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Partnership between Municipality and Public University to Improve the Sustainable Development of Small Municipalities

Camilo Michalka Jr.
Federal University of Rio de Janeiro (UFRJ) - Urban Engineering Program
michalka@ufrj.br
Brazil

1. Introduction

Rio de Janeiro suffers from the fast growth of migration, which is approaching the city from the smaller municipalities and rural areas. This causes a variety of tremendous social problems. One of them is the lack of a complex social housing program to manage the highly needed residential space for the new inhabitants. In the same time, it makes the cities aim to provide a sustainable urban development of the Metropolitan Area of Rio de Janeiro a lot more difficult. The migration in the metropolitan areas has been very intensive in Brazil along decades. In the history of these metropolises, the necessary planning for technical and social infrastructure to receive this migration was missing.

Another problem is that the most part of the people that migrate to the big cities, do not have a profession. They look for works that do not need qualification. Because of this, they do not have a good salary, which would permit support their homes. As consequence appear the slums (Safatke & Bernardi, 2008).

One of the solutions for this urban situation is to establish and improve the render and substantial improvement of the smaller cities' development and education, which are responsible for the migration towards the Metropolitan Areas.

The tasks for the smaller cities are to develop sustainable concepts as an answer to the huge pressure on the migration into the Metropolises, in order to integrate the city in the countries' necessities and further on to reduce the migration from the small cities towards the big cities and metropolitan areas.

In this concept, it is necessary to improve a professional education, to give the inhabitants opportunity to work in professions that are necessary to the economical reality of the municipality. The most part of the young people do not have yet opportunities to learn a profession in his municipality.

It is important to consider that the small cities in Brazil, still have the opportunity to implement a sustainable development and growth of their own municipality. The scale of these cities can still be influenced and has several chances to establish a planning structure. This focus can contribute to solve these tasks of an accelerating agglomeration of inhabitants

that produces tremendous areas of informal settlements like in the Metropolitan Area of Rio de Janeiro.
It happens frequently that Brazilian and international efforts are combined to solve problems in the Metropolis, like in the urban area of Rio de Janeiro.

A project from *Escola Politécnica* of Federal University of Rio de Janeiro, is to work with this new perspective, which means to handle the Metropolis, by looking at one of the most important origins of the problem, as there is the migration towards the Metropolises.
To this propose it was taken the municipality of São José do Vale do Rio Preto, in the state of Rio de Janeiro (ca. 20,000 inhabitants) as a study case (Michalka, 2007b).
The work is focused on the prior action lines:

- master plan;
- land use;
- technical infrastructure;
- social infrastructure;
- environmental planning;
- local sustainable development;
- regional development.

The projects aim is to provide methodologies, concepts and ideas for the municipality so that it will be able to develop and establish a sustainable planning structure for its municipality independently. The exchange of ideas about the reality of the community and the look for a development with the contributions of experts is a pilot project for the city as well as for the academy, and an important step towards a sustainable future.
The focus will be on Brazil, but it is easily adaptable to many developing countries.
One of the objectives of the pilot project is, to give the academy an overview of the big differences between small and big communities. The aim is to make both aware of what happens to most of the people who move from a small community to a megacity, often in order to improve their life.
The small city that was chosen for this work is *São José do Vale do Rio Preto*, located in the state of Rio de Janeiro, 110 km north of the City Rio de Janeiro. The *Escola Politécnica* of Federal University of Rio de Janeiro works in this project with the local authorities since the year 2000. The University of Applied Sciences Berlin is also participating.

1.1 Geographical and Political Context of Brazil

Brazil covers 8,500,000 km² with a population of 188,300,000 people in 5,564 municipalities. That makes 22.11 hab/km², which means that, there is a lot of space for each individual.
Of course the Brazilians don't spread out equally over the country – not even in regions with similar geographical characteristics. Figure 1 shows the political division of Brazil, with the 26 states with their capital and the Government District.
Table 1 shows the distribution of the population in these 26 States of Brazil and the Government District, as well as the rate of inhabitants per square kilometer in percent as well and the number of municipalities in each state.

State	Capital	Number of Municipalities	Area (km²)	Population (Estimation 2006)	Inhabitants per km²
Acre	Rio Branco	22	152,581	686,652	4.50
Alagoas	Maceió	102	27,767	3,050,652	109.86
Amapá	Macapá	16	142,814	615,715	4.31
Amazonas	Manaus	62	1,570,745	3,311,026	2.10
Bahia	Salvador	417	564,692	13,950,146	24.70
Ceará	Fortaleza	184	148,825	8,217,085	55.21
Distrito Federal	Brasília	1	5,802	2,383,784	410.85
Espírito Santo	Vitória	78	46,077	3,464,285	75.18
Goiás	Goiânia	246	340,086	5,730,753	16.85
Maranhão	São Luís	217	331,983	6,184,538	18.62
Mato Grosso	Cuiabá	141	903,358	2,856,999	3.16
Mato Grosso do Sul	Campo Grande	78	357,125	2,297,981	6.43
Minas Gerais	Belo Horizonte	853	586,528	19,479,356	33.21
Pará	Belém	143	1,247,689	7,110,465	5.69
Paraíba	João Pessoa	223	56,439	3,623,215	64.19
Paraná	Curitiba	399	199,314	10,387,378	52.11
Pernambuco	Recife	185	98,311	8,502,603	86.48
Piauí	Teresina	223	251,529	3,036,290	12.07
Rio de Janeiro	Rio de Janeiro	92	43,696	15,561,720	356.13
Rio Grande do Norte	Natal	167	52,796	3,043,760	57.65
Rio Grande do Sul	Porto Alegre	496	281,748	10,963,219	38.91
Rondônia	Porto Velho	52	237,576	1,562,417	6.57
Roraima	Boa Vista	15	224,299	403,344	1.79
Santa Catarina	Florianópolis	293	95,346	5,958,266	62.49
São Paulo	São Paulo	645	248,209	41,055,734	165.40
Sergipe	Aracajú	75	21,910	2,000,738	91.31
Tocantins	Palmas	139	277,621	1,332,441	4.79
BRAZIL	**Brasília**	**5.564**	**8,514,205**	**188,298,099**	**22.11**

Table 1. Distribution of the population in the states of Brazil (www.portalbrasil.com.br)

Fig. 1. Political division of Brazil (www.portalbrasil.net/brasil)

The urbanizing process in Brazil has increased strongly, which can be seen in Table 2. We verify that in 1960 there were 45% of the population in urban areas, and in the following decades it has been increased to 55.9%, 67.6%, 78.3% and reached 81% in year 2000.
Not only the migration of people towards the cities that causes this enormous urbanization growth. It started out with the migration to the capitals of the states. In consequence the capitals became metropolitan areas. Table 3 lists the most important metropolitan areas of Brazil and their population.

Population of Brazil							
Total	**2000**	**1996**	**1991**	**1980**	**1970**	**1960**	**1950**
Urban	137,953,959	123,076,831	110,990,990	80,437,327	52,097,260	32,004,817	18,782,891
Rural	31,845,211	33,993,332	35,834,485	38,573,725	41,037,586	38,987,526	33,161,506
Percentage							
Urban	81.25	78.36	75.59	67.59	55.94	45.08	36.16
Rural	18.75	21.64	24.41	32.41	44.06	54.92	63.84
Reference: Demographic Census 2006							

Table 2. Urban and rural population

Metropolis	Population / 98 – 1000
São Paulo	17,054,900
Rio de Janeiro	12,270,100
Belo Horizonte	3,957,700
Porto Alegre	3,337,500
Recife	3,157,100
Salvador	2,797,600
Curitiba	2,584,900
Fortaleza	2,699,500
Belém	1,550,000
Total - Metropolitan Areas	**47,485,200**
Total – Brazil	**161,340,000**

Table 3. Population in metropolitan areas - Data IBGE 2000

There are 5,564 municipalities in Brazil. In comparison to the metropolises the number of inhabitants in smaller communities varies a lot. Figure 2 shows the amount and size of communities in relation to the number of citizens. Only 0.6% of the cities are megacities, where as 71% of the cities don't have more than 20,000 inhabitants.

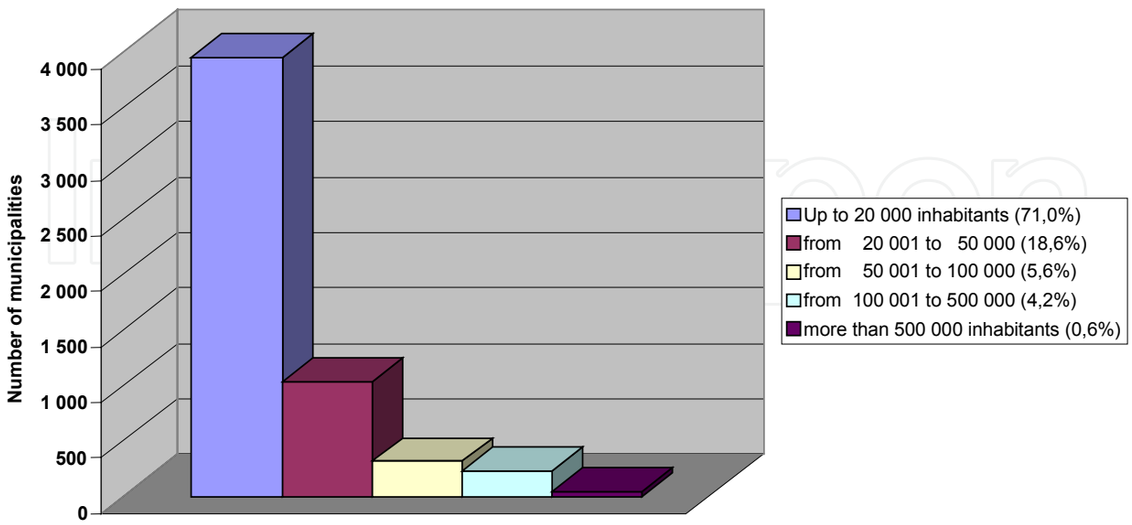

Fig. 2. Distribution of the population in the 5,564 municipalities (www.ibge.gov.br)

2. Considerations about the Urban Development

2.1 Metropolitan Areas

The sustainable urban development needs planning. On the other hand, to plan a sustainable development, it is necessary to consider the influence of each parameter that is present in the nature and how they interact. A systemic approach how explained in Capra (1997). To a sustainable urban development, it is necessary to consider the necessary technical and social infrastructure needs for the process. Its is necessary to take in account haw the different parts of each kind of the infrastructure (traffic, water supply, education among others) interacts.

Most of the urbanization and the urban plans in Brazil haven't considered the projects that included the technical infrastructure and the social infrastructure.

The migration in the metropolitan areas has been very intensive in Brazil along decades. In the history of these metropolises, the necessary planning to receive this migration was missing. Because of that, the enlargement of the cities happened without the necessary infrastructure plans for the migrations process. In the part of the cities where an infrastructure exists, it has been permitted a concentration of inhabitants without considering the impact in the existing infrastructure. Because of this appear the problems with traffic, water, waste, air pollution, sound pollution, health, education and others.

Without a plan to the habitation, the people construct their homes. To this, the people use frequently empty areas, where there is no infrastructure. Appears then the slums. They grow in a spontaneous way. It makes very difficult and expensive to act in order to organize all the necessary urban services. One big problem of the metropolitan areas in Brazil is the big amount of slums, and they are in a permanent grown.

An important consequence of the lack of plan and the existence of the slums in the metropolitan area is that the environment is strongly attacked. The effect of this in the quality of life of the city and the inhabitants is enormous. The humanity is part of the environment and suffers influence from it.

2.2 Small Municipalities

In figure 2 can be seen, that 71% of the Brazil's municipalities have no more than 20,000 inhabitants. In these municipalities, even with existing poverty, there are not big problems with slums. The environment in these small cities is more natural.

It make possible to plan. An intervention to solve problems of inhabitation and infrastructure is easier and not too expensive.

In these municipalities with low number of inhabitants is possible to plan a sustainable development. Taking the title of the book of McHarg (1992) it is possible to *Design with Nature*.

To reach this objective, it is necessary to use the existing knowledge about planning with consideration of the environment, the social necessities and the necessary economical development.

Important tools to plan, for example, the use of geo information systems to make diagnosis, canaries and prognosis are not know or understand in these municipalities. The university possesses a lot of the necessary knowledge to support the planning. An example is in da Silva (2004). The universities have not only the knowledge. Has the tools to apply this information to the particularities of each municipality too.

It can be assert, that the biggest difficulty of the small municipalities is exactly, how to get the necessary information, particularly the technical information, to support the necessary political decisions.
This is the objective of this work, which will be detailed next.

3. The Focus

After this brief introduction, the question of most interest is: which circumstances lead to this situation?
Together with the University of Applied Sciences of Berlin, the Federal University of Rio de Janeiro is working continually with the municipality of São José do Vale do Rio Preto, in the state of Rio de Janeiro.
The state of Rio de Janeiro covers 43,700,000 km² with a population of 15,380,000 inhabitants, counted in 2005. 95% of the people are living in urban areas. The state of Rio de Janeiro consists of 92 communities. Figure 3 shows the state of Rio de Janeiro and its political division.

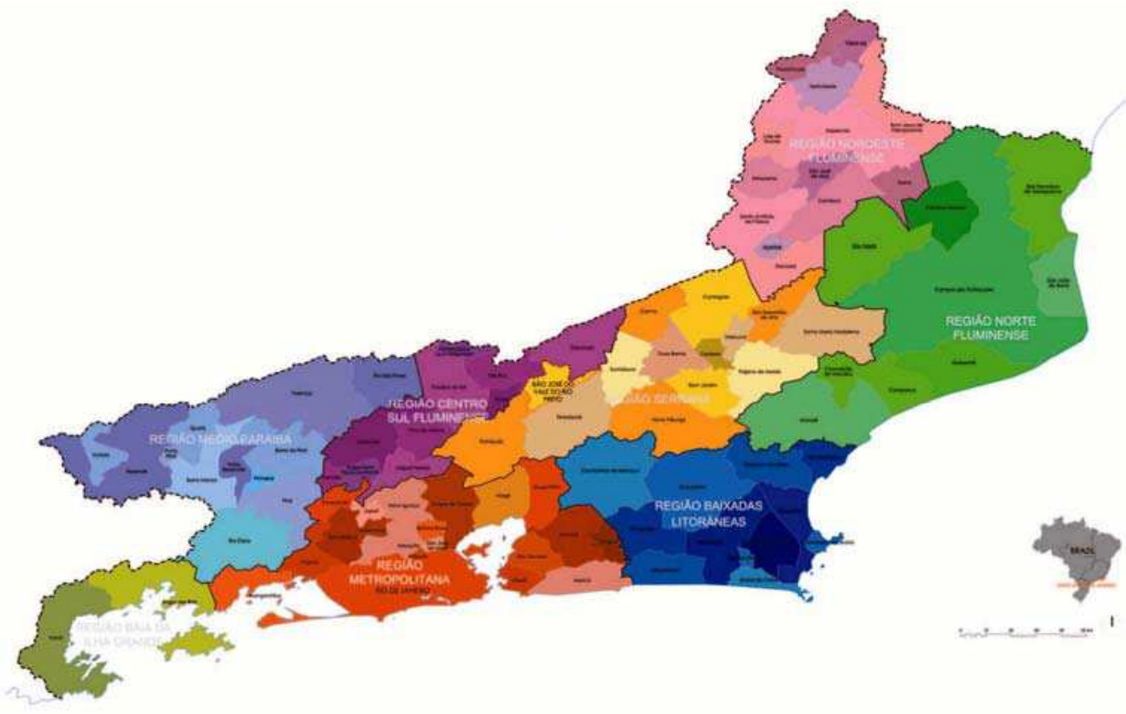

Fig. 3. Political division of the state Rio de Janeiro – 92 communities

This work assumes that there are equal problems in other small communities as the ones we have analyzed in São José do Vale do Rio Preto and considered to be keys for changing the situation. The most important are as follows.
The small communities:

- don't have the support of a skilled technical team in their administrations;
- have difficulties in accessing the needed information;
- have, as a consequence, difficulties in making the best decision, because they neither possess the information nor the staff to analyze and solve the problem.

Dealing with this kind of problems, it is difficult for the small communities to plan the economically growth of the municipality. But in order to offer further jobs in the community, this plans above a must be considered. Lacking this plan means, that on the long run young people won't have opportunities to make their livings in their hometowns. As a consequence these young people migrate to the metropolis looking for jobs and a better future.

Without any doubt the problems of the Metropolises won't be solved, if the small cities don't find solutions for their own people. Of course the Metropolises are trying to improve the situation as well. But if there are no jobs in the small cities meanwhile the big cities seams to provide them – no matter how bad they pay, and how bad the living conditions will be – more and more people will migrate to the big cities. The work of improving a big city will then be without an end and the aims will never be reached.

Nowadays there is a focus on research and necessary projects in the small communities. Therefore the decision was made; to work in cooperation with the community of São José do Vale do Rio Preto, how mention above. The University and the Community have experience in working together and know how to benefit from each other. The Community needs consulting and the University needs to find a way of providing the necessary information and knowledge to the Community in a way that it can be understood and used also by less educated workers. The University needs to take its knowledge "outside its own walls".

3.1 The Community of São José do Vale do Rio Preto

São Jose do Vale do Rio Preto is located in the state of Rio de Janeiro and used to be part of the municipality of Petrópolis. In 1989 it became independent.

São José do Vale do Rio Preto is located in the micro region Serrana (Mountain Region) marked red, in the map of figure 4. This area is well known for its mild climate and the beauty of its landscape, reaching from the mountains of the Natural Park Serra dos Orgãos to the remaining parts of the Mata Atlântica (Atlantic Forest).

Sao Jose do Vale do Rio Preto is in a 110 km distance to the city of Rio de Janeiro which are a 2 hour car drive. It is accessed over the federal road BR 040 on the way from Rio de Janeiro to Belo Horizonte. The other option is the federal road BR116 from Rio de Janeiro leading northeast through the country. Other main cities in reach are Belo Horizonte (370km) and São Paulo (530km).

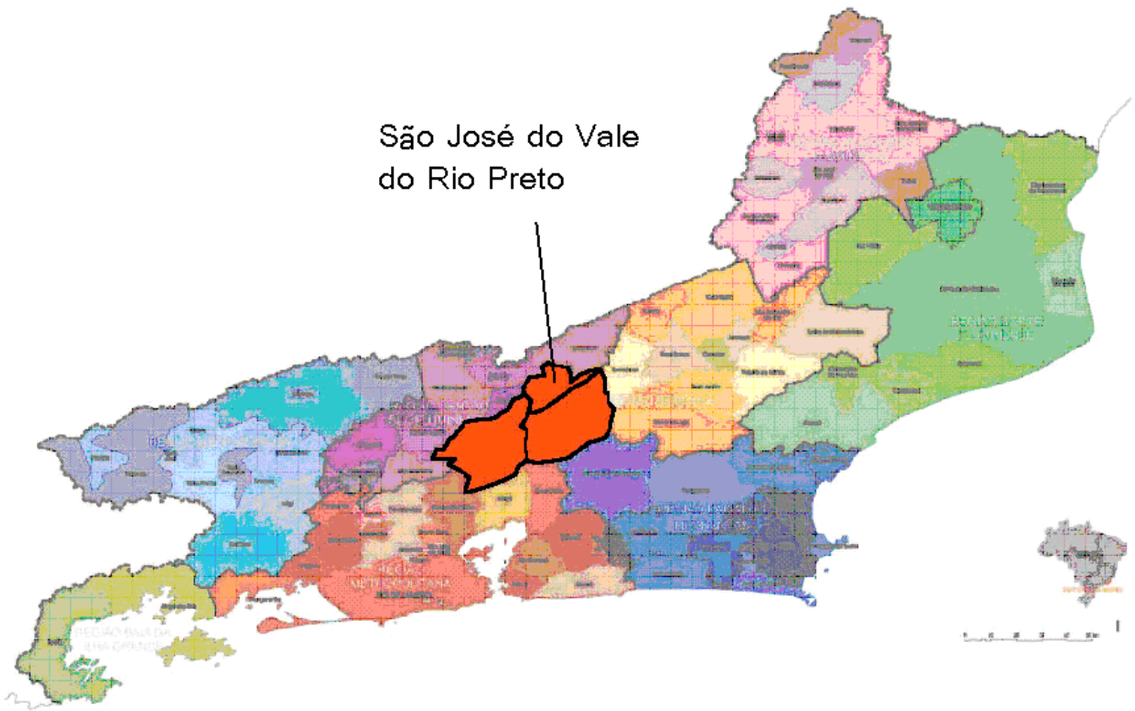

Fig. 4. Mountain region and São José do Vale do Rio Preto

3.1.1 A Short Introduction to São José do Vale do Rio Preto

São José do Vale do Rio Preto is spread out over more 20 km alongside the beds of the river Preto, covering 250 km². On an average height of 600m above sea level, it is surrounded by several mountain ranges. The southern peaks top up to 1,450 m, the northern summits reach 950 m. Sao Jose is split into several smaller communities which form the city with a total of 20,000 inhabitants. Figure 5 shows a overview from São José do Vale do Rio Preto's downtown.

Fig. 5. São José do Vale do Rio Preto downtown

3.1.2 The river

The Rio Preto ("Black River") gains its name from the black stones covering the river bed which is only 1 to 3 meters deep (figure 6). It flows from the municipal of Friburgo in the east to the Paraiba river in the west, which leads into the sea at São João da Barra. The Preto river is the characterizing natural wealth of Sao José.

Unfortunately today, the waters are polluted. When it arrives in Sao Jose the waters are already polluted due to the direct pouring of sewage in the city of Teresópolis. Neither of the cities located on the river possess over a water cleaning system.

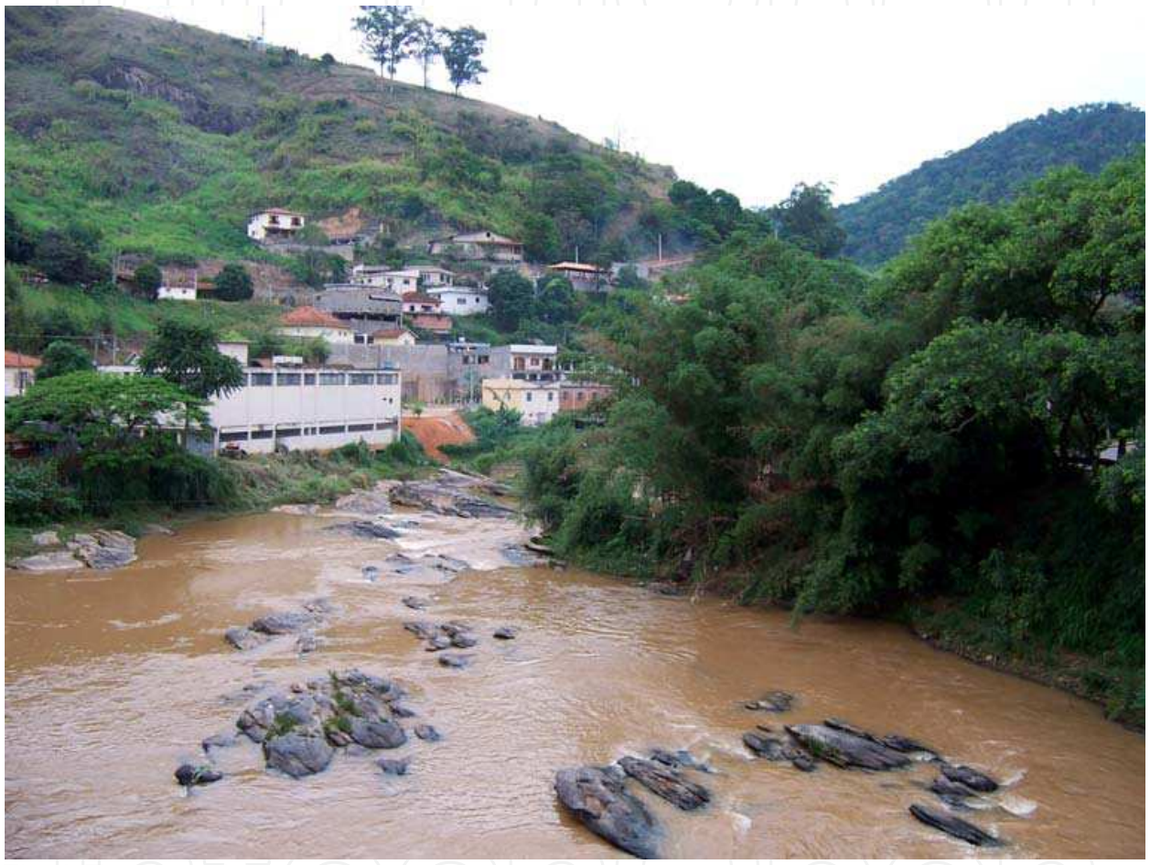

Fig. 6. The Preto river

3.1.3 Water supply

The city gains its fresh water basically from two main springs Maravilha tank (60m^3, daily production of 500,000 liters), and Glória (180m^3, daily production of 115,000 liters). This covers 70% of the populations needs. All the distributed water is chlorinated

There are dozens of small gains, that the inhabitants have constructed along side the small rivers to supply their households. In the communities of Barrinha, Pedras Brancas and Contendas, three bigger reservoirs have been built, supplying about 500 inhabitants each.

3.1.4 Population and economy

There is no visible misery in the population of Sao Jose: there are no beggars found in the streets, but none the less, poverty exists.
The poorest part of Sao Jose is the quarter of Pedras Brancas. Recently there are a range of programs in order to improve the situation.
Between 1991 and 2000 the city's average growth rate was 2.5 % per year. The majority of the population is 20 to 49 years old. Nowadays there is no population growth.
In 1950 São José de Vale do Rio Preto was considered the biggest poultry raising center in South America. As a side effect of the poultry farming São José produced tons of natural fertilizers – a contribute to the vegetable production of the following years. Until today São José has the biggest poultry farmer concentration in Brazil.
The agriculture is also important for the city of Rio de Janeiro. The production of São José do Vale do Rio Preto goes to there, so that São José do Vale do Rio Preto is economically dependent of the city of Rio de Janeiro.

3.2 The Work between Federal University of Rio de Janeiro (UFRJ) and São José do Vale do Rio Preto

The associated work of the UFRJ and the city of São José do Vale do Rio Preto is the result of the starting team work of the UFRJ and the University of Applied Sciences Berlin.
The first steps were made in a Seminar in 1999 in Berlin, where Prof. Michalka was present. In 2000, the *Escola Politécnica* of UFRJ invited professors of the Technische Fachhochschule Berlin (TFH Berlin) to a conference in Rio de Janeiro intending to start a team work to do research and initiate projects to develop the environment in small communities. Since then the two universities have been realizing projects together successfully.
An important part of this work is the exchange of students. Thanks to this association, German students have the opportunity to live and work in São José do Vale do Rio Preto and participate in projects, and Brazilian students have the opportunity to study and to make projects in Berlin.
As mentioned above, small communities are dealing with big difficulties in order to access basic knowledge to make wise economical, social and environmental decisions. The participation of students gave the opportunity of providing the community in a simple comprehensive way with the information that is needed. In an exchange the students learned about the "every day problems" a community is handling, how to solve problems and how to develop plans for economical, social and environmental growth. In exchange, the University and their students learn about the process of making decisions in a small city.
Many decisions made by the community since the associated working has started, have been influenced by students as well as by meetings with professors from the UFRJ and some visits of professors from the TFH Berlin in São José do Vale do Rio Preto. Since 2002 there are regular meetings between the *Escola Politécnica* of UFRJ and authorities of the municipality.
Between 2005 and 2007, the UFRJ took part in the ALFA Project (project ALFA AURORA). This has allowed that Students from Holland, Spain and Italy have also worked in São José do Vale do Rio Preto (Michalka, 2007b).
It is important to stand out that the university do not want to take the decisions on what the municipality must do. The objective of the contribution of the University to the Municipality is to give the necessary knowledge to permit the municipality can take de best political

decision. Is to permit that decision can be based on technical information. The university can also help to create scenarios to make prognoses of the consequences of different decisions.
Results of the associated work can be seen in Michalka (2007a) and Tem Hold et al. (2007).
As example, two initiatives from the long list of successful teamwork results were chosen which have become real in the municipality.
The first one deals with sewage. With a student concept for a sewage system, the community was able to initialize a project and also gained money to start constructing a small part of the sewage net. Because of the convincing results the community won more money to be able to do the same work it in city center as well.
The second example is in the public houses of the executive, legislative and judicative powers. Taking in account that the community only exists since 1989, it is not astonishing, that the three powers are jet not housed efficiently. The community has done research with the result that it would be best to construct new buildings. Also because the necessary space for this project could easily be provided. In the first place it was planned to construct only the public buildings. Then students made further suggestions to improve the concept. As a result today's concept is to build a whole new quarter that covers the needs of a lot of different interest such as public housing, trade and habitations, with the actual knowledge for urban planning.
Because the good results in the partnership between the *Escola Politécnica* of UFRJ and São José do Vale do Rio Preto, the *Escola Politécnica* intents to enlarge and deepen the partnership. One objective is being discussing nowadays, that is the possibility to create a representation of the university in the municipality, in order that professors and students, can have the possibility to be together with the municipality administration, as also with the legislative and judicative powers.

4. Conclusion

The Team of the *Escola Politécnica* of UFRJ was focusing on the contribution of a solution for the metropolises urban situation. It is intended to establish and improve the specific and substantial improvement of the urban development of the smaller cities, which are responsible for the immigration towards the Metropolitan Area.
With the participation of the University of Applied Sciences of Berlin (Technische Fachhochschule Berlin) the *Escola Politécnica* of UFRJ is supporting the municipality of São José do Vale do Rio Preto with information on how to develop and establish a sustainable urban planning structure.
The work with the community is becoming stronger with the support of a project that has been run by the European Community for Latin America - ALFA Project, called AURORA ("Architectural and Urban Research of Regional Agglomerations" – www.alfa-aurora.net)[6].
Results of this project can be seen in Michalka (2007a) and Ten Hold et al. (2007).
The exchange of ideas about the reality of the municipality and the intention to elaborate a sustainable development with the contribution of international experts is a very important step towards the future for the community. This is also possible with the partner universities to gain a better understanding about the "every day problems" of a small community in Brazil. Handling this process and giving contributions that can be used by the administration in order to take more appropriate decisions on planning, land use and infrastructure, is what the universities are helping to develop.

Nowadays there are six priority action lines:

- master plan;
- land use;
- technical infrastructure;
- social infrastructure;
- environmental planning;
- local sustainable development;
- regional development.

It is very important to clarify the objectives of the team work of university and community:

- the university provides the community with the necessary information and consults in order to enable the community to make wise decision within the projects for a sustainable development.
- it is the responsibility of the community to make the decisions; because the community knows better about its own necessities.

The aim is to develop sustainable solutions for the smaller cities, as an answer to the huge pressure by the immigration towards the Metropolises, in order to integrate the city in the county's necessities in order to reduce the migration from the small cities and the rural areas.
The smaller cities have better opportunity to implement a sustainable development and growth of their municipality. The scale of these cities can still be influenced and have several chances to establish a planning structure. This focus may contribute to solve the tasks of an accelerating agglomeration of inhabitants that produces tremendous areas of informal settlements like the ones in Rio de Janeiro's metropolitan area.
The objective of the *Escola Politécnica* of UFRJ is to work with this new point of view. This means to handle the problems of the Metropolis by going to one of the most important origins of the problem, which is the migration towards the Metropolises.

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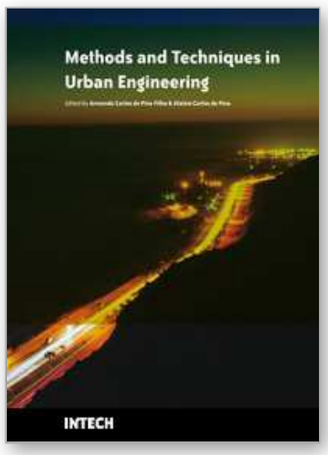

Methods and Techniques in Urban Engineering

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A series of urban problems such as dwelling deficit, infrastructure problems, inefficient services, environmental pollution, etc. can be observed in many countries. Urban Engineering searches solutions for these problems using a conjoined system of planning, management and technology. A great deal of research is devoted to application of instruments, methodologies and tools for monitoring and acquisition of data, based on the factual experience and computational modeling. The objective of the book was to present works related to urban automation, geographic information systems (GIS), analysis, monitoring and management of urban noise, floods and transports, information technology applied to the cities, tools for urban simulation, social monitoring and control of urban policies, sustainability, etc., demonstrating methods and techniques applied in Urban Engineering. Considering all the interesting information presented, the book can offer some aid in creating new research, as well as incite the interest of people for this area of study, since Urban Engineering is fundamental for city development.

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
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InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
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中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
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