
Shlmoga	1.0067	1,767,274	1,779,115	1,791,035	1,803,035	1,815,115	1,827,276	1,839,519	0.034	1.034

Source: Data developed by SANIGEST for GoK project under WB TA assistance

Annexure 6: District wise BPL population projections until 2018

BPL 2012	Population Growth Rate	2012	2013	2014	2015	2016	2017	2018
Belgaum	1.01	2,860,859	2,899,767	2,939,204	2,979,177	3,019,694	3,060,762	3,102,388
Bidar	1.01	1,201,369	1,217,708	1,234,269	1,251,055	1,268,069	1,285,315	1,302,795
Hassan	1	1,572,533	1,593,920	1,615,597	1,637,569	1,659,840	1,682,414	1,705,295
Mandya	1	1,623,945	1,646,031	1,668,417	1,691,107	1,714,106	1,737,418	1,761,047
Raichur	1.01	1,395,647	1,414,628	1,433,867	1,453,367	1,473,133	1,493,168	1,513,475
Shlmoga	1.01	1,268,725	1,285,979	1,303,469	1,321,196	1,339,164	1,357,377	1,375,837

Source: Data developed by SANIGEST for GoK project under WB TA assistance

……. End of report…….