Abstract

The subject of this work is the university campus and the spacial structure of its respective city, meaning, the way in which the university campus is distributed in a certain territory and the way in which it relates to the city, in a comparative analysis for the BRIC countries (Brazil, Russia, India, China and South Africa). As such we will look at the way in which the university campus is distributed in the territory and its relation to its surroundings [Sotelo Models (Calvo-Sotelo, 2011,pp. 200-206)].

The constant growth of both HEIs (Higher Education Institutions) and developing emerging regions, of which the BRICS are a part of, give rise to great investments in learning infrastructures, including university campuses. The BRIC countries, being states going through rapid growth and development, not only economically but also at a social-cultural level and, therefore, educational level, suffer from a growing demand for higher education. Therefore, these developing and emerging regions have been preforming "massive investments at all educational levels in order to minimize the needs of their emerging economies. They are also exploring new innovation policies in strategic areas, from reducing disparities in the quality of basic education to the establishment of globally competitive research and higher education institutions." (UNESCO, 2014, p.2)

This work has as its main objective the exploration of the different types of interface between university campuses and urban structures, through a comparative study between the reference models of some authors (Caldenby and Calvo-Sotelo) and the HEIs chosen for analysis in the countries which constitute the economic bloc known by the acronym BRICS.

This theme will be developed in five stages, the first being the study of several authors who analyse various basic university campus insertion models into the urban structure (Literature Review), followed by the creation of several criteria for the selection of the HEIs to be studied in each of the BRICS countries, proceeding then to the choice of two HEIs by country. In fourth place a compilation of statistical data was made in relation to the previously selected HEIs, as well as to the cities where they are embedded, with the creation of interface maps showing the relation between the campuses and the studied cities. Finally we proceeded to the analysis of the study cases and respective comparative readings.

For the purposes of this work, the object of study was defined as any university precinct, which we chose to call "campus" without creating a distinction between "campus" and "university city" seeing as their functionality is practically identical as agglomerators of higher learning infrastructures and associated buildings, even if in many cases they incorporate units which are not directly linked to teaching, but which serve as support structures to the academic community.

From the literary review several university/city interface models resulted, both in what concerns the distribution of HEIs in the territory, and the relation of the studied campuses with the urban macro-structure and their immediate surroundings, resulting in two different analyses iin different scales. These analyses allowed an understanding of: 1) in which Distribution Models (University/Territory) each of the selected HEIs is framed (Calvo-Sotelo, 2011, pp. 200-201); 2) the type of Territorial Structure presented by each campus (Calvo-Sotelo, 2011, p. 201) ; 3) the Location Models (City/University) which best describe each of the studied campuses (Calvo-Sotelo, 2011, pp. 202-206); 4) the type of City/University Relation presented by each of the case studies (Calvo-Sotelo, 2011, p. 206).

In order to select the BRIC countries' HEIs whose university campuses and respective cities will be studied, we proceeded to the elaboration of a series of criteria: number of HEIs per country, in different cities; category of HEIs; number of students; reputation and year of foundation.

In this way we ended up with the following case studies:

- **Brazil: UNIVERSIDADE DE SÃO PAULO** (**USP**), being the largest in terms of number of students (criteria 3) and also the HEI with the best reputation (criteria 4). The second university to be chosen was the **UNIVERSIDADE FEDERAL DO RIO DE JANEIRO** (**UFRJ**), as it also fulfils two criteria: it is among the four largest public universities in terms of student numbers, being a federal university, and was also the first to be founded (criteria 5), even if under a different name.

- **Russia:** The two HEIs (criteria 2) chosen for analysis were those who fulfilled more criteria, those being **MOSCOW STATE UNIVERSITY**, being both best by reputation (criteria 4) and one of the first to be founded (criteria 5); and **ST. PETERSBURG STATE UNIVERSITY**, as it also fulfils these two criteria in a way similar to the **MOSCOW STATE UNIVERSITY.**

- **India:** there was no HEI which fulfilled more than one criteria, therefore we opted for those which other than fulfilling one criteria also had more available information. Therefore the first university to be chosen, **PUNE UNIVERSITY** was the second largest by student number, seeing as the first – **INDIRA GANDHI NATIONAL OPEN UNIVERSITY** – is an open university focused on long distance learning. The second HEI to be selected was the **UNIVERSITY OF PANJAB**, as it is the best in terms of reputation (criteria 4).

- **China:** In what concerns the choice of HEIs for China, the same phenomenon happened as in the case of India: none of the HEIs fulfilled more than one criteria, leading us to opt, therefore, for those which had more available information. The first to be chosen, **PEKING UNIVERSITY** was the best in terms of reputation (criteria 4), as in what respects the number of students (criteria 3) the first university was another open university **THE OPEN UNIVERSITY OF SHANGHAI**. The second HEI selected was the **UNIVERSITY OF TIANJIN**, being in second place in terms of reputation.

- **South Africa:** The first institution to be chosen was **CAPE TOWN UNIVERSITY**, as it is the only one who fulfils two of the established criteria, being the best by reputation (criteria4) and the first to be founded (criteria 5). The second choice fell, therefore, to the largest by number of students (criteria 3) the **UNIVERSITY OF SOUTH AFRICA**.

After selecting the HEIs and respective cities to be studied, we proceeded to a series of statistical data compilations about those and the creation of maps. However, this work required a previous study in what concerns the administrative system of each country.

After the process of data compilation and the creation of study maps, we moved on to the comparative analysis between case studies of the different HEIs in BRICS' cities and the models studied in the literature review, specifically the Calvo-Sotelo models. This comparative study was done through several analysis levels:

1) Comparative analysis between cities:

- The average population growth rate in each city demonstrates the future population which might use a HEI in the future, the larger this rate, the more potential students this city will have and, therefore, the more will be demanded in term of infrastructures of each HEI, or the possible creation of new HEIs. We observed a high population growth rate for the cities located in India, China and South Africa, while Brazilian and particularly Russian cities present markedly inferior levels. This points to a faster growth of HEIs in the first three countries, although other factors, such as the high illiteracy rate in Indian cities temper this expectation.

- The prevailing age group in each city has similar effects to the population growth rate, but is, however, complimentary to this one. If we take as an exemple the Indian case, we can see the in Pune, although there is a high population growth rate, the prevailing age group is that which goes from 24 to 35 years of age, contrasting with Chandigarh, where the prevailing age group goes from 0 to 9 years of age. This leads us to the conclusion that Pune grows not only due to births, but also due to a high immigration of an older population which does not correspond to the profile of potential HEIs students. Chandigarh, having a much younger prevailing age group shows a growth connected to natural causes, with a population influx which might frequent higher learning throughout their life. In this case, therefore, even if the growth of Chandigarh is inferior to that of Pune, this factor is compensated in what respects the possible future impact on HEIs, as it has a younger population.

- Three other factors: illiteracy rate, HDI and per capita GDP can be seen together as consisting of an interrelated socio-economic complex, with a typical relation between them. The higher the GDP, the higher the HDI and the lower the illiteracy rate. This dynamic seems natural, and this is usually the case, even so there are some exceptions. One of these exceptions is visible in the case of Brazil, in which Rio de Janeiro and São Paulo present an atypical relationship in what comes to the interrelation of these three factors, seeing as the per capita GDP of São Paulo is substantially higher, but this city

also has a higher illiteracy rate and an only marginally higher HDI. This relation, which might at first sight seem odd, may be explained though factors such as a higher income and social inequality, when compared to Rio de Janeiro, which help explain how a higher GDP leads to a city with higher illiteracy rate and worse quality of life. It is also worthwhile to pay attention to the two extreme cases in what concerns the illiteracy rate: Russia on the positive side and India on the negative one, but these also correspond to the previously explained dynamic between GDP, HDI and illiteracy, seeing as these two countries are also extremes in what concerns GDP and HDI. These factors strongly influence both the present and the future of the HEIs in these cities, seeing as the lower the illiteracy rate, the more instructed the population is and therefore the more likely it is that this population has frequented or will come to frequent higher education. The higher the GDP and HDI the higher the attendance of HEIs will be, seeing as these values point to a social and economic prosperity level required in order to frequent tertiary education in developing countries.

2) Comparative analysis between HEIs :

- The founding year of the universities gives us clues as to their distribution in the urban space, as an example the case of St. Petersburg State University, the oldest of the studied institutions, previous even to the development of the concept of Campus in the mid 18th century, presents itself as a university spread throughout its city, even re-using buildings, such as in the case of Peter II's palace in Vasilievsky Island, starting its activity in a single building (Twelve Collegia), as would be normal at the time of the University's foundation. It is also interesting to note that 5 out of the 10 universities being studied were founded in the 19th century, 2 in the 18th century and 3 in the first half of the 20th century, with no university being more recent than this. It is possible that the relative old age of the studied HEIs is related not only with the age criteria use in their choice but also with the level of academic reputation and prestige, seeing as the age of the institutions is often reflected in the development of academic traditions and a certain institutional pride which help to justify their age.

- The number of students present in each university gives us an idea of the size and impact of the university in their urban context, the larger the university in terms of student numbers, the larger its social weight will be, seeing as the students will have to be integrated in the surrounding city which will have to answer to their needs by supplying services (such as lodgings, night life and restaurants). This number should also be compared to the size of the city being studied, seeing as the impact will be proportional to the percentage of inhabitants in the city who are students in higher learning institutions. A good exemple of this is the University of South Africa, which being situated in Pretoria, a medium sized city, has 352 823 students, while the Universidade de São Paulo in the very large city of São Paulo has only 92 064 students, less than a third of those in University of South Africa. This makes us conclude that the socio-economic impact of the University of South Africa in the city of Pretoria is necessarily more marked that that of the Universidade de São Paulo in its city.

- In last place the number of campuses in each HEIs allows us to see the way in which each university is organized in the urban space, being that 6 of the studied universities have only 1 to 2 campuses, while the remaining HEIs are fragmented into up to 9 campuses, such as in São Paulo. However, all the HEIs analysed have their main administrative headquarters in the cities which were studied.

3) Comparative analysis between campuses:

- When it comes to size, the largest campuses are in Brazil, namely the "university city" of São Paulo and the campus with the same name in Rio de Janeiro. At the opposite end are the campuses of South Africa and St. Petersburg in Russia. It would be expected that Brazilian campuses being the largest would also have the universities with the largest number of students, but such is not the case. The HEI with the largest number of students is Pune University, with 496 531 students, but we must not forget that this number also counts all students in its 811 affiliated colleges.

- In the case of St. Petersburg in Russia, which has the smallest campus, this small size is also due to the spread of the HEI's buildings in Vasilievsky island, and not being able to find all the necessary information as to what belongs or not to the university. The area studied represents the largest continuous concentration of buildings in that university.

- The case of China is similar to that of India in terms of proportions, seeing as each of these HEIs has one single campus which concentrates all the university's infrastructures, even if in some cases these have spread out of the central campus in a not very significant way, and always to the immediate surroundings (such as in the University of Panjab which has occupied some buildings around sector 14 where it was originally founded).

- South Africa also has some apparently small campuses, but this is also somewhat of an illusion: in the case of the University of South Africa we have only studied one of the campus in the city of Pretoria, while it holds another, smaller, campus in the city centre, which was to be expected as it is the second largest HEI studied in terms of number of students (352 823), it is also not to be forgotten that much like Pune University, this number counts all the affiliated centres spread throughout all of South Africa. The case of the University of Cape Town is also similar, in spite of appearing to have the smallest campus it is connected to other two campuses nearby, the Middle and Lower campuses, also having buildings spread throughout the centre of Cape Town.

- The conclusions reached is that the size of the campus does not have a direct relationship with the number of students in each HEI in these case studies, it depends however, on the way in which the institution is organized in terms of infrastructures, often spreading throughout its city as an answer to the need created by a growth of the attendance rates in higher learning, or concentrating mainly in one single area.

- The configuration of each campus also differs markedly in each case study. The C*idade Universitária* campus in São Paulo incorporates a group of contiguous blocs (in terms of space), granting it a somewhat compact form, while its *Complexo da Saúde*, only has some buildings in the city centre,

making it more permeable. The case of the "*EACH*" campus, which is in the periphery, is also more compact, such as its infrastructures are to be found contained in a single delineated area, bordered on one side by the city, and on the other by an ecological park.

- The *Cidade Universitária* the *Universidade Federal do Rio de Janeiro*, splits the whole of the *Fundão* island with the Technological park, with which it has strong institutional links in terms of R&D, leading to an irregular looking campus. The campus of *Praia Vermelha* has a much more regular configuration, seeing as it occupies buildings in the centre of the city, with a much smaller area, seeing as the concentration of most of the infrastructure of the university can be found at *Cidade Universitária*.

- The campus which was studied for Moscow State University, in Leninskiye Gory, is the largest of this HEI, and this university also has another campus in the city centre. This campus presents a classical and well organized configuration (it was founded in the 18th century), in spite of having suffered expansions throughout the years, and is still growing. It mostly results from the joining of several adjacent city blocs, conferring it some permeability, which is cancelled out by the fact that all these blocs are closed-in on themselves. It is worth noting that the monumental central building and main thoroughfare of this HEI are landmarks of the area of the city where they are integrated.

- The case of St. Petersburg State University results of the occupation of a series of buildings spread throughout the city, the majority of which are concentrated in Vasilievsky island and in historical buildings. From this results a dispersed configuration, even if the studied portion is a part of a city bloc, therefore having a more or less regular shape.

- The University of Pune is not to be found at the centre of the city, being slightly peripheral, and relatively more recent (20th century) than other institutions studied. It occupies an area with dispersed buildings but contained within a perimeter, which results in one of the largest campus areas in our case studies.

- The University of Panjab has the configuration of a whole city sector (even if it has bled out of this bloc), in Chandigarh, a city whose master plan was made by a team of architects led by Le Corbusier in 1951, having also projected the capital complex.

- The University of Peking, also has a quite linear quadrangular shape, if it were not for the ramifications which have been created, possibly due to a need for expansion, as an answer to the needs of modern higher education. The university of Tianjin had a less contained form, even if it does have a very regular geometry.

- The campus of the University of South Africa here studied, in Muckleneuk has a more organic shape, seeing as it is to be found in the periphery of the city. Even if it is bordered by a large road it still has room for growth. The superior campus of Cape Town University also possesses a less contained and more irregular shape, also being located in a more peripheral area of Cape Town, being surrounded by two other campuses of that university and by a large set of mountains and hills.

4) <u>Attribution of Calvo-Sotelo Models</u>:

- In what concerns the Distribution Models (University/Territory), meaning, the way in which the HEI is to be found in the territory, we concluded that in all case studies the HEI has a local distribution: all the HEIs studied have a polarized central headquarters around a specific city with a large territorial/urbanistic entity, even if this might, simultaneously have a representation in other municipalities or provinces (as a singular case, the university might have a distance-learning substructure which consists in the existence of small centres in populations distributed throughout the territory) (Calvo-Sotelo, 2011, pp. 200-201).

- Still in relation to the territorial structure of the HEIs, we conclude that the majority has more than one dedicated compound – Multi-compound/Multi-Campus- with the exception of the institutions in India and China, where the studied HEIs have a single dedicated compound. – Mono-compound/Mono-Campus. (Calvo-Sotelo, 2011, pp. 201).

- The analysis of each of the studied campuses requires a more detailed description in what respects the Location Models (City-University), reaching the conclusion that all the HEIs belong to the same campus model, the Urban model, seeing as all can be found to be directly linked to their city's urban mesh. However, this model has several subsets, in this way we have, as models:

  - **Urban- Periferal:** The *EACH* campus in São Paulo and the *Cidade Universitária* campus in Rio de Janeiro, seeing as these university campuses are to be found located in the urban periphery, being defined in a clear way through an edge or compact perimeter, juxtaposed and in close contact with the city's urban structure.

  - **Urban** – **As part of the urban mesh:** The *Complexo da Saúde* in São Paulo, the campus of Vasilivesky island in St. Petersburg, the campus of University of Panjab (even if we have not confirmed if this one is closed in on itself, but admitting that, being one of the city sectors, it is open to the city), seeing as all of these assume an aggregated configuration, but slightly dissolved within the urban structure, being limited to occupiying niches or internal divisions, without having a highly defined perimeter, or being globally compact. The doubt remains if the University of Panjab's campus has a closed perimeter or not, in case it does it should belong more properly to the next model.

  - **Urban** – **Isolated in the urban interior:** With this configuration we have the campus of São Paulo's *Cidade Universitária*, the *Praia Vermelha* campus in Rio de Janeiro, the *Leninskyie Gory* campus in Moscow, the campus of the University of Pune and the University of Peking (which occupies several blocs of the city, without us being able to determine with certainty if its perimeter is closed, but as it has specific entrances defined on the map we have assumed that it is, otherwise it should belong to the previous model), the campus of the University of Tianjn (which present the same problem as that explained for Peking), the campus of the University of South Africa in Muckleneuk and, lastly, the Upper Campus of the University of Cape Town. All of these campuses present perimeters which occupy spaces completely

incorporated in the urban fabric, which are however vocationally differentiated from their surrounding environment. They have highly defined dispositions and formal compacity, which both shape themselves to the general urban structure and, on the other hand, are determined as a body clearly separated from the resto of the city. However, the case of South Africa is slightly different, seeing as we considered the Metropolitan Municipality as the area where the city-university relationship was studied this result was obtained, however if we take into account the cities as being Pretoria and Cape Town instead of their municipalities, in which they were incorporated in 2000, the studied campuses, in both cities would be a part of the Urban-Peripheral model. The case of the University of Pune also raises some questions, as it was not possible to determine if it is closed within itself.

- **Urban** – **Diffused in the Urban Interior :** Although no campus was found to be in this model, there was a question raised about the Vasilievsky Island campus in St. Petersburg, about which we were not able to obtain the necessary information in order to locate all the buildings belonging to this HEI, leading us to opt for the study of the area which contains the largest group of buildings. However, we can see that this campus occupies a series o historical buildings spread throughout the territory of the island, and if we consider this factor, this campus can be framed under this model: the university complex limits itself to occupying a series of isolated and dispersed buildings throughout the city without any apparent relations between them; the physical disaggregation of the several architectonic pieces prevents a direct functional connection, so that they are not configured as a compact or unitary group.

- Still, in what concerns the relation between university and city, we conclude that the majority of studied campuses is segregated in relation to its corresponding city, meaning that they keeps themselves removed from the physical and functional dynamic urban space. There are only 3 case studies in which the campus is fully integrated into the city, the *Complexo da Saúde* in São Paulo, the Vasilievsky Island campus in St. Petersburg, and the University of Punjab campus in Chandigarh (if our supposition that it is an open sector is correct): all of these perimeters are largely incorporated in the space and urban functional dynamic. (Calvo-Sotelo, 2011, pp. 201-206)

This work has allowed a better understanding both of the dynamics and the countries which constitute the economic bloc of the BRICS countries, and some of their cities in specific, in what respects socio-economic and cultural factors and mainly in what respects Higher Learning, the state of it and its potentialities for evolution and growth. This leads us to learn about their social and economic limitations, but above all gain a broad view of the great potentialities that each presents in terms of future development.