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An Environmental Plan for Mysore, India

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ABSTRACT

This paper summarizes the report of a graduate level workshop that took place at the School of Planning, College of Architecture, Art and Planning, University of Cincinnati, USA, the objective of which was to prepare students to work overseas in data-poor environments as professional consulting planners. Several lectures were given to set the framework for the class of eighteen students to operate in sector-level working groups to prepare a 5-year plan to solve the urban environmental problems of Mysore, India, one of Cincinnati's sister cities, utilizing a real-world data base and a limited budget. This project culminated in the preparation of a professional quality plan. The instructor, who has over thirty years of planning experience in developing countries, including India, attempted to create an atmosphere within the project that duplicates the actual conditions of carrying out such a consultancy.

Key Words: Urban environmental management, UEM, environmental planning, planning for development, Mysore

INTRODUCTION

This paper is a case study of Urban Environmental Management (UEM) in developing countries that summarizes the results of a graduate level workshop that took place at the School of Planning, College of Architecture, Art and Planning, University of Cincinnati, USA from August to December 2013. The objective of the workshop was to prepare students to work overseas in data-poor environments as professional consulting planners. Several lectures were given to set the framework for the class of eighteen students to operate in sector-level working groups to prepare a 5-year plan to solve the urban environmental problems of Mysore, India, one of Cincinnati's sister cities, utilizing a real-world data base and a limited budget. The seven working groups or sectoral teams (Poverty Alleviation, Industry, Sewage and Solid Waste, Transportation, Energy, Water and Finance) conducted internet and library research and wrote sectoral reports, which were combined to form the Environmental Plan for Mysore.

POVERTY ALLEVIATION

Problem Statement

The State of Karnataka's poverty rate is estimated at 24.53% (Government of India Planning Commission, 2013). The current population is 920,550 individuals, 461,042 males and 459,508 females, making up 215,061 households (Mysore City Corporation, n. d.). 225,810 individuals live below the poverty line (BPL). An article from *The Hindu*, however, cites more than twice as many BPL households (Bennur, 2013).

While the Mysore City Corporation lists a slum population of 10,394 (or 44,486 individuals (Mysore City Corporation, n. d.), the Administrative Staff College of India in its City Sanitation Plan lists 10,380 households (or 46,776 individuals) (Administrative Staff College of India, 2011), and the Government of India Census of India reports 8,843 households (or 39,029) individuals (Government of India, Ministry of Home Affairs: Office of the Registrar General &

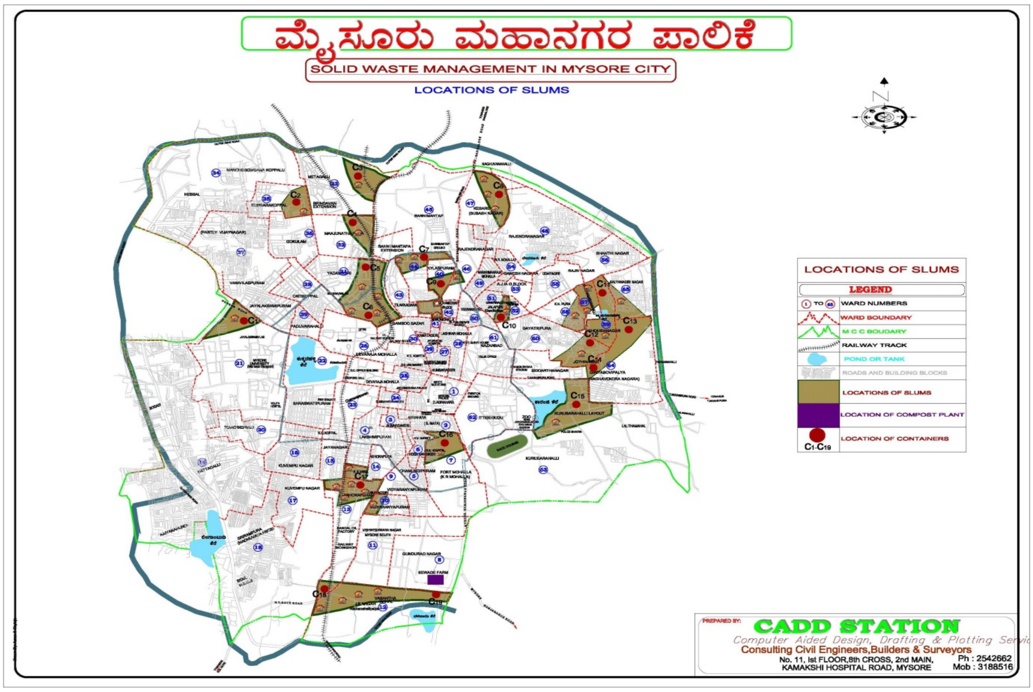
Census Commissoner, India, 2013). While 13% of the Scheduled Caste and Tribe population lives in a slum, those individuals make up 50% of the slum population.

Mysore's slum dwellers are significantly less literate than the overall population. While the city boasts an 86.84% literacy rate, 89.96% and 83.73% for males and females, respectively, the corresponding rates for slum dwellers are 63.38%, 67.17% and 59.62% (The Indian Census 2011). Slum unemployment is 56% overall, and over 72% of women in the slums are unemployed.

In the 69 slums in Mysore, nearly two-thirds, i.e. over 30,000 individuals, reside in slums with a population of 800 or more (Administrative Staff College of India, 2011). By focusing efforts on these 22 larger slums (Exhibit 1), the efficient allocation of efforts and funds to benefit the as much of the population as possible can be maximized. To this end, it is important to recognize that as slum size decreases, particularly in terms of population and numbers of households, it is most appropriate to seek a remediation that eliminates the settlement or incorporates it into an adjacent existing neighbourhood. In some cases, this approach also allows for the aggregation of slums in close proximity.

Using such a methodology, the interventions suggested here can include three additional slums reaching nearly 70% of the total slum population. Direct interventions, therefore, are focused on 25 slums (Exhibit 2).

Exhibit-1: Slum Locations



Source: CADD Station

Exhibit-2: Slums for Direct Alleviation

Ward	Slum Name	POP	HH	BPL POP	BPL HH	%BPL TOT
8	Chinnagirikoppalu	2,163	550	2,163	550	4.6%
9	Nellurushed Part A	866	200	866	200	1.9%
9	Nellurushed Part B**	594	143	580	140	1.2%
6	Ashokapuram 13th Cross	987	202	987	202	2.1%
8	D. Devaraja urs Colony	895	157	895	157	1.9%
28	Part of Kumbarakoppalu* **	525	122	525	122	1.1%
29	Metagalli Harijana Colony & Adhijambava Colony	963	204	963	204	2.1%
29	Metagalli Janata Colony	1,181	290	1,181	290	2.5%
29	Part of Metagalli* **	465	108	465	108	1.0%
30	Manjunathapura	900	190	900	190	1.9%
34	Medhars Block	1,091	289	1,078	285	2.3%
42	Budbudakeri Chikkaveranna Road	803	226	794	223	1.7%
42	Budbudakeri Pulikeshi Road	1,438	321	1,438	321	3.1%
44	Halim Nagara*	882	163	882	163	1.9%
45	Ekalavya Nagara*	1,383	353	1,383	353	3.0%
46	Kesare near slaughter house	1,258	285	1,258	285	2.7%
51	Siddappaji Cross Road 1,2,3	881	185	881	185	1.9%
51	Chamundeshvari Road Gandinagara	967	225	967	225	2.1%
51	Siddappaji Cross Block A	1,038	215	1,003	208	2.1%
52	Kalyanagiri Usmani Block*	2,067	389	2,067	389	4.4%
56	Sathagalli	2,509	523	2,509	523	5.4%
59	Kyatamaranahalli A.K. Colony	1,781	363	1,781	363	3.8%
59	Gousiya Form House*	1,730	357	1,730	357	3.7%
59	Gousiyanagara A Block*	3,657	730	3,657	730	7.8%
62	Jyothinagara	1,278	212	1,025	174	2.2%
	Totals	**32,302**	**7,002**	**31,978**	**6,947**	**68.4%**
	Percent Overall	**69.1%**	**67.5%**			

** Designate Non-notified Slums; ** Designate Adjacent Slums*

Source: Administrative Staff College of India, 2011.

Programs for Poverty Alleviation

Rather than attempt to relocate the slums, a renovation of the current slum development should take place. In many cases people who have lived on the land for many generations do not have property rights. However, it is important that the land belong to the family that is living on it before renovating. It is recommended that in Mysore a partnership be forged with current government interventions, such as the Jawaharlal Nehru National Urban Renewal Mission (JnNURM). JnNURM is at the forefront of land tenure and building projects in India, and it helps to bring together financial institutions, citizens, and other nonprofit organizations in order to make sustainable growth and development take place. JnNURM finished the preparatory phase of its Mysore renovation project, and began the infrastructure phase in June 2013.

According to the Karnataka budget of 2010, the state has set aside US$3,194,000, to build housing for homeless slum families. With this budget, it will be able to provide housing to one third of the neediest population (Saral VAT: Complete VAT Solutions for Karnataka, n.d.). It is suggested to supplement the other two thirds of this cost so that all families in need of shelter can obtain a home. By providing citizens with the basic necessities, there will be a decrease in the amount of assistance required for each family over time, and the city's overall worth will increase due to increased employment and decreased poverty.

Existing housing programs be supplemented financially by providing US$2,000,000 the first year. This will allow the NGOs that have formed a reliable working relationship with the people of the area to continue their work while meeting this chapter's overall goal of providing housing for the poor population of Mysore. An additional amount of US$1,250,000 will be given each year thereafter for four years. At the end of the five-year period, it is expected that 15,000 family dwellings will have been developed, with the land tenure rights provided to the families residing on the land.

Community and Sack Gardens

Beyond the fact that in India malnutrition accounts for roughly 50% of all childhood deaths, it also limits body and brain development and the capacity to learn. Coupled with malnourishment, vitamin and mineral deficiencies play a large role in children's underdevelopment in India. To help fight these deficiencies and malnourishment, the provision of leafy green gardens which can grow produce such as kale, collards, turnip greens, Swiss chard, and spinach in addition to other vegetables, is recommended. These greens can grow in resilient conditions and shallow soils to provide families and children with the appropriate vitamins and minerals commonly missing in the slums.

Keyhole Gardens

To accomplish this, the installation of a type of garden developed by TECA called a "keyhole" garden is recommended. TECA claims that keyhole gardens at their prescribed size can grow enough produce to feed a family of 8 persons with a production of at least 5 varieties of vegetables to support dietary diversity. The greatest benefit of TECA's keyhole gardens is that they require little labor, little water and no fertilizers or pesticides, and they act like an organic recycling tank, using food and garden waste as fuel to grow vegetables (Chiara, 2012). Someone unskilled in construction can build one with simple instructions.

Each keyhole garden unit should be constructed with Interlocking Stabilized Soil Blocks (ISSBs) produced by new business owners from the ISSB block compressing machine buy-out program specified later in this section.

Exhibit 3: Keyhole Garden

Source: Chiara, 2012.

Sack Gardens

Alternatively, if there is not ample space for construction, sack gardens may be employed. Sack gardens offer many of the same advantages that keyhole gardens do, such as low maintenance and labor requirements, drought resiliency, and little to no fertilizer. Sack gardens require only a small area, but yield a relatively large amount of garden growth. A one cubic meter sack may provide as much as five cubic meters of potential growing area, and can grow vegetables with mostly reused materials, so the cost is generally limited to the seeds and seedlings (Appropedia, 2012).

Exhibit 4: Sack Garden

Source: Cheffy, 2013.

Toilet Block

Health is a major issue in slums with people living in very close proximity to one another without toilet facilities or waste removal. The water is often contaminated, and diarrhea, parasitic infestation and fecal oral epidemics are common. Thus, the need for basic toilet facilities is apparent. In conjunction with the water and sanitation team, the installation of self-sustaining toilet blocks throughout 19 of Mysore's 69 acknowledged slums is proposed (Administrative Staff College of India, 2011). Each toilet block has the capacity to serve over 1000 people per day and reclaim the waste to produce biogas for heating and cooking, potable water and fertilizer.

The construction of these facilities is also coupled with the above mentioned business initiative for the inhabitants of the slums. Each toilet block facility will be constructed with ISSBs, which use a mixture of local clay soils (typically 90%) and a small amount of cement (10%). This mixture is compressed with the manually operated ISSB machine. It is proposed that after the completion of a toilet block, the workers are offered a buy-out program for the ISSB compression machine to begin their own business. More detailed information can be found about a proposed toilet block in the water and sanitation section of this plan (Sec. 3).

Gender-based Hiring or Gender-based Training Programs

Since there is a clear correlation between poverty and gender, it is recommended that incentives be created for the employment of women who have not been employed in the previous 12 months, and single mothers from Scheduled Castes or Tribes. The recommendation is initially to charge a tax by industrial sector for *not* hiring a predetermined quota from such a population, rather than to provide tax abatement for doing so. The proceeds would go to the development of vocational and technical education centers for these women. Over the medium to long term, the charge should be converted to abatement for hiring and training the target population. To this end, a sum of US$250,000, equally spread out over 5 years, is suggested for awareness campaigns and the partial funding of education centers.

INDUSTRY

Background: Indian Industrial Development

The second largest city in Karnataka state, Mysore is unequivocally its cultural center. The Dasara is a ten day celebration with a 400 plus year history, and includes parades, performances, and other cultural and religious events. The festivities attract tourists from the state, country, and even international guests. In addition, the city's rich architectural heritage, lush gardens and zoo are major attractions. Between 2006 and 2010, the number of tourists who visited the city increased from 1.4 million annually to over 3 million (Kumar, 2011). Other historically important industries are sandalwood and silks (Mysore City Corporation, 2013). Recently, the city, with the aid of organizations like the Karnataka Industrial Areas Development Board, has expanded its economic base to include technological services, engineering and heavy industry.

Mysore Industrial Areas

Following the direction of the State's Fiscal Reforms Facility, the state government in Karnataka set aside more than 5280 acres of land to establish 45 special economic zones (SEZs). Of these approved zones, 33 were committed to information technology (IT), generating an investment in the state of over US$3.9 billion, which will provide direct employment to 615,500 people (Mudde, 2008). Mysore will have SEZs committed to food processing, IT, and readymade garments. Industries established in SEZs enjoy a number of benefits, including tax holidays for 15 years and exemptions from levies such as Value Added Tax, entry tax, and octroi. In addition, industries in SEZs do not require licenses for imports and are exempt from paying customs duties on capital goods and raw materials (The Hindu, 2006).

The Karnataka Industrial Areas Development Board (KIADB) is essentially a blend between a land bank and a real estate development enterprise. The organization acquires land to form industrial areas in the state, provides basic infrastructure in those industrial areas, and then attracts global investors. To date, the KIADB has formed 141 industrial areas in the state, covering over 40,000 acres. The largest of these industrial areas is Hebbal, which includes Electronic City, home to campuses for both Infosys and Wipro. It consists of 1387 acres of land, which is primarily dedicated to fostering growth in information technology (IT). In 2007 - 2008, the Mysore-based IT sector contributed US$ 220 million to the Indian IT export economy (The Hindu, 2008).

Problem Statement

While revenues generated from tourism will likely grow with the rise of the Indian middle class, the city cannot afford to maintain a singular focus on tourism alone. By adopting policies to attract investment from domestic and international interests, Mysore might diversify its production to include a broader base of sectors within the city's portfolio. Bangalore, the economic heart of Karnataka State and an international source of expertise in IT services, sits 143 km to the northeast. While a similar trip in the United States or Europe might take 1.5 hours, due to limited transportation options and inferior road quality, the trip from Mysore to Bangalore takes twice as long. As a result, companies like Infosys and Wipro, which have offices in both Bangalore and Mysore, depend on private helicopter services to travel between the two, which is not a practical option for the general public. Mysore's primary developmental gap is not one of designation, but rather system integration.

Selected Options

In order to address this challenge, the city of Mysore should adopt three options. The first is the construction of an international airport, which will require nearly 343 acres of land to be acquired around the existing Mysore airport and consist of 3 stages of construction.

The second is the privatization of electricity distribution in the city of Mysore to allow energy companies, rather than the government, to control the transmission and distribution of electricity.

The third option is higher investment in Mysore's growing manufacturing and retail sectors and a change in policy. This will involve increasing the funds allocated for the improvement of infrastructure conducive to reliable logistics, including expansion and repairs of existing highways, land acquisition for distribution centers, and technological advances in the freight industry. The growing retail industry will require a change in policy from the central government. That is, the government policy requiring single-brand retailers to have no less than 30% of their products originate from India should be lowered to 15%.

SEWAGE AND SOLID WASTE

Problem Statement

Sewage Situation in Mysore

The management of sewage, which encompasses sewage collection and transportation, as well as its reuse, is a challenge. This is compounded by sewage overflows into open spaces and drainage systems. Presently, the existing sewage treatment plants in the city are also not able to treat the quantity of sewage generated, which in turn poses difficulties for sewage management. Problems include the fact that many households resort to open defecation, despite the fact that they have toilet facilities. In addition, public restrooms are inadequate, the sanitation in many government schools needs to be upgraded, and many commercial areas lack adequate sanitation facilities and depend on public ones. With the pressure on public restrooms, many people in commercial areas also resort to open defecation (Mysore City Corporation, 2011).

Solid Waste Management in Mysore

Solid Waste Generation

The population of Mysore generates about 385 tons of solid waste a day. This excludes waste generated from industries, restaurants, hospitals, construction activity and bio-medical waste (Harish, 2012). At the household level, both degradable and non-degradable wastes are generated. Vegetative matter constitutes the bulk of household solid waste, an estimated average of 45.65% of all household waste generated.

It is estimated that by the end of 2020, the waste generated could reach 583 thousand tons per year (Mysore City Corporation, 2011), which requires improved solid waste management systems to control the generation, collection, transportation, processing, treatment and disposal of waste.

Solid Waste Collection

The total amount of solid waste transported to the composting plant is 273 metric tons per day (Ibid.) from the total of 443.5 tons per day generated, producing an efficiency rate of 61.5%. According to the Draft City Plan of Mysore, upon arrival at the composting plant (200 TPD capacity), much of the waste is dumped on adjacent vacant land due to the plant having reached its full capacity or intermittent breaks in operation. When waste is processed, organic waste is composted, dried, packaged and stored to sell, whereas non-compostable waste is tossed onto the adjacent land. The inefficiency and dumping of nonorganic waste in an ad hoc manner has been detrimental to the quality of life for the surrounding neighbors as the unpleasant smell and unsanitary conditions are worrisome (Bennur, 2011). To accommodate the increasing generation of solid waste in Mysore, and to ease the burden on the composting facility, a more efficient process is needed, including a landfill.

Selected Options

Selected Options for the Sewage Sector

The following projects were selected for implementation to improve Mysore's sewage situation:

Exhibit 5: Selected Sewage Options for Implementation

Rank	Projects
1.	Construct ventilated improved latrines at discounted, subsidized prices for households.
2.	Extend the de-silting of manholes and the repair of UDGs.
3.	Re-construct nalas with concrete and de-silt open drains.
4.	Construct toilet facilities for all public schools in Mysore.

Source: Edelman, 2014.

Selected Options for the Solid Waste Sector

Based on their political and economic feasibility, as well as the prospective impact of all possible technical alternatives, the following solid waste options were selected for implementation:

Exhibit 6: Selected Solid Waste Options for Implementation

Rank	Projects
1.	Develop, adopt, and implement new responsibility acts and government policies.
2.	Reform the hazardous waste sector.
3.	Decentralize recycling centers.
4.	Establish and develop a landfill with a gas collection system.
5.	Enlist all health facilities of the existing treatment system available in the city.
6.	Purchase biomedical waste bins to facilitate waste segregation at health facilities.
7.	Implement a study of decentralized biogas centers to evaluate expansion possibilities.

Source: Edelman, 2014

TRANSPORTATION

Problem Statement

Mysore's transportation network faces significant pressure. First, the city's population is growing at a rapid pace, as is the number of registered vehicles (Mysore Urban Development Authority, n. d.). Second, the numerous transportation modes (motorized and non-motorized bikes, four-wheeled vehicles, buses, auto rickshaw, etc.) are not separated from each other, causing sometimes chaotic and dangerous situations, as well as traffic jams in many areas. Third, Bangalore, the largest city in Karnataka, suffers from such severe congestion that some believe the industrial operations in Bangalore will expand closer to Mysore in order to escape it (Ibid.). If Mysore does indeed absorb economic activity from Bangalore, the city must steer this growth into areas that will cause the least congestion and pollution. Fourth, the commuter rail line between Bangalore and Mysore has yet to be fully doubled and electrified, which may contribute to an influx of vehicular traffic between the two cities due to rail delays (Aravind, 2013). Fifth, Mysore is a major tourist destination for Indians.

Priorities

The following goals were deemed priorities for improving the transportation network and accessibility in Mysore:

Exhibit 7: Priorities for Future Transportation Projects

Rank	Priorities
1.	Connect existing transportation options into an integrated system.
2.	Improve public transportation, specifically the crowded bus system.
3.	Discourage vehicles from entering Mysore through park-and-ride facilities and tolling of major roads entering the city.
4.	Boost pedestrian safety through investment.
5.	Reduce tourist traffic through a year-round shuttle system.
6.	Improve the commuter rail system by completing the doubling and electrification of the line between Bangalore and Mysore.
7.	Improve existing roads, especially major roads entering the city.
8.	Implement public policies that ban certain vehicles on major roads to improve traffic flow and increase safety.

Source: Edelman, 2014

ENERGY

Background

This section of the Environmental Plan for Mysore discusses issues of energy in the city, and advocates the implementation of three strategies that will cleanly increase electricity capacity in Mysore without the construction of new generation stations. Increasing end user efficiencies through the retrofitting of the Amba Vilas Palace illumination system and initiating a twenty year city-wide energy efficiency rebate program is the first. Benign generation through the capture of low temperature waste heat from industry and existing thermal stations for additional generation, without any additional fuel use and through the introduction of solar powered irrigation pumps, is the second. Enabling agriculture to redirect the use of natural gas from fertilizer production to use as a cleaner and more efficient replacement of coal is the third.

Mysore's Energy

Mysore's energy demands are geometrically increasing. By 2020, the population is expected to increase to 1,412,800 (Mysore Urban Development Authority, 2012), and an increase in industrial and consumer activities is expected. Therefore, the municipality needs to address its systems of services, which include water, sanitation, transportation and energy. The city's electricity production is directly tied to that of the state, and production has been steadily increasing, much of it derived from hydro, thermal, and, happily, cogeneration, while electricity sales in Karnataka are primarily to agriculture, high voltage industry and for domestic needs. Agricultural demands are for irrigation purposes, industrial demands are predominantly for IT, and domestic demands are for illumination and appliances.

Problem Statement

With a growing population and a desire for electricity intensive IT industrial development, Mysore's energy demands are surging. The main goal of this section's proposals is to increase electric generation, while both avoiding excessive capital outlays for additional large-scale generation plants and minimizing the environmental impact of capacity enhancement.

Priorities

The following are considered priorities for improving energy efficiency and long-term sustainability in Mysore:

Exhibit 8: Priorities for Future Energy Projects

Rank	Priorities
1.	Conserve energy through end user efficiency enhancement.
2.	Maximize energy potential and reduce waste quantity by returning waste items to the stream of energy production through benign electric generation enhancement.
3.	Reduce diversion of natural gas to fertilizer production with national agricultural reform.

Source: Edelman, 2014

Selected Technical Options

Project 1: Light Bulb Replacement in Amba Vilas Palace

According to Greenpeace (Greenpeace India, 2007), if the Amba Vilas Palace were to switch all of its 96,000 bulbs from incandescent to compact fluorescent (CFL), it could reduce its annual electricity usage from 120,000 KWh to 40,000 KWh, lower its carbon footprint by 46,632 kg. (102,590 lbs.), and shave nearly US$ 66,764 from its annual electricity expenditure. On the other hand, switching to LED bulbs would be more costly than CFL replacement, but would yield greater benefits. The average cost per bulb is US$36, but they last 50 times longer than incandescent bulbs and use 1/6th of the energy. An investment of US$3,500,000 to replace the bulbs and secure spares would save US$25,608,000 during the 50,000 hour lifespan of LED bulbs.

Project 2: Community Wide Energy Efficiency Rebate Program

Structural retrofits that improve energy efficiency not only reduce end use expenditures, but also stimulate the local economy through workforce capacity building and material stream provision and recycling. This suggested program, which would be heavily advertised (US$50,000), would provide up to US$10,000 in rebates to a building owner for the appropriate technology changes and tightening of the cooling envelope. Over a 20 year period, this program would train certified energy auditors (US$132,000), incentivize product manufacturers and waste recovery (US$200,000,000), and offset the cost of building additional electric generation stations through energy savings.

Project 3: Waste Heat Recovery

Given that 27% of the electricity in Karnataka is generated thermally, primarily through the combustion of coal, a waste heat recovery system is a strategic manner in which to increase production without increasing the quantity of fuels burned. Dürr Engineering (Dürr AG, 2013) produces variable Organic Rankin Cycle (ORC) models to fit specific heat availabilities and generation requirements, adding an additional 11% or 22% gain in the conversion of heat to electricity in the original thermal system. A feasibility study should be conducted to determine the specifications of the units required for such a project, as well as the technical, logistical, and financial need.

Project 4: Agricultural Reform

Precision Agriculture

A growing technology is the use of GPS and GIS technologies for the more frugal application of fertilizers on medium to large-scale farms in which large tractors are required. Several land-grant universities and private firms in the US offer technical assistance in getting farm-scale systems set up. To demonstrate applicability in Karnataka, 3 or 4 demonstration projects should be established. The average cost for establishing a system is US$15,000, given that there are 100 acres and the appropriate farm equipment to justify such a system.

Crop Rotation and Low/No Till Farming Techniques
It is recommended that education, training, and starter seeds for farmers be provided through Mysore University to teach new sustainable farming practices to increase energy efficiency and yield crops. The benefits of these techniques are soil conservation, watershed protection and the decreased use of fertilizers. This reduces the agricultural use of natural gas, which can then be applied to thermal electricity reduction.

Poly-culture Market Gardening
For smaller agricultural establishments, a movement away from commodity crop production and toward poly-culture and specialty crops is encouraged, not only to reduce the use of artificial fertilizers, but also to increase the share of perennials, which will help keep the soil intact, as well as protect the groundwater, and to move into the retail market rather than being victimized by required wholesale pricing.

WATER

Background

Flooding

Flooding is a significant problem within Mysore, particularly during the May to November monsoon season. Flooding causes problems when combined with human waste and pollution. The practice of open defecation in the city, as well as a waste treatment plant being located in the flood zone, leads to human waste being picked up by the flood waters and sitting as a breeding ground for illness. As the water dissipates, it carries these pollutants to the water sources thereby resulting in unsanitary drinking water, especially for the impoverished slum dwellers.

Sanitation - Toilet Complexes

Mysore's slums do not have consistent access to sanitary sewage removal. Furthermore, methods of waste disposal may vary by household. One house may have an internal septic tank that is utilized, whereas the next house may have the same internal septic tank, but the space that it occupies is used for storage of household items, thus rendering the septic tank useless. Another house may drain into an open drainage channel (nala), and a neighboring one may drain sewage into storm water drainage or underground drainage. Lastly, individuals may practice open defecation. This presents a lack of uniformity in waste sanitation. The Karnataka Municipal Reforms Cell, as cited by the City Sanitation Plan, Mysore, Karnataka (2011) identifies the following breakdown of slum sewage disposal: digester, 30.2%; not connected, 31.2%; storm water drainage, 44.1% and underground drainage, 53.1%. Given the incidence of poorly regulated human waste disposal, the risk of drinking water contamination resulting in subsequent outbreaks of fecal-oral transmitted disease remains high without a targeted slum intervention. A centralized toilet complex in portions of the slums can aid in combatting this threat to public health as it can be standardized and regulated. The water team recommends a toilet complex that requires no connection to city sewers but allows for regulated operation, in particular the successful model at Adarsh College, Badlapur (see Section 6.3.2).

Water Supply

Today, 85% of Mysore's residents receive drinking water from a piped supply system sourced from the Kaveri and Kabini Rivers (Scheme, 2006). There are also numerous private companies selling bottled water in Mysore. These companies provide water that is not always hygienic, and can be more expensive (Raju et al., 2010). Moreover, there are many limitations to the availability and uses of this supply: piped water is available for approximately 3 hours/day for household use, as water for agricultural purposes limits usage in the city

(Maramkkal, 2012). In addition, Unaccounted for Water (UFW) due to theft, lack of operation and maintenance, and inadequate storage accounts for up to 50% of water usage (Scheme, 2006).

Mysore has adopted a plan addressing many of its water supply problems. Steps to rehabilitate water facilities, impose strict metering and efficiently retain water are being considered (Scheme, 2006). In addition to the city's efforts to ease the competition of water resources and availability, it is recommended that water conservation and groundwater recharging methods be implemented. In particular, residents of slum dwellings have inadequate access to water for daily use. Small-scale, residential options of water harvesting may be a beneficial means of remediation.

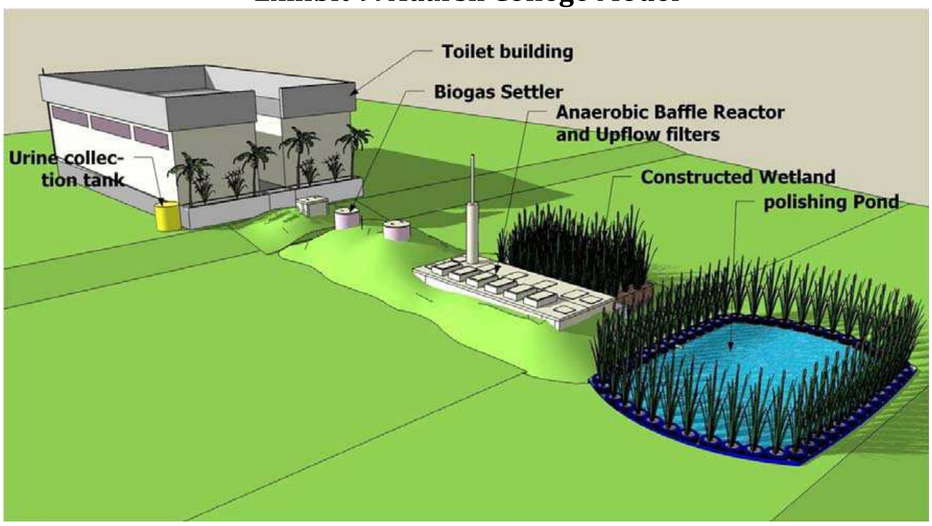
Selected Options

Urban Tree Pits and Constructed Wetlands

To address the issue of flooding within the city of Mysore, two projects to be implemented consecutively are recommended: a series of 378 urban tree pits and the installation of 2, 1 to 4 acre wetlands. Urban tree pits for this project are a structured planting of trees for the specific purpose of absorbing rainwater runoff while filtering toxins and pollutants from the water, including suspended solids, metals, and nutrients. Urban tree pits have the potential to absorb and filter up to 954 gallons of water per rain event depending on the tree that has been planted (Charles River Watershed Association, 2008). The two wetlands should be located at the base of decline of highlands in order to retain storm water runoff from higher elevations.

The Adarsh College Model

Exhibit 9: Adarsh College Model



Source: Zimmerman, Wafler and Thakur, 2010.

The Adarsh College Model is the recommended option for sanitation. The system consists of a toilet house with passive (gravity fed) urinals with 4 pour flush toilets and 1 western style toilet per gender. Additionally, 5 urinals are built in for a total of 15 waste collection units. The collection units drain into a passive treatment complex that consists of a biogas settler, an anaerobic baffle reactor and up flow filters. The biogas settler produces 6.8 cubic meters of gas for cooking or lighting purposes (Zimmermann, Wafler and Thakur, 2010).

The anaerobic baffle reactor/upflow complex holds 1.5 days of wastewater and produces 9.75 m^3 per year of agriculture grade compost. The toilet complex produces 8 m^3 of wastewater per day that flows through a wetland with a commensurate capacity to a collection pond. The entire complex occupies approximately 93 m^2. Given that the toilet blocks require a slight gradient for passive drainage, excavation of the intended areas for the treatment system will provide soil that can be utilized for the creation of Interlocking Stabilized Soil Blocks or ISSBs (Ibid.).

Drinking Water

Rainwater harvesting (RWH) is proposed here as the most efficient and easily implemented option to supplement Mysore's water supply, especially in slum areas. Karnataka has already heavily invested in RWH (Scheme, 2006), and the National Institute of Engineering – Center for Renewable Energies and Sustainable Technologies (NIE – CREST) has started urban programs and training on RWH within Mysore. Their projects include a RWH system at Mysore Palace using rainwater for gardening. Because of Mysore's urban environment and high density of housing in slum areas, using rooftop RWH systems is suggested.

FINANCE

Objective

The objective here is to identify funding sources, both foreign and domestic, for the various projects requested by each sectoral group. The financial team reviewed all requests for funds and created a database that would determine the financing ability of each project based on projections of foreign direct investment, foreign aid and Mysore's capacity for municipal debt. The process of financing each sector's projects is outlined below.

The Process

Research Process for Foreign Direct Investment

In this paper, Foreign Direct Investment (FDI) is defined as a direct investment of one country in another. This is done either by investing in a previously existing business, or by financing a new one. The countries that have invested the most in India are detailed later in this section.

Research Process for Foreign Aid

Foreign aid is defined here as official development assistance (ODA) in areas of need such as food aid, emergency relief, peacekeeping, infrastructure, poverty alleviation, etc. The most significant foreign aid agencies in India are: JICA (Japan), DFID (UK), AFD (France), SIDA (Sweden) and USAID (United States). After calculating the total amounts given, the sectors each aid agency contributed to were identified. Certain countries had the propensity to focus on one sector more than another. For example, most of Japan's aid was tied up in transportation (jica.co, 2013), whereas France focused on renewable energies (afd.fr, 2013). In determining the amounts given to specified sectors, the team needed to make certain assumptions. For instance, if it found a project SIDA was involved in was with a city similar in size to Mysore, it assumed that SIDA would be willing to give the same amount to a similar project located in Mysore. Another aspect necessary to consider was the fact that Britain's foreign aid agency (DFID) is ceasing all aid to India as of 2015. It is, however, fulfilling all commitments made before then (gov.uk, 2013; gov.uk, 2011.).

Determining Mysore's Maximum Debt Capacity

Mysore does not publish its budget on an online database. As a result, an assumption was made that the debt capacity for the cities of Mysore and Cincinnati, USA were similar. The financial team determined Cincinnati's debt capacity, based on the 2014-2015 proposed budget specified on Cincinnati's website (Cincinnati-oh.gov, 2013), to be US$520,400,000 of post- sale general obligation unlimited tax and debt. As of December 4, 2013, the 30-year US Treasury bond rate was valued at 4%. Therefore, the financial team assumed that Mysore could assume a maximum debt of US$30,094,783 per year based on the 30-year US Treasury rate of 4% and a maximum debt allowance of US$520,400,000. It was also assumed that Mysore would account for 20% of each year's total cost. If the 20% portion of Mysore's financing exceeded US$30,094,783 in any given year, then additional financing would need to be sought for the remainder of Mysore's 20%.

The Grant Application

While the need for funding to improve the environment in Mysore is significant, there is a limited supply of resources. Consequently, the financial team created a grant application for each sectoral team to complete. The grant application created the opportunity for each group to request funding in a structured manner. The financial team focused on the prioritization of projects, project cost per year, and percentage of project completed at the end of 5 years.

Database

The finance team compiled a series of Excel spreadsheets to document the detailed funding requests and identify foreign aid, foreign direct investment and debt capacity for Mysore.

Request for Funds

The Request for Funds spreadsheet (Exhibit 10) displays each team's funding requests from the grant application. As noted above, the assumption was made that Mysore would finance 20% of each project's total cost, and the fourth column from the left displays this. The total amount that Mysore needs to finance over the 5-year period is US$84,939,643. The funding without aid column shows the final cost of each project after Mysore's 20% is subtracted from the total cost. The second to last column shows the number of years each project would take to complete. Each sectoral team acknowledged that the finance team's role was to find money only for 5 years. Finally, the priority that each project was given by its team is shown on the very right.

Exhibit 10: Group Requests for Funds

Projects	Group	Project Cost (USD)	Local Currency Cost	Funding Needed (w/o Aid)	Number of Years to Construct	Priority
Urban Tree Pit	Water	$163,000	$32,600	$130,400	2	3
Decentralized Toliets	Water	$889,920	$177,984	$711,936	1	2
Rain Water Harvesting	Water	-			5	1
Ventilated Latrines	Sanitation / Solid Waste	$364,250	$72,850	$291,400	4	1
Repair and Extend UDG	Sanitation / Solid Waste	$682,090	$136,418	$545,672	3	2
Manhole	Sanitation / Solid Waste	$3,485,584	$697,117	$2,788,467	5	3
Inlist Health Facilities	Sanitation / Solid Waste	$6,250	$1,250	$5,000	5	4
Biomedical Waste Bins	Sanitation / Solid Waste	$80,352	$16,070	$64,282	5	5
Public School Toliets	Sanitation / Solid Waste	$20,000	$4,000	$16,000	1	6
New Gov Policies	Sanitation / Solid Waste	$71,286	$14,257	$57,029	5	1
Decentralize Recycling	Sanitation / Solid Waste	$196,560	$39,312	$157,248	5	2
Landfill/Gas Collection	Sanitation / Solid Waste	$528,768	$105,754	$423,014	3	3
Hazardous Waste Reform	Sanitation / Solid Waste	$32,862	$6,572	$26,290	5	4
Biogas Centers	Sanitation / Solid Waste	$5,000	$1,000	$4,000	1	5
Light Bulb Replacement	Energy	$3,500,000	$700,000	$2,800,000	5	1

Projects	Group	Project Cost (USD)	Local Currency Cost	Funding Needed (w/o Aid)	Number of Years to Construct	Priority
Urban Tree Pit	Water	$163,000	$32,600	$130,400	2	3
Decentralized Toliets	Water	$889,920	$177,984	$711,936	1	2
Rain Water Harvesting	Water	-			5	1
Ventilated Latrines	Sanitation / Solid Waste	$364,250	$72,850	$291,400	4	1
Repair and Extend UDG	Sanitation / Solid Waste	$682,090	$136,418	$545,672	3	2
Manhole	Sanitation / Solid Waste	$3,485,584	$697,117	$2,788,467	5	3
Inlist Health Facilities	Sanitation / Solid Waste	$6,250	$1,250	$5,000	5	4
Biomedical Waste Bins	Sanitation / Solid Waste	$80,352	$16,070	$64,282	5	5
Public School Toliets	Sanitation / Solid Waste	$20,000	$4,000	$16,000	1	6
New Gov Policies	Sanitation / Solid Waste	$71,286	$14,257	$57,029	5	1
Decentralize Recycling	Sanitation / Solid Waste	$196,560	$39,312	$157,248	5	2
Landfill/Gas Collection	Sanitation / Solid Waste	$528,768	$105,754	$423,014	3	3
Hazardous Waste Reform	Sanitation / Solid Waste	$32,862	$6,572	$26,290	5	4
Biogas Centers	Sanitation / Solid Waste	$5,000	$1,000	$4,000	1	5
Light Bulb Replacement	Energy	$3,500,000	$700,000	$2,800,000	5	1

Source: Edelman, 2014.

Estimated Project Cost by Year

The Estimated Project Cost by Year worksheet (Exhibit 11) is also a result of the grant application. Teams were asked to provide their request per year to ensure a steady level of financing over the 5-year period. This worksheet is also important because it was used to evaluate the level of Mysore's 20% debt each year and because it shows how much money needs to be financed each year after the local currency costs are calculated. These figures are those calculated before foreign aid is applied.

Proposed Aid by Country

Once the amount each foreign aid agency gave to India by sector was determined, it was necessary to make assumptions to determine a realistic amount that would be given to Mysore. This was done by first calculating the percentage of India's population living in the state of Karnataka to be 5.3%, and allocating total aid accordingly. After the 5.3% of aid was given to Karnataka, the assumption was made that Bangalore would receive 25% of this total, and Mysore 20% (the same percentages used to calculate the FDI figures). This process was used for each sector that received funds from that particular aid agency. With this information in hand, the financial team was then able to address a sectoral team's preliminary questions regarding how much money they could expect from each country. See Exhibit 12.

Exhibit 11: Estimated Project Costs by Year

Projects	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Urban Tree Pit/ Wetlands	$250	$750	$62,000	$50,000	$50,000	**$163,000**
Decentralized Toliets	$468,379	$421,541	$0	$0	$0	**$889,920**
Rain Water Harvesting	$0	$0	$0	$0	$0	**$0**
Ventilated Latrines	$0	$77,000	$95,750	$95,750	$95,750	**$364,250**
Repair and Extend UDG	$0	$0	$75,000	$303,545	$303,545	**$682,090**
Manhole	$75,000	$852,646	$852,646	$852,646	$852,646	**$3,485,584**
Inlist Health Facilities	$5,250	$250	$250	$250	$250	**$6,250**
Biomedical Waste Bins	$21,600	$29,106	$29,106	$270	$270	**$80,352**
Public School Toliets	$0	$20,000	$0	$0	$0	**$20,000**
New Gov Policies	$27,600	$14,475	$14,475	$14,475	$0	**$71,025**
Decentralize Recycling	$46,440	$46,440	$34,560	$34,560	$34,560	**$196,560**
Landfill/Gas Collection	$0	$0	$176,256	$176,256	$176,256	**$528,768**
Hazardous Waste Reform	$5,000	$27,862	$0	$0	$0	**$32,862**
Biogas Centers	$0	$0	$0	$0	$5,000	**$5,000**
Light Bulb Replacement	$3,500,000	$0	$0	$0	$0	**$3,500,000**
Community Wide Energy Efficiency Rebate Program	$40,382,000	$40,000,000	$40,000,000	$40,000,000	$40,000,000	**$200,382,000**
Waste Heat Recovery	$200,000	$0	$0	$0	$0	**$200,000**

Source: Edelman, 2014.

Exhibit 12: Proposed Aid by Country

Source	Project	Amount	Karnataka	Bangalore	Mysore
Japan (JICA)	Small Industry	$305,640,000	$16,086,316	$6,434,526	$3,217,263
	Water	$427,602,000	$22,505,368	$9,002,147	$4,501,074
	Renewable Energy	$305,640,000	$16,086,316	$6,434,526	$3,217,263
	Bengaluru Metro	$662,220,000	$34,853,684	$13,941,474	$6,970,737
	Sewage	$285,068,000	$15,003,579	$6,001,432	$3,000,716
	Electricity	$111,991	$5,894	$2,358	$1,179
	Forrest	$155,025,337	$8,159,228	$3,263,691	$1,631,846
UK (DFID)					
	Low Carbon Energy	$3,400,000	$178,947	$71,579	$35,789
	Water	$5,730,167	$301,588	$120,635	$60,318
	Sanitation	$5,730,167	$301,588	$120,635	$60,318
	Poverty	$4,995,079	$262,899	$105,160	$52,580
	HIV	$41,246,600	$2,170,874	$868,349	$434,175
	Health	$62,601,034	$3,294,791	$1,317,916	$658,958
France (AFD)					
	Renewable Energy	$205,905,000	$10,837,105	$4,334,842	$2,167,421
	Co Finance w Jica Bengulu	$150,997,000	$7,947,211	$3,178,884	$1,589,442
	Water	$31,572,100	$1,661,689	$664,676	$332,338
ADB					
	Transportation		$921,052,631	$250,000,000	$184,210,526
	Water	$90,000,000	$4,736,842	$1,894,737	$947,368
	Sewage	$90,000,000	$4,736,842	$1,894,737	$947,368
	Housing	$90,000,000	$4,736,842	$1,894,737	$947,368
	Energy	$2,000,000	$105,263	$42,105	$21,053
	Transmission line for soloar	$500,000,000	$26,315,789	$10,526,316	$5,263,158
World Bank					

Source: Edelman, 2014.

Proposed Aid by Project

After total amounts of aid given by each country by sector were ascertained, a table was prepared to show the respective funding found for each sector, in order for teams to see how much they could expect in total for their own projects. It was again assumed that Karnataka represented 5.3% of India's population, and that 20% of this total would be allocated to projects located in Mysore. See Exhibit 13.

Exhibit 13: Proposed Aid by Project

Source	Group	Project	Amount	Karnataka	Bangalore	Mysore
JICA	Water	Water	$427,602,000	$22,505,368	$9,002,147	$4,501,074
UK	Water	Water	$5,730,167	$301,588	$120,635	$60,318
France	Water	Water	$31,572,100	$1,661,689	$664,676	$332,338
ADB	Water	Water	$90,000,000	$4,736,842	$1,894,737	$947,368
World Bank	Water	Water Pumping Improveme	$1,500,000	$78,947	$31,579	$15,789
					TOTAL:	$5,856,887
ADB	Transportation	Transportation		$921,052,631	$250,000,000	$184,210,526
Sweeden	Transportation	Sustainable Infrastructure	$907,714	$47,774	$19,110	$9,555
World Bank	Transportation	Sustainable Transport	$17,500,000	$921,053	$368,421	$184,211
World Bank	Transportation	Highway Improvement	$350,000,000	$18,421,053	$7,368,421	$3,684,211
					TOTAL:	$188,088,502
JICA	Sanitation / Solid Waste	Sewage	$285,068,000	$15,003,579	$6,001,432	$3,000,716
UK	Sanitation / Solid Waste	Sanitation	$5,730,167	$301,588	$120,635	$60,318
ADB	Sanitation / Solid Waste	Sewage	$90,000,000	$4,736,842	$1,894,737	$947,368
					TOTAL:	$4,008,402
JICA	Energy	Renewable Energy	$305,640,000	$16,086,316	$6,434,526	$3,217,263
JICA	Energy	Electricity	$111,991	$5,894	$2,358	$1,179
UK	Energy	Low Carbon Energy	$3,400,000	$178,947	$71,579	$35,789
France	Energy	Renewable Energy	$205,905,000	$10,837,105	$4,334,842	$2,167,421
ADB	Energy	Energy	$2,000,000	$105,263	$42,105	$21,053
USA	Energy	Environment	$2,700,000	$142,105	$56,842	$28,421
Sweeden	Energy	Environment	$1,809,445	$95,234	$38,094	$19,047
IFC	Energy	Waste to Energy	$9,000,000	$473,684	$189,474	$94,737
					TOTAL:	$5,584,910
UK	Poverty	Poverty	$4,995,079	$262,899	$105,160	$52,580
UK	Poverty	HIV	$41,246,600	$2,170,874	$868,349	$434,175
UK	Poverty	Health	$62,601,034	$3,294,791	$1,317,916	$658,958
ADB	Poverty	Housing	$90,000,000	$4,736,842	$1,894,737	$947,368
IFC	Poverty	Housing	$24,000,000	$1,263,158	$505,263	$252,632
USA	Poverty	Healthcare	$63,300,000	$3,331,579	$1,332,632	$666,316
USA	Poverty	Educational & Social Servic	$2,900,000	$152,632	$61,053	$30,526
Sweeden	Poverty	Health	$2,177,931	$114,628	$45,851	$22,926
Sweeden	Poverty	Education	$1,038,197	$54,642	$21,857	$10,928
Sweeden	Poverty	Humanitarian Aid	$673,702	$35,458	$14,183	$7,092
					TOTAL:	$3,083,500
JICA	Industry	Small Industry	$305,640,000	$16,086,316	$6,434,526	$3,217,263
World Bank	Industry	Agriculture	$40,000,000	$2,105,263	$842,105	$421,053
USA	Industry	Economic Development	$7,800,000	$410,526	$164,211	$82,105
Sweeden	Industry	Market Development	$332,945	$17,523	$7,009	$3,505
Sweeden	Industry	Agriculture / Forestry	$818,734	$43,091	$17,237	$8,618
					TOTAL:	$3,732,544

Source: Edelman, 2014.

Amount Needed for Financing of Selected Options

The total amount that must be financed through loans or other funding sources is listed on the Amount Needed for Financing of Selected Options spreadsheet (Exhibit 14), which displays each project with its respective sector and its total cost as stated on the grant. The total amount requested was US$424,698,217 for the 5-year period. The next column shows the amount of aid that was identified through the finance team's research, which is US$84,939,643. The total amount of aid was subtracted from the total amount of the project cost. The local currency portion was then accounted for by adding up the total amounts of local currency provided for each project. The total project cost was then subtracted, with the total amount of aid and the total amount of local currency leaving some teams with a need for additional financing. The total amount needed by all of the sectoral teams is US$162,191,190. The sectors that do not need additional financing are water, transportation, and industry. The team requiring the largest amount of additional financing is energy, which is attempting to implement a costly rebate program. The energy and transportation sectors are the most expensive to finance. However, more aid was found for transportation related projects than for energy. Nevertheless, substantial foreign aid was found for most sectors. The team that had the most aid identified is transportation at US$188,088,502.

Exhibit 14: Amount Needed for Financing Selected Options

Group	Projects	Requested Funds	Available Aid	20% Local Currency	Amount Needed
Water	Urban Tree Pit/ Wetlands	$163,000		$32,600	
Water	Decentralized Toliets	$889,920		$177,984	
Water	Rain Water Harvesting	$0		$0	
	TOTAL	**$1,052,920**	**$5,856,887**	**$210,584**	**$0**
Sanitation/Solid Waste	Ventilated Latrines	$364,250		$72,850	
Sanitation/Solid Waste	Repair and Extend UDG	$682,090		$136,418	
Sanitation/Solid Waste	Manhole	$3,485,584		$697,117	
Sanitation/Solid Waste	Inlist Health Facilities	$6,250		$1,250	
Sanitation/Solid Waste	Biomedical Waste Bins	$80,352		$16,070	
Sanitation/Solid Waste	Public School Toliets	$20,000		$4,000	
Sanitation/Solid Waste	New Gov Policies	$71,286		$14,257	
Sanitation/Solid Waste	Decentralize Recycling	$196,560		$39,312	
Sanitation/Solid Waste	Landfill/Gas Collection	$528,768		$105,754	
Sanitation/Solid Waste	Hazardous Waste Reform	$32,862		$6,572	
Sanitation/Solid Waste	Biogas Centers	$5,000		$1,000	
	TOTAL	**$5,473,002**	**$4,008,402**	**$1,094,600**	**$370,000**
Energy	Light Bulb Replacement	$3,500,000		$700,000	

Source: Edelman, 2014.

Foreign Direct Investment Estimates

The process of financing each sector's projects began with an examination of what countries played the largest role in terms of foreign direct investment (FDI) in India, and the finance team compiled a list of the top contributors. It then focused on the top 9 countries that invested in India, and calculated the amount they gave each year assuming that Mysore would be able to utilize 10% of those funds. For example, Singapore invested a total of US$21,600,000, which, over a 13 year period, came out to be US$1,661,538 annually. Once the 10% assumption is factored in, Mysore would have US$166,154 with which to work. The finance team found the vast majority of FDI funding to come from the US, which for Mysore is US$14,474,286. The 9 countries taken together are able to contribute a total of US$21,206,643 to Mysore. Another factor here is the propensity of a country to invest in a particular sector. These countries are most likely to invest in: services, construction, telecommunications, computer software and hardware, drugs and pharmaceuticals, chemicals, autos, power, metallurgical industries and hotel/tourism. It is, then, the responsibility of the sectoral teams to conclude whether or not their projects can elicit funds from FDI, and, if so, to estimate how much they could obtain. See Exhibit 15.

Exhibit 15: Estimated Foreign Direct Investment

Country	Top Sectors	Amount Given	Period	Amount Per Year for India	Likely mmount to Mysore
Singapore	Services, construction, telecommunications, computer software & hardware, drugs & pharmaceuticals, chemicals, automotive, power, metallurgical industries, & hotel/tourism	$21,600,000	2000-2013	$1,661,538	$166,154
USA	Services, construction, telecommunications, computer software & hardware, drugs & pharmaceuticals, chemicals, automotive, power, metallurgical industries, & hotel/tourism	$2,026,400,000	2008-2009	$144,742,857	$14,474,286
UK	Services, construction, telecommunications, computer software & hardware, drugs & pharmaceuticals, chemicals, automotive, power, metallurgical industries, & hotel/tourism	$17,600,000	2000-2015	$1,173,333	$117,333
Netherlands	Services, construction, telecommunications, computer software & hardware, drugs & pharmaceuticals, chemicals, automotive, power, metallurgical industries, & hotel/tourism	$9,400,000	2000-2016	$587,500	$58,750
Japan	Services, construction, telecommunications, computer software & hardware, drugs & pharmaceuticals, chemicals, automotive, power, metallurgical industries, & hotel/tourism	$14,700,000	2000-2017	$864,706	$86,471
Germany	Services, construction, telecommunications, computer software & hardware, drugs & pharmaceuticals, chemicals, automotive, power, metallurgical industries, & hotel/tourism	$6,000,000	2000-2018	$333,333	$33,333
France	Services, construction, telecommunications, computer software & hardware, drugs & pharmaceuticals, chemicals, automotive, power, metallurgical industries, & hotel/tourism	$3,600,000	2000-2019	$189,474	$18,947

Source: Edelman, 2014.

Loan Availability

The finance team searched for the loan rates and terms of payment of various banks (deccanherald.com, 2013), and found that the World Bank provides an IBRD (International Bank for Reconstruction and Development) loan of various lengths and interest rates. Loans to be repaid in 12 years or less are offered at 0.28%; those to be repaid in 12 to 15 years are available at 0.38%; and loans to be paid over 15 to 18 years are offered at 0.48%. Each loan required a 0.25% front-end fee as soon as the project goes online in order to obtain the IBRD loan (treasury.worldbank.org, 2013). The Asian Development Bank offers a LIBOR (London Interbank Offered Rate), which is a loan that utilizes average interest rates as determined by leading banks in London. This loan is offered at 0.35% over a span of 19 years. There is no front-end fee required in order to obtain the loan. The finance team made the assumption that the interest rate is 0.35% given that this was the rate offered in the past 6 months (adb.org, 2013). The last loan found is a direct loan offered by the US Export-Import Bank, which is offered at 2.99% and could exceed a loan term of 11 years, but not 12. The exception would be a loan used to develop a renewable energy project, which could be obtained at 3.82% over a span of 18 years (treasury.gov, 2013).

CONCLUSION

Financing foreign development has been made easier since the onset of globalization. However, the ability to attract a level of financing that will mitigate all of Mysore's inadequacies in industry, energy, poverty, sewage and solid waste, transportation and water is minimal. Mysore has a strategic location 3 hours from Bangalore, which makes it an ideal location for foreign investment. The city, like the rest of India, is growing at an astonishing rate, shifting more people into the middle-class than ever before. Financing development in Mysore is required for it to participate in the continued success of India's economy, and the problems in Mysore will prove to be severe if the city cannot continue to attract a certain level of aid and foreign investment.

FINAL COMMENTS

The intent of the project this paper summarizes was to bring the contemporary thinking and practice of Urban Environmental Management to the solution of real problems in a major city in a developing country. The exercise, then, was to replicate as much as possible the conditions under which a team of expatriate consultants would operate in this context so that they could develop solutions that fit the circumstances they would likely find as professional planners. In this working environment, it was instructive for the students to formulate a 5-year plan of solutions to the environmental problems and issues they faced rather than to be told how to solve them. This expanded their analytical skills and taught them how to utilize the limited knowledge and resources available to come up with implementable solutions for the benefit of the population of Mysore. They learned that such skills are transferable to other projects, and they gained a greater appreciation of the skill set that they are developing as planners. Bringing the reality of development to the classroom and asking students to confront it gives them an appreciation of professional practice that the study of theory alone does not. Thus, this project has attempted not only to expand the education of planning graduate students, but also to provide a meaningful contribution to planning pedagogy.

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