

Social vulnerability in a metropolitan context: the case of Campinas ¹

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Introduction

One of the most notable outcomes of the changes that Brazil has experienced in recent decades is the diversification of the forms of demographic movements and human settlements, as well as the consolidation of a pattern of urban expansion characterized by social, demographic, economic and environmental segmentation and differentiation.

This pattern is also characterized by the low quality of urban life and by a process of territorial expansion where phenomena such as conurbation, demographic deconcentration, peripherization, and the corresponding excessive densification of areas devoid of urban infrastructure and social equipment are increasingly present realities in large urban agglomerations.

The growth of the municipality of Campinas, which today has one million inhabitants, has been very similar to that seen in other large Brazilian cities, defined by high rates of population growth and by peripherization of both demographic and territorial growth. The formation of the city's immediate periphery, which began in the 1970s, has been articulated with considerable migratory flows leaving the municipality of Campinas itself, as its process of expansion spread beyond its geographical boundaries. In fact, in a metropolitan context, the political-administrative boundaries, although sometimes important for explaining certain processes, are usually little more than abstractions or arbitrary divisions for those who attempt to understand the populational trends

¹ This text represents the first effort at analysis within a broader project underway in the Population Studies Center and the Center for Urban and Regional Research, both at the State University of Campinas. This analysis makes use of studies already carried out in preparation for the project "Intra-metropolitan dynamics and socio-demographic vulnerability in two large urban areas in the State of São Paulo: Campinas and Santos", with support from the CNPq and the São Paulo Foundation for Research Support - FAPESP.

in this broader space, the metropolitan region.²

Territorial expansion spread out from Campinas and was based on the dynamics of horizontal expansion, a phenomenon which has produced discontinuous spaces with rarefied settlement, especially toward the South and Southwest, progressively absorbing portions of neighboring municipalities. This type of urban expansion is caused largely by the nature of the subdivision of the land for urban purposes, but it is also affected by sectoral public policies, such as transportation, and by the impact of development of urban legislation of the various municipalities involved. These numerous factors affect the differential occupation of the sub-spaces that are based in large measure on discrepancies in the price of land. This process has also occurred in a number of smaller cities in the Campinas Metropolitan Region, where the network of streets and roads and the economic dynamism of the region are comparative advantages that stimulate their growth. The resulting territorial occupation is therefore the sum total of the horizontal expansion not only of the central municipality, but that of neighboring cities as well, forming the irregular urban pattern described above.

Notwithstanding the metropolitan nature of these phenomena, all these aspects are reproductions or reflections of what is taking place in the intra-municipal context. The areas or vectors of expansion of the municipality of Campinas are generally in the same direction as the main trends of demographic deconcentration toward neighboring municipalities. The same thing is happening to the area's socio-spatial differentiation. It is therefore essential to study this set of phenomena in order to acquire a clearer conception of the current problems existing in the region.

Part of this situation has been discussed in earlier studies (Cunha and Oliveira, 2001, and Hogan et al. 2001). The aim of the present article is to describe an innovative way to analyze the spatial heterogeneity of the families and households in the municipality. Specifically, based on the concept of *social vulnerability*, we will seek to broaden our understanding of the conditioners - besides poverty itself - of the differentiation among persons or families in terms of their "incapacity to respond to contingencies... and their inability to adapt to the new scenario brought about by the materialization of risks" (CEPAL, 2002: 1) to which they are exposed every day.

The concept of social vulnerability undoubtedly still requires much discussion and empirical validation, besides confrontation with other concepts, such as socio-spatial segregation,

² The Metropolitan Region of Campinas, made up of 19 municipalities with approximately 2.4 million inhabitants, was

urban sprawl, poverty and social exclusion. All of these notions have been present in the literature since the 1970s, referred to in studies regarding living conditions and alternatives for survival of the population in large Brazilian cities.

This article begins with an attempt to summarize the literature, including a number of conclusions in reference to the meaning and importance of the concept of vulnerability for urban studies. It then seeks empirical application of the conclusions based on the use of secondary data, specifically the Demographic Census of 2000. As a result, it presents a division of the city into "zones of vulnerability," making it possible to identify types of privation or advantages in the intra-urban sphere, beyond the question of income levels. These factors can give segments of the population more or less power to react to the difficulties that the unequal city imposes on them. Although this is admittedly a preliminary approximation, especially because of the deficiencies of the data used, it is nonetheless considered distinct from the traditional approaches used in this type of study.

I. The concept of social vulnerability as a way to understand the socio-spatial heterogeneousness of Campinas

From the theoretical/conceptual perspective, the most recent studies on urban realities have privileged the analysis of the transformations in the socio-spatial configuration of the cities. The considerable social inequalities encountered over the last two decades are expressed by what has been called spatial segregation of the low-income population. The comprehension of the phenomenon of spatial segregation as a factor of exclusion is found in the context of Marxist analyses of urban phenomena, in contrast to ecological analyses, and involves, among other aspects, the formation of the price of urban land and the consequent generation of urban real-estate income (Caiado, 2001).

As early as the 1970s sociological studies on Brazilian urban realities described the process of "peripherization," which, although it coincides with the geographical meaning of the term ("areas far from the center"), give a central place to the concept of "differential income

derived from the land” to define the peripheral areas, in contrast to the central areas, creating the concept of a dichotomy between center and periphery (Prefeitura Municipal de São Paulo, 1991, Bonduki and Rolnik, 1979, Maricato, 1977, Duarte (coord.), 1981).

This “peripheral pattern” is characterized by the establishment of human settlements based on an arrangement which combines low-cost housing developments and self-construction, an arrangement still quite common and widely disseminated today in Brazilian metropolises; often irregular, such developments generally have either no or precarious infrastructure and are located in areas more and more distant as the metropolis expands and its land increases in value.

In fact, although this solution constitutes one of the few alternatives for the low income population which desires to remain and take advantage of the opportunities of the metropolis, other alternatives have arisen with increasing intensity, such as squatter settlements, land invasions and slums³ which in different ways represent a break with the capitalist logic of settlement of metropolitan space; we refer to this as the peripheral model.

Among other motives, this led some authors involved in the national debate, including Preteceille, 2000, Ribeiro and Lago (1994), Bogus (1992), Rolnik et al. (1990), to warn of the increasing difficulty in making a clear distinction between center and periphery. They consider that land use is heterogeneous, with rich and poor – the included and the excluded – occupying the same space; the dual perspective (center/periphery) is no longer sufficient to describe socio-spatial land use. In this regard it is worth mentioning the considerations of Caldeira (2000:211) who sees in the Paulista metropolis after the eighties a new pattern distinct from the classic center-periphery, and which generates “spaces in which different social groups are often in close proximity but are separated by walls and security technology, and tend not to circulate or interact in common areas.

In any case, the fact is that socio-spatial segmentation is clearly visible in urban agglomerations in Brazil. In addition, it is clear that the periphery, devoid of services, conveniences and even adequate space for sociability, continues to be “reserved” for the poorer segments of society. According to Kaztman (2001: 173), the poor live in virtual social isolation, based on the

³ Although there is not total consensus, an interesting definition of *favela* (squatter settlement) is that of the municipal government of São Paulo, which considers them as “the set of household units built of wood, zinc, tin cans, paper or brick, in general distributed in a disorganized way on land where individual property of the lot is not legalized by those who live on them. (Pasternak, 2003). In the same way, *cortiços* (slum houses) can be defined as precarious rented dwellings, with insufficient, collective sanitary installations, generally involving large, old and deteriorated houses in the city center. (Pasternak, 1995). In the case of land invasions, among which the *favela* is

conjunction of two aspects, besides, of course, segregation itself: the precariousness and instability of the labor market and the segmentation of services, that is, the existence of spatially distinct privations related to the various services offered to the population.

The emergence of a new socio-spatial configuration includes such features as the presence of exclusive residential and commercial spaces, the privatization of public spaces and the stigmatization of spaces used by the lower-income population. Therefore, as if the inadequacies in housing, infrastructure, environmental quality and ownership were not enough, the stigma and high probability of social disaggregation impose an even heavier burden on the peripherized population. It is in this regard that the phenomenon of vulnerability, to be discussed in greater detail below, despite its intimate relationship with the process of socio-spatial segmentation (or segregation), creates new ways of identifying and analyzing the strategies employed by the population to eliminate or mitigate the various types of urban privation.

Hogan et al. (2001) note that authors such as Cutter (1996) identify eighteen different definitions of vulnerability, most of which revolve around either social or territorial aspects. The term is often used in academic language, but it is also used by civil society in general from a number of points of view and with varying meanings (Torres et al., 2003, Cepal, 2002, Kowarick, 2002, Watts and Bohle, 1993). The present study suggests an approach to vulnerability focused on factors that cause individuals and/or families to be more or less vulnerable, leaving aside, therefore, the aspects of this concept regarding territory (for example, areas subject to flooding, to erosion, to landslides – vulnerabilities inherent to specific geographical realities)⁴. It is also clear that urban risks and vulnerabilities have an increasingly significant environmental component (World Resources Institute, 1996) and that they contribute to the worsening of the quality of life of the population.

One point of consensus regarding the concept of social vulnerability is that it has a multifaceted character, with numerous dimensions on the basis of which one can identify situations of vulnerability of individuals, families or communities. These dimensions involve aspects related both to characteristics proper to individuals and families, such as property and socio-demographic characteristics, and to those characteristics related to the social milieu where populations live. For scholars who deal with this topic, vulnerability refers to the ability to respond to situations of risk or

one type, the central characteristic refers to the juridical status of the land.

discomfort.

Perhaps one of the definitions that best synthesizes the concept of vulnerability is that presented by Chambers (1989):

"[Vulnerability is the] exposure to contingencies and stress and the difficulty of coping with them. Vulnerability has thus two sides: an external side of risks, shocks and stress to which an individual or household is subject; and an internal side which is defenselessness, meaning lack of means to cope without damaging loss" (Chambers, 1989: 1, apud Watts and Bohle, 1993: 45).

There are three important aspects in this definition: the exposure to certain risks, the ability to face them, and the possibility of their having serious consequences for those affected.

In a very elucidating article, Kaztman (2000) points out that vulnerability can be understood as *a person's or a household's ability to profit from the opportunities available in different socio-economic spheres to improve their situation of well-being or prevent their deterioration* (Kaztman, 2000: 7, free translation). Kaztman holds that this condition results from an *"incongruity, or a lack of synchrony, between the need to access the structures of opportunities offered by the market, by the State and by society, and the assets of the households that would enable them to profit from these opportunities"* (Kaztman, 2000: 2).

As a result, the question which the concept focuses is the weakness or strength of the assets that individuals, families or, in a broader way, households have if they are to face the risks around them which entail the loss of well-being (Busso, 2001). The general idea of vulnerability therefore has to do with *"a state of households that varies in inverse proportion to their ability to control the forces that model their own destiny, or to combat their effects on well-being"* (Kaztman, 2000: 2).

This leads us to believe, therefore, that the situation of vulnerability is delineated on the basis of a number of interrelated factors. It results from an aggregation of conditions and/or characteristics in various dimensions that, operating jointly or individually, may become elements that can increase the capacity to respond to the effects of (structural or momentary) phenomena that affect the conditions of well-being.

It is in this perspective that the advantages of using the concept of social vulnerability arise. It clearly has analytic potential for approaching social problems in intra-urban space, in comparison

⁴ For an analysis of geographic literature on risk, see Marandola and Hogan, 2004.

with other concepts often used – such as poverty – because it allows one to take other essential dimensions into account in order to capture the distinctions between families or persons that have similar wage or consumption levels (Kaztman, 2000, Watts and Bohle, 1993).

According to Busso (2001: 25), "*... the focus on vulnerability has the potential to contribute toward an identification of individuals, groups and communities that, in view of their more limited assets and less diversified strategies, are exposed to higher levels of risk due to meaningful changes in the social, political and economic levels that affect their individual, family and community living conditions.*

The fact that the analysis focuses on "assets" rather than on "liabilities" of persons or families underscores "*the presence of a number of attributes that are considered necessary if those affected are to make effective use of the structure of opportunities available.*" Emphasis is therefore placed "*on the dynamics of the formation of various types of potentially mobilizable capital and on the relationships among them, as well as on losses, fatigue or other limiting factors that block access to sources of replacement and accumulation of assets*" (Kaztman, 2000: 3). The degree of the *ability to respond* to adversity or risk will obviously depend on the diversity of the resources to be mobilized and the flexibility available for their use.

It is felt that by adopting an approach that allows one to go beyond the dimension of income earned or of the set of basic needs addressed, one can go more deeply into an understanding of the socio-spatial differentiation existing in the intra-urban context and, especially, provide more suitable information for drawing up public policies aimed at increasing the ability of families to react to the many risks (social, environmental, physical, etc.) that arise in the urban space.

It is important to examine two central aspects of the proposed approach: the first is in reference to the *dimensions* of vulnerability or, in other words, to the various types of mobilizable assets; the second is related to the *sources* of these assets, or their expression as sources of vulnerability.

The multifaceted nature of vulnerability implies that one need not necessarily operate on the basis of a dichotomous category of the vulnerable vs. non-vulnerable type. A type of scale of situations can be created that will facilitate better identification of the main weaknesses (or sets of weaknesses) of each socio-spatial segment of the population. However, this scale can only be

constructed – at least theoretically – on the basis of the identification of the sources of the assets available to the individuals and/or families. In this regard, Kaztman et al. (1999a: 10 and 11) suggest the following classification:

1. **Physical Capital:** this aspect involves all the essential means for pursuing well-being. These means can be subdivided into Physical Capital strictly speaking (housing, land, machinery, animals, significant durable goods for social reproduction, etc.); and Financial Capital, whose characteristics are high liquidity and multi-functionality, involving savings and credit, as well as forms of insurance and protection;
2. **Human Capital:** the most important aspect of this category is work, plus the value added to it through investments in health and education, which imply greater or lesser physical ability to work, qualification, etc.;
3. **Social Capital:** this concept includes networks of reciprocity, trust, contacts and access to information. In the words of Kaztman et al., it is "the least alienable of all the types of capital, whose use strongly overlaps and is limited by the very network of relationships that defines this form of capital" (p. 11). Studies such as that presented by Saegert, Thompson and Warren (2001) call attention to the role of social capital in the struggle against poverty: "[A] community's social assets can improve the health, security, education, economic well-being, political participation and quality of life of residents in poor communities" (p. 1).

Also relevant to this context are the **sources** of these assets, namely, the market, the State, the community, and even the family, as well as the effects of their actions (or non-actions) and the structural or transitory conditions that cause situations of vulnerability.

As proposed by Kaztman et al. (1999b: 19), the condition of vulnerability should consider the situation of the persons involved in terms of the following aspects: insertion and stability in the labor market, the debility of their social relationships and, finally, the degree of regularity (quality could also be added here) of their access to public services and other forms of social protection.

"The major sources of social vulnerability today are related to the phenomena of occupational precariousness and instability, to the functioning of the market, as well as to the lack of protection and the insecurity related to the weakening of the State and of the basic institutions, the family and the community" (Kaztman, 2000: 5).

These considerations may well be behind the main difficulties of the present study, which describes situations of vulnerability only on the basis of the use of secondary data. Therefore, if, on the one hand, census data allow for positive quantification of the human and physical-financial capital, on the other hand, there is room for improvement in taking into account factors related to social capital, especially to the specific aspects mentioned above.

In fact, as Saegert, Thompson and Warren (2001: 8) show, there are at least three levels on the basis of which social capital can operate: within communities, among communities and through ties with financial and public institutions. These various aspects thus indicate how difficult it is to adequately grasp this dimension on the basis of the census.

Unfortunately, this operational difficulty contrasts with the importance of this dimension of the concept of vulnerability. By recognizing the importance of social capital as a component able to distinguish, for example, similar situations of poverty (a construct based solely on consumption capacity), the focus adopted here can be seen as an advance toward better diagnoses and analyses of the differences existing among different sectors of the population in intra-urban space.

In any case, if the empirical approaches used here fail to provide a completely satisfactory answer to the challenge of materializing this concept, they at least represent a first step toward attaining this goal, a process which will undoubtedly require further effort and more adequate data.

II. A brief diagnosis of demographic trends in the intra-municipal sphere

The municipality of Campinas has undergone intense demographic growth in recent decades. Its population of approximately 300,000 inhabitants in 1970 grew to almost one million by 2000. This demographic growth, characterized especially by the arrival of migrants⁵ and by an intense process of urbanization, can be seen in Table 1.

Table 1.
Resident Population (total, urban and rural) and level of urbanization.
Municipality of Campinas
1991 and 2000.

⁵ See Baeninger (1996).

Year	Total	Urban	Rural	Level of Urbanization (%)
1991	847,595	824,924	22,671	97.3
2000	969,396	953,218	16,178	98.3

Source: FIBGE, Demographics Censuses of 1991 and 2000.

The demographic concentration in urban areas, however, was not accompanied by an increase in basic infrastructure services. There are areas, such as those located in the southern area of the municipality, that although they concentrate the greatest numbers of the city's population, still suffer from a lack of basic services and adequate housing. As will be seen in greater detail below, this is one of the most essential dimensions for defining the most vulnerable demographic groups in the municipality.

The difficulty the city faces in providing all its citizens with basic services is largely due to the manner in which urban expansion occurred historically. Settlement was directed mainly by the interests of the real-estate market, with a pattern of settlement of non-contiguous areas, causing the existence of extensive unoccupied spaces within the urban area. These spaces were gradually occupied as they became more valuable, thus generating comfortable profits for their owners.⁶

This logic of settlement did not prevail in some areas where there was irregular use of public and private areas. Irregular settlements (according to a study carried out by Cohab⁷, there are over 100 such areas in various parts of the municipality) represent a reaction by lower-income segments of the population to the lack of an adequate housing policy.

As can be seen in Map 1,⁸ below, demographic growth in the municipality of Campinas during the 1990s was quite unequal, and, as will be discussed below, tended to be most intense in the more peripheral areas where substandard situations are more common.

Another result of the high price of land in the municipality of Campinas was the increase in population of the surrounding municipalities. Large numbers of persons live in municipalities such as Sumaré and Hortolândia but work or study in Campinas. This situation explains the more intense demographic growth of the municipalities surrounding Campinas and the recent designation of the

⁶ This is virtually the same type of occupation that occurred in the early 1970s in the city of São Paulo, described by Kowarick (1983).

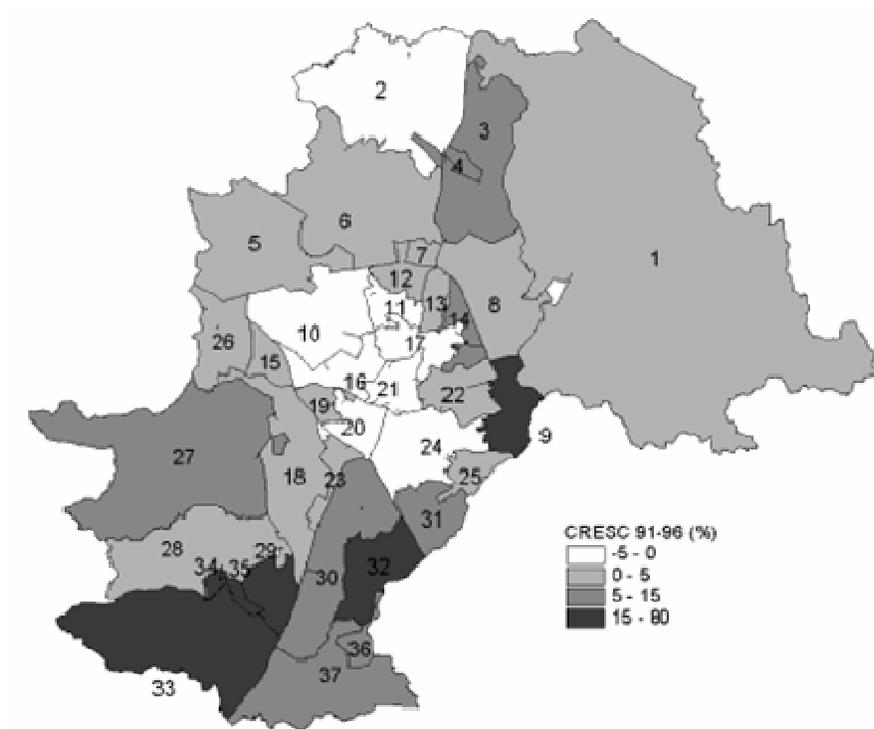
⁷ Agency for low cost housing.

⁸ Unfortunately, for operational reasons, it was not possible to estimate the demographic growth of census tracts for the period between 1991 and 2000. However, it is safe to say that the data for the period between 1991 and 1996 adequately

Campinas Metropolitan Region as a formal entity.

In fact, as can be seen in Table 2, the slow growth of the municipality of Campinas itself contrasts with that seen in its neighboring areas, especially the municipalities of Hortolândia, Sumaré and Indaiatuba, which have obviously absorbed a considerable part of the demographic growth that was "impossible" or "unfeasible" in Campinas.

Map 1. Average annual growth rate, Campinas Planning Areas, 1991/96.



Source: Cunha and Oliveira, 2001

An important fact is that even growing at a much slower rate, the municipality of Campinas receives many of the people who commute daily from one municipality to another to work or study. In the case of the municipalities mentioned above, these numbers are impressive: 82% of Hortolândia commuters and 69% of Sumaré commuters go to Campinas.

reflect the trends observed in the city.

In view of the above, it is clear that, although this study concentrates only on the space within the administrative city limits of Campinas, a broader perspective of the metropolitan area in general is essential if one is to understand and analyze the area's demographic phenomena in greater depth, in this particular case, its social vulnerability.

Table 2.
Resident population, average annual growth rate and volume of commuting
Metropolitan Region of Campinas
2000.

Municipality	2000 Population			1991/2000 Migratory Balance	1991/2000 Annual Growth Rate	Commuting (*)	% commuting to Campinas
	Total	Urban	Rural				
Americana	182,593	182,159	434	10,341	1.9	9,569	13.0
Artur Nogueira	33,124	30,464	2,660	10,107	1.9	2,781	9.3
Campinas	969,396	953,218	16,178	28,521	1.5	25,002	-
Cosmópolis	44,355	42,546	1,809	4,905	2.1	4,043	12.7
Engenheiro Coelho	10,033	7,009	3,024	2,016	-	364	3.0
Holambra	7,211	3,938	3,273	540	-	218	22.0
Hortolândia	152,523	152,523	0	50,022	-	29,511	82.1
Indaiatuba	147,050	144,740	2,310	30,069	4.3	5,387	41.3
Itatiba	81,197	65,925	15,272	11,763	3.1	2,253	13.9
Jaguariúna	29,597	25,812	3,785	2,871	1.9	1,398	49.1
Monte Mor	37,340	34,173	3,167	7,029	4.3	3,339	77.3
Nova Odessa	42,071	41,110	961	3,609	2.4	4,384	9.6
Paulínia	51,326	50,762	564	8,532	3.8	2,583	68.3
Pedreira	35,219	34,132	1,087	4,644	2.6	1,050	20.8
Santa Bárbara d'Oeste	170,078	167,917	2,161	8,604	1.8	21,684	3.2
Santo Antônio de Posse	18,124	14,673	3,451	2,943	2.6	1,063	12.4
Sumaré	196,723	193,937	2,786	34,173	-1.6	31,326	69.7
Valinhos	82,973	78,506	4,467	8,055	2.3	7,841	43.6
Vinhedo	47,215	46,174	1,041	9,153	3.8	3,432	25.6
Total RMC	2,338,148	2,269,718	68,430	237,897	2.5	157,228	39.1

Source: FIBGE, Brazilian Demographic Censuses of 1991 and 2000.

FSEADE, migratory balances

(*) Working population of 15 years-old and more.

III. Toward an implementation of the concept of social vulnerability

One of the questions emphasized in Section I was the challenge of defining social vulnerability, due to the multifaceted nature of this phenomenon, the nature of the data available

(Kaztman, 2000) and the difficulties involved in using a single indicator to capture the risks that characterize situations of this nature.

In order to contribute to the debate on the theme and propose forms for better grasping the concept in question, we believe it is possible to identify, at least tentatively, the areas where the more vulnerable populations live - here called *Zones of Vulnerability* - taking into account characteristics gathered from the demographic censuses.

Since it is not possible to gather information from the Sample Questionnaires⁹ for individualized census tracts, the present analysis was based entirely on an intermediate spatial level, the so-called "areas of weighting."¹⁰ Campinas has 49 such sub-areas, an appreciable number, and, based on prior knowledge of the territory, they clearly reflect the great heterogeneousness of the municipality.

On the basis of the definitions of physical/financial, human, and social capital mentioned above, and of the possibilities offered by the Sample Questionnaires of the Demographic Census of 2000,¹¹ the following indicators were proposed:

- **Physical Capital:**
 - o Density: the Density of Dwellers per Room;
 - o IncomeFH: % heads of families (or individuals) with income between "0 and 2 minimum wages" (inclusive);
 - o House: % persons living in dwellings classified as "houses";
 - o Room: % persons living in dwellings classified as "rooms";
 - o Owned: % persons living in dwellings classified as "owned and being bought";
 - o Rented: % persons living in dwellings classified as "rented";

⁹ While basic data are collected for the universe of households, much of the relevant data for this study are from a sample of the population.

¹⁰ Since some of the indicators listed presuppose access to the micro-dada from the Sample Forms of the Census of 2000, it is not possible to use the census tracts, since, for this spatial level, IBGE does not permit access to the information on the Sample Forms. We therefore decided to use "weighting areas" that refer to aggregates of sectors for which the data from the Sample Questionnaires are available.

¹¹ It is important to stress that the authors are aware of the limitations of some of the indicators used to measure the desired dimensions. Given the possibilities at hand and the shortcomings of the information gathered from the census, the data used appear to reflect the dimensions they are meant to represent.

- o NoPlumbing: % persons living in dwellings without plumbing;
- o NoBathroom: % persons living in dwellings without bathrooms;
- o 2+Bathrooms: % persons living in dwellings with 2 or more bathrooms;
- o NoSewage: % persons living in dwellings without a general sewage system;
- o NoGbgCol: % persons living in dwellings without trash and garbage collection.

As can be seen, the indicators adopted to reflect this dimension were proposed in order to allow an understanding, on the one hand, of inadequacies in the infrastructure of the dwellings and, on the other, of aspects usually related to characteristics that are common in the more peripheral areas, such as high density per dwelling, substandard housing, "ownership" of dwellings, etc.

- **Human capital:**

- o Illiterate15: % illiterate persons age 15 or over;
- o EducFH: % heads of families (or individuals) with less than 4 years of formal education;
- o Depend: Dependency Ratio (Pop. ages "0 to 14" + "ages 65 or over"/Pop. ages "15 to 64").

These indicators also seek to measure not only the extremely low level of formal education, but also the degree of economic dependence and aging in the areas studied, considering that these aspects may also reflect difficulties for the families or households in their process of social reproduction.

- **Social Capital:**

- o FemFHteen: % female heads of families (or individuals) ages "10 to 19";
- o FamSize: average size of family 01 (main);
- o NonFam: % persons who are non-family household members

- Informal: % persons age 14 or over working without signed contract;
- N/AttSchl: % children ages 7 to 14 who attend neither a school nor a day-care center;
- FamIncNWk: % families with income not derived from work.

These indicators all refer to aspects related to services, general conditions of social protection (such as access to the formal labor market) and domestic formations that could limit or reduce the population's quality of life.

Factor analyses were carried out for each of these three sets of indicators, and 5 factors were obtained: 2 for physical capital, 1 for human capital, and 2 for social capital, whose meanings, factor loads and percent of the variability explained¹² are shown in the table below:

Panel 1. Results of the factor analysis of the three dimensions considered.							
Physical Capital			Human Capital		Social Capital		
	Factors			Factor		Factors	
Variables	1	2	Variables	1	Variables	1	2
Density	0.719	0.643	Illiterate1	0.974	FemFHteen	0.806	0.185
IncomeFH	0.677	0.634	5	0.970	FamSize	0.632	-0.334
House	0.923	0.010	EducFH	0.909	NonFam	-0.102	0.815
Room	0.122	0.785	Depend		Informal	0.838	0.015
Owned	0.209	0.100			N/AttSchl	0.799	0.237
Rented	-0.867	-0.216			FamIncNWk	-0.245	-0.641
AguaNCanal	0.087	0.778					
2+Bathrooms	-0.589	-0.556					
NoSewage	0.388	0.679					
NoGbgCol	0.431	0.404					

¹² Factor loads correspond to the correlation of the variable to the factor. That is, based on them, the meaning of the factor can be interpreted. Explained variance corresponds to the ability of the factor to explain total variability, that is, the higher the explained variance, the safer one can be in replacing all the variables by that factor. Therefore, in some cases, it was necessary to choose two, since only one would fail to be an acceptable representation of the variability of the data.

% Explained Variance	33.27	30.26		90.53		41.63	20.66
Suggested interpretation of factors	<i>Peripheral expansion pattern</i>	<i>Deficient house- hold infra- structure</i>		<i>Defi- cient human capital</i>		<i>Lack of social protec- tion</i>	<i>Family strategy of social protecti on</i>

After the factor analysis was carried out and the factors were chosen, the factor scores were calculated for the "areas of weighting" for each of the factors. This resulted in five distinct values for each of the sub-areas considered. For the later analyses, it is important to keep in mind the interpretation given to the factors identified, since it will be on the basis of the reading of these new constructs, resulting from factor analysis, that we will analyze and interpret the results, especially in regard to the factor scores attained by each of the weighting areas.

As an example, let us consider Factor 2, related to Physical Capital, whose interpretation led to considering it as indicative of the "deficiency in dwelling infrastructure." The higher the score, i.e., the closer to 1,¹³ the worse are the conditions in this particular aspect of the "area of weighting." A similar reading will be carried out for the other factors.

One factor that deserves special comment is no. 2, of the Social Capital dimension. It can be seen that this factor has a close positive correlation with the "percentage of non-family household members" and a negative correlation with "percentage of families with income not deriving from work." On the basis of this perception, one might conclude that this factor indicates forms of "family strategies" that are put into action in order to lessen the effects of poverty, unemployment, etc. The formation of extended families may be one way of overcoming the temporary or prolonged difficulties of its members in entering the labor market. Discussions of the "housing deficit", for example, based on the presence of more than one family or non-family members in the household, ignore the positive strategic benefits from such arrangements; the present research will delve more

¹³ To facilitate the analysis, the factor scores were standardized in such a way that all would vary between 0 e 1, thus facilitating their interpretation.

deeply into such issues.

In addition, this negative correlation of the factor with the existence of other types of income suggests that these strategies help the families avoid having to resort to social programs or other sources that, as is known, are not universal, much less are they easily accessible to the majority of the population. Even the negative correlation of this factor with family size tends to be consistent with this interpretation, since larger families would very probably be those with the greatest number of children and therefore with a high degree of economic dependence, and this would entail the need to resort more often to social programs.

Higher values of Factor 2 in Social Capital suggest the existence of factors of social protection structured on the basis of the family sphere. This implies that areas with domestic arrangements of non-extended families or alternative families (comprised of friends, individuals, etc.) might always have greater vulnerability whenever, of course, their situation in relation to the other types of capital are also unfavorable.

Once the factors and factor scores for each spatial unit of analysis have been defined, the "zones of vulnerability" are defined by applying a cluster analysis,¹⁴ a procedure that allows units with similar characteristics to be grouped together.

IV. Zones of vulnerability: a distinct form of recognizing the diversity of the municipal space

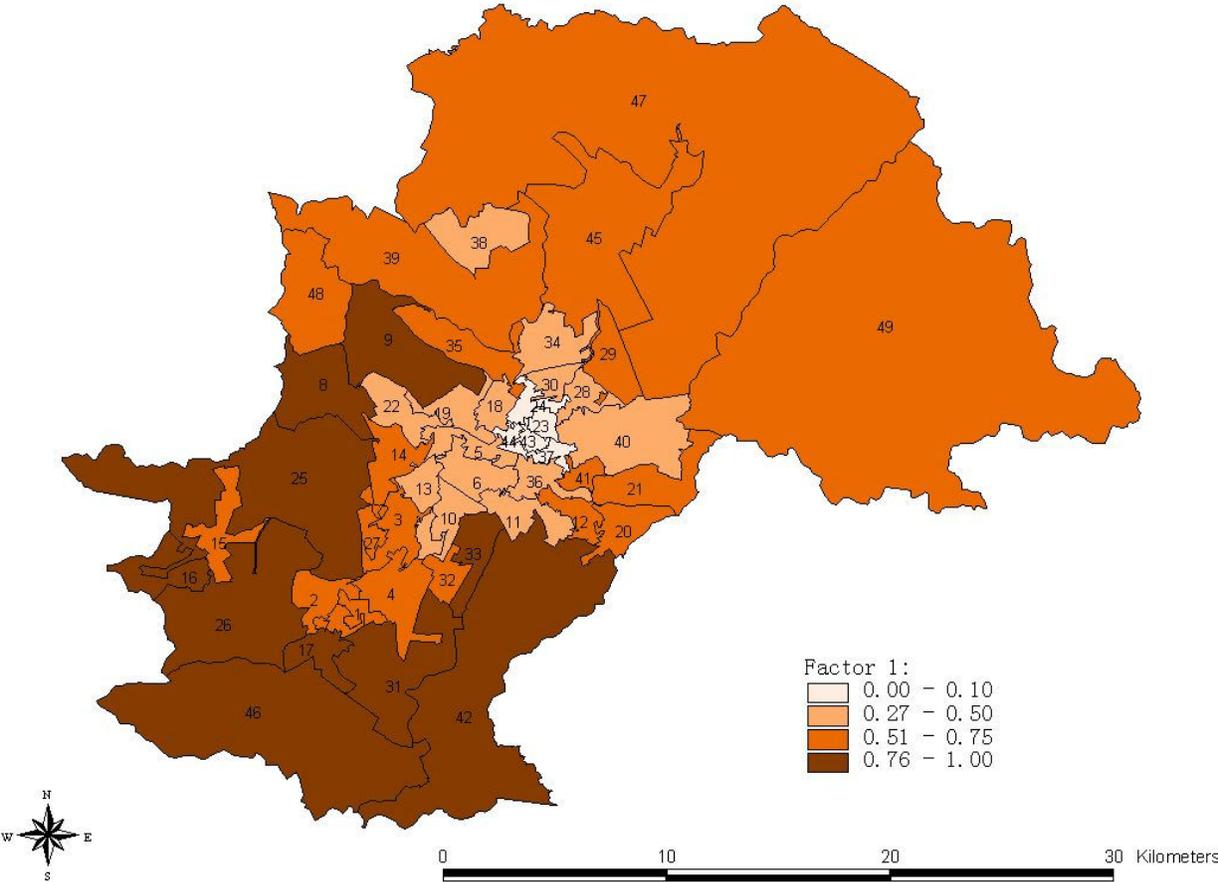
Considering the 49 areas of weighting and based on the factor analysis carried out, we arrived at the values for each spatial unit of the five factors described and identified above. These values were mapped out to allow visualization of the spatial heterogeneousness in Campinas related to each of these factors, which were then analyzed together in view of the zones of vulnerability.

First, Maps 2 and 3 show the municipality's spatial differentiation in terms of Physical Capital. As can be seen, the city has at least four very distinct regions regarding this dimension: a distant and very substandard periphery to the South and, especially, to the Southwest; another, including much of the northern portion of the city in a somewhat better situation but still showing

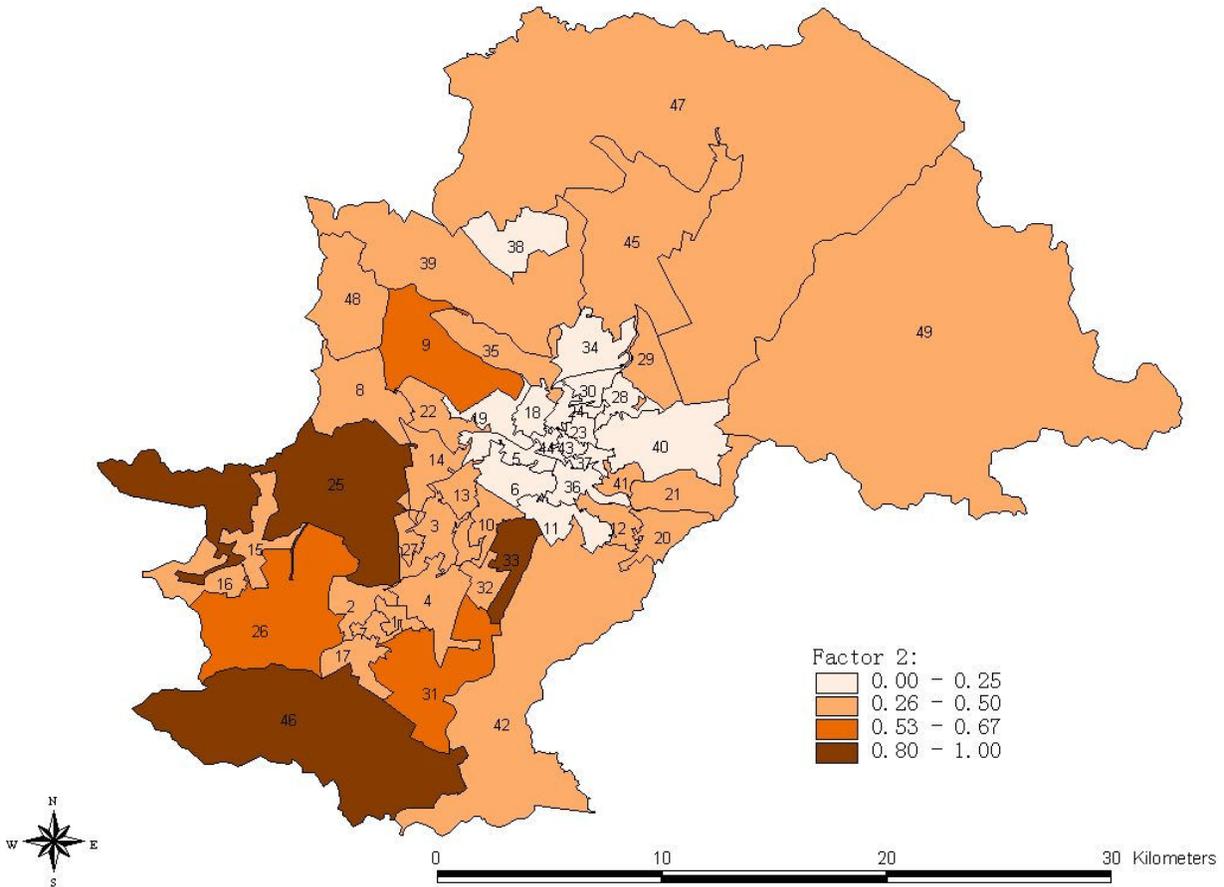
¹⁴ This procedure (cluster analysis) groups observations (in the case of the areas of weighting) in function of the values taken on by each of these units in the variables considered in the analyses, in this case the scores obtained in the five factors resulting from the factor analysis, in an attempt to show the most probable groupings, based on the "distance" existing between these units that, mathematically, would be given by the distance between the points in the five-dimensional space (since there are five scores for each spatial unit).

serious limitations; a third, involving the immediately peripheral areas around the central section, and the northern area (*Cidade Universitária/Barão Geraldo*), in much more satisfactory conditions; finally, the central region, with the best conditions.

Map 2: Factor 1, Physical Capital by Areas of Weighting, Campinas, 2000.



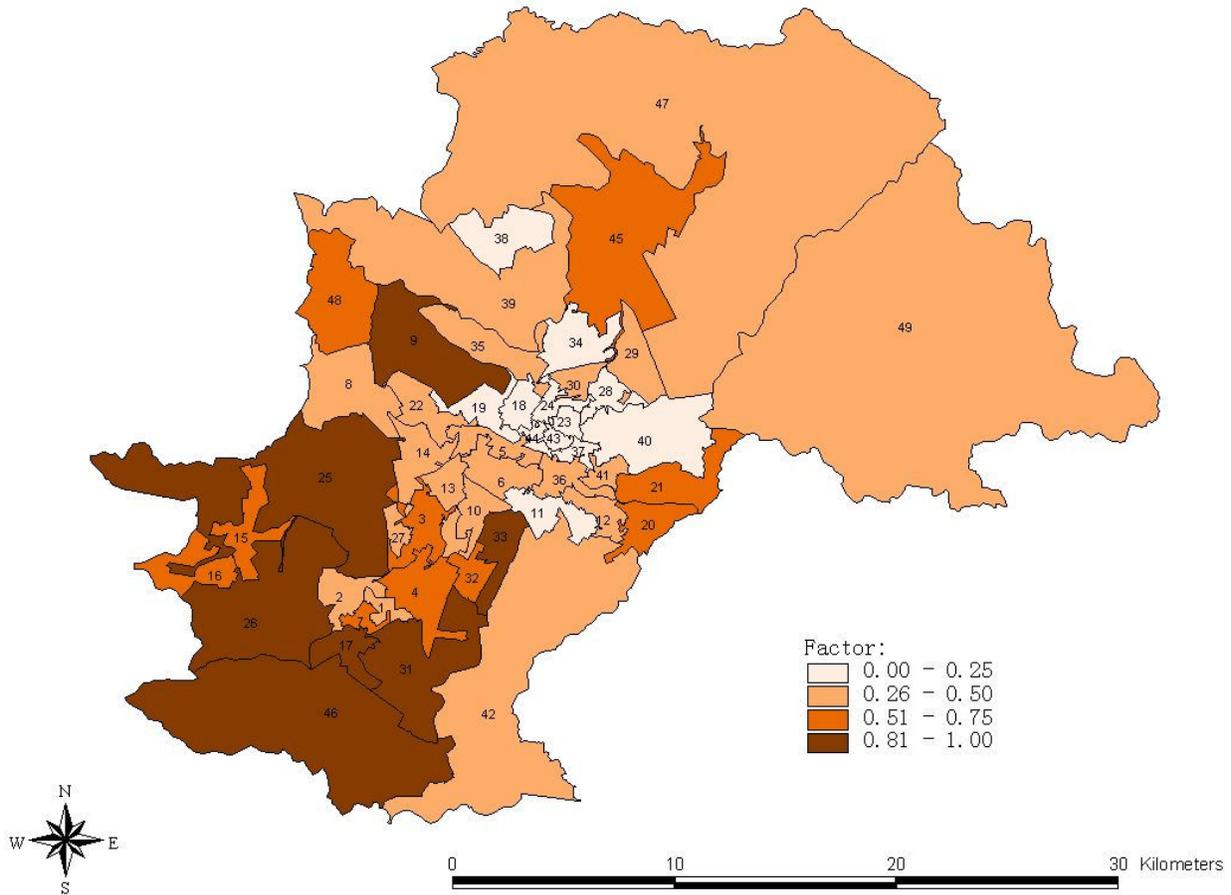
Map 3. Factor 2, Physical Capital by Areas of Weighting, Campinas, 2000.



As might be expected, Factor 1 is related to the conditions of the process of peripheral settlement, and Factor 2 to the infrastructural conditions of the dwellings. High values of both these factors jointly indicate the situations of greatest substandard conditions.

In terms of Human Capital, the spatial pattern is somewhat different, although the most distant periphery to the South, as well as part of the Northern region, especially Nova Aparecida - an area known to have many social deficiencies - continue to reveal the worst conditions. However, as shown in Map 4, the most favorable conditions stretch far beyond the downtown area, and the spatial groupings can be seen quite clearly.

Map 4. Human Capital by Areas of Weighting, Campinas, 2000.



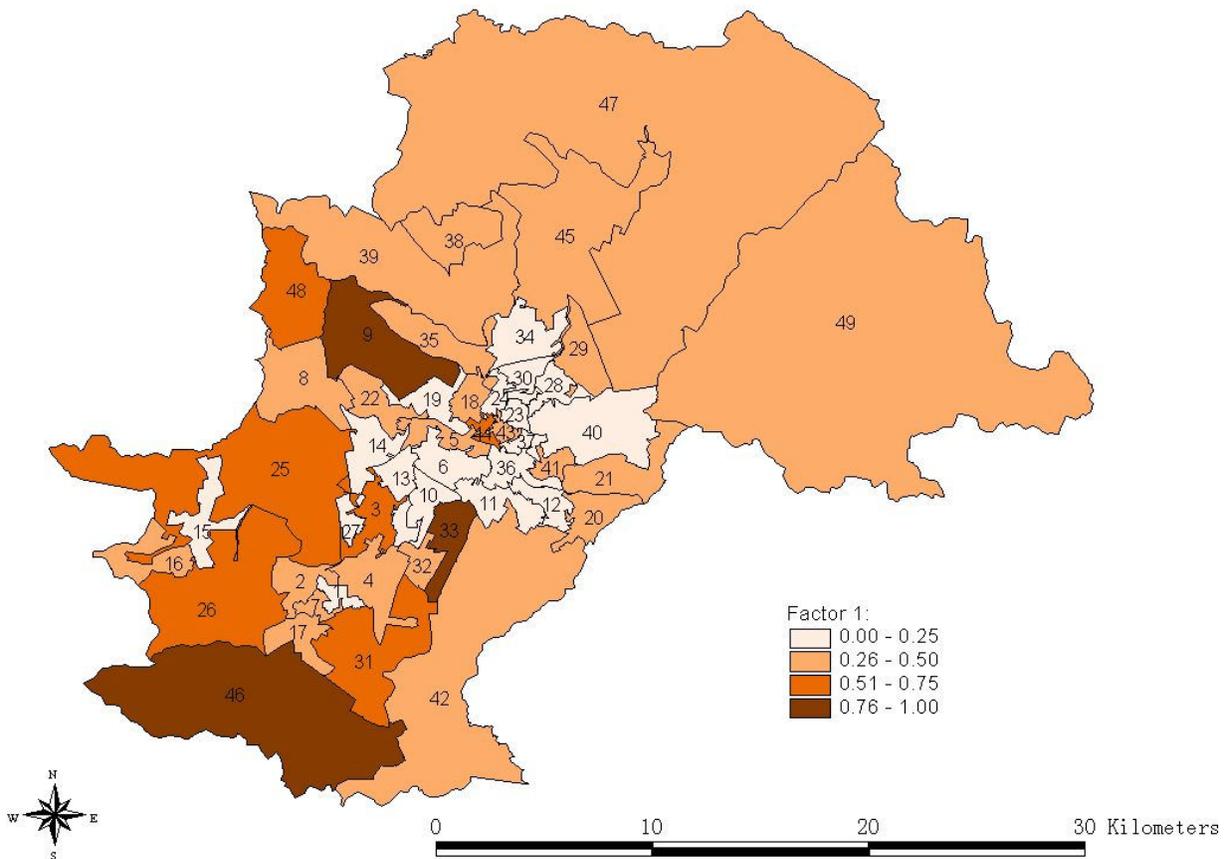
Finally, the spatial pattern of the two factors constructed for Social Capital can be seen. It should be recalled that this factor attempts to grasp aspects related to the assets available to the population in the form of services, protection nets, forms of social organization, etc. Based on our working hypothesis, one would expect that consideration of this type of capital implies analytic differentiation that would reveal more clearly the heterogeneity of the families and households in the city than socioeconomic data are able to do.

In fact, the results show that in contrast to what occurs with the two other types of capital, Social Capital shows a spatial pattern somewhat distinct from those detected so far.

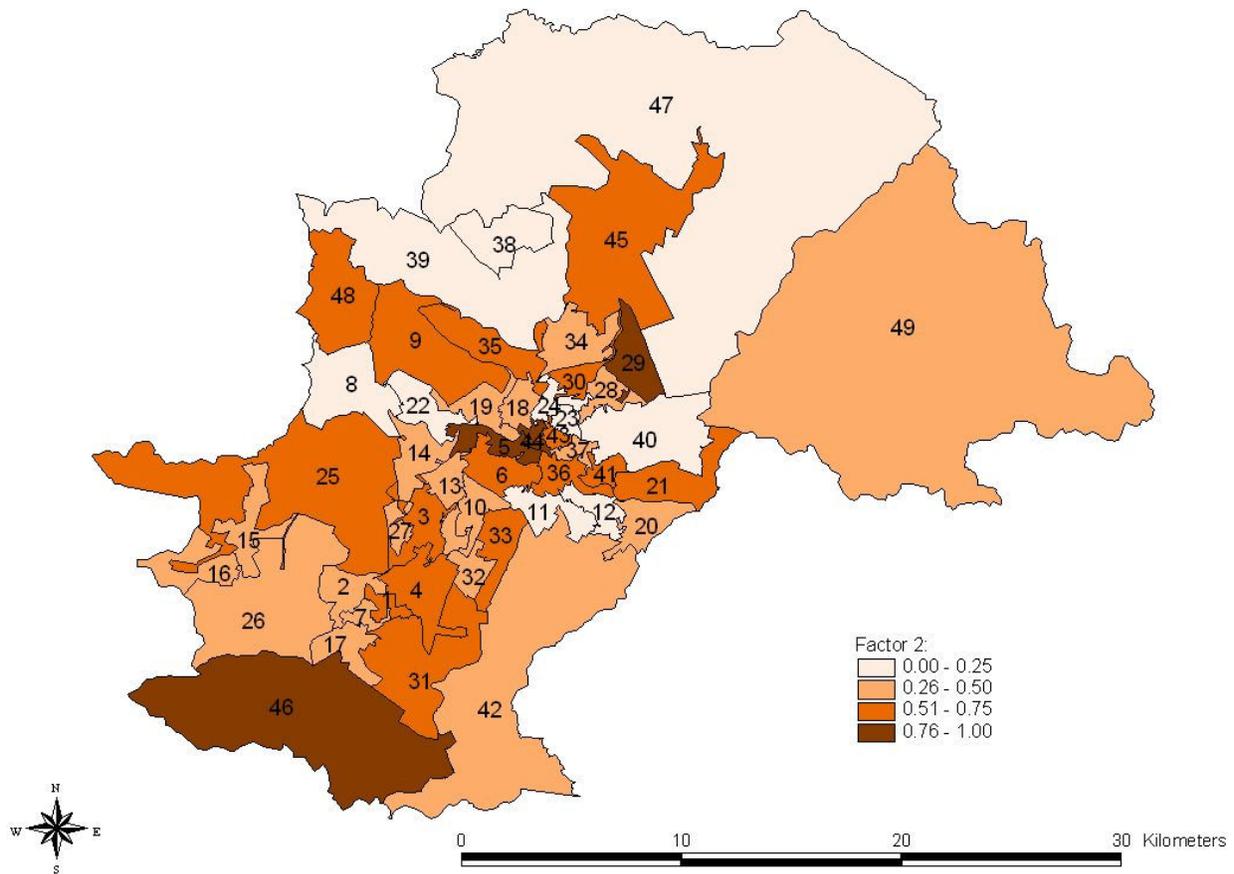
Maps 5 and 6 clarify this question, first by not clearly reproducing the pattern of "concentric circles" shown on previous maps and, secondly, by grouping very distinct areas in relation to the

other two types of capital. An eloquent example of this can be obtained when one perceives that, according to these two factors, the distinctive area of *Cidade Universitária/Barão Geraldo* (this is the University of Campinas region, with 25,000 students; it is number 38 on Map 4) is on a par with peripheral zones in the southwestern and northern sections of the city.

Map 5. Factor 1, Social Capital by Areas of Weighting, Campinas, 2000.



Map 6. Factor 2, Social Capital by Areas of Weighting, Campinas, 2000.



However, it is sufficient to examine closely the meaning of these two factors to realize that this result makes sense because this area is now inhabited by students who have occupied the region much more intensely in recent years. The region is thus no longer so dominated by its role as one of the preferred alternatives for middle-class housing. Although this assertion lacks solid empirical proof, it seems quite consistent with the low values given to these areas, especially in Factor 2 (traditional arrangements/access to the labor market).

Taking into account the three situations considered and based on a cluster analysis, a proposal of different zones of social vulnerability for the municipality of Campinas was drawn up. Map 7 shows the results, and Table 3 presents the average scores of each of the suggested groupings. Although there is no clear contiguity among the zones of vulnerability encountered, it can safely be said that there is a certain spatial pattern observed:

- Group 1: Distant periphery (Southwest);
- Group 2: Central Region 1;
- Group 3: Central Region 2;
- Group 4: Distant periphery (North and Southeast);
- Group 5: Immediate periphery 1;
- Group 6: Immediate Periphery 2 and Barão Geraldo.

However, Map 7 and Table 3 show that there is no clear spatial contiguity in terms of social vulnerability in Campinas, since even in the more peripheral areas there are certain sub-areas with more favorable conditions, not only due to differences in infrastructure (Factor 2 of Physical Capital) but also to their access to services and other means of social promotion other than work (Social Capital).

Map 7. Clusters of Areas of Weighting, Campinas, 2000.

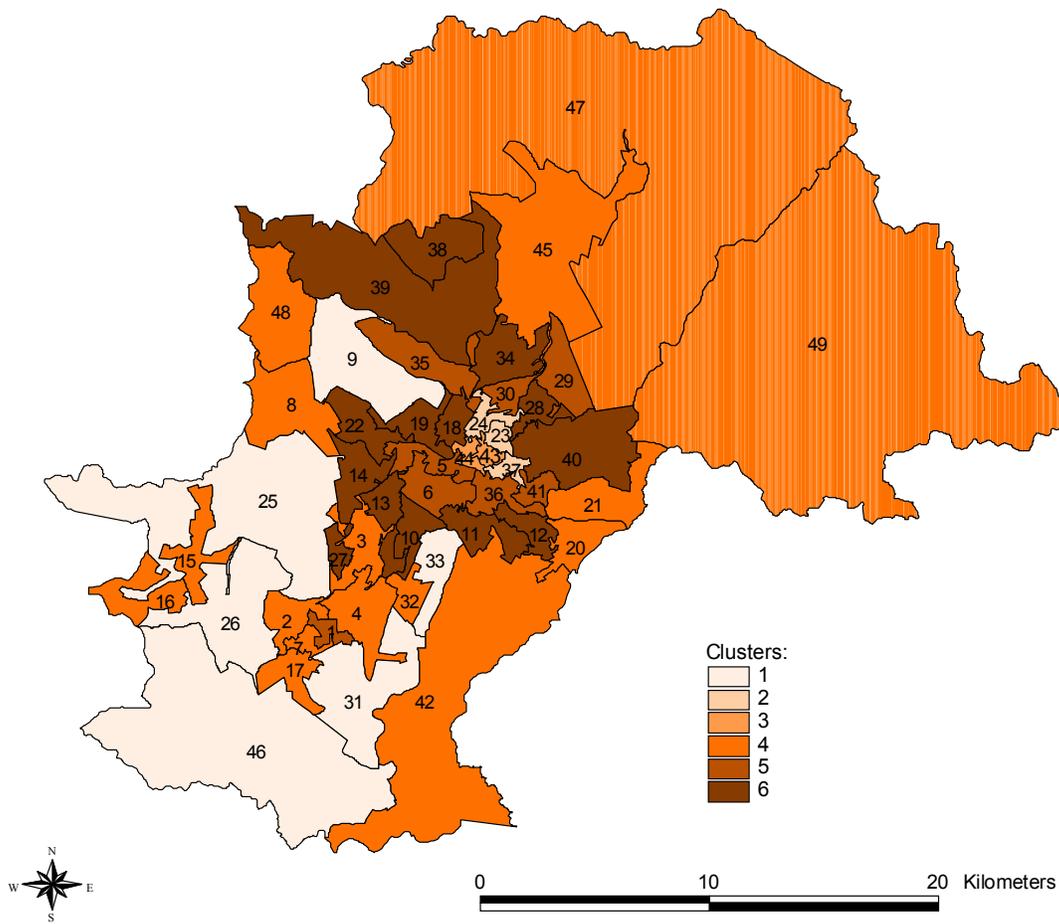


Table 3.
Average values of the factors, by group
Municipality of Campinas
2000.

Factors	Groups					
	1	2	3	4	5	6
Physical Capital - Factor 1	0.91	0.06	0.03	0.72	0.51	0.48
Physical Capital - Factor 2	0.77	0.04	0.15	0.46	0.24	0.21
Human Capital - Factor 1	0.89	0.08	0.05	0.60	0.38	0.26
Social Capital - Factor 1	0.73	0.05	0.52	0.40	0.25	0.23
Social Capital - Factor 2	0.61	0.16	0.85	0.43	0.68	0.24

In addition, Table 3 shows that such distinct spaces as part of the Central Area (Group 3) and the Southeastern Region (Group 1) share similar characteristics in terms of Factors 1 and 2, related to Social Capital. The most interesting fact to be noted in this example is that, considered jointly with the other factors, these coincidences are insufficient to approximate them, since alternative domestic arrangements and access to resources deriving from work may have different implications for the higher-income groups (in the center, see Factor 1 of Physical Capital), when compared with lower-income strata (located in the periphery).

It can therefore be said that although distinct situations regarding the degree of vulnerability can be identified, especially in extreme cases such as Groups 1, 4 and 5, the classification presented here is far from representing a clear and unquestionable scale of situations of vulnerability in the city. Due to its multifaceted nature, this notion requires an analysis of the three components that will allow a more precise evaluation of the difficulties encountered in each of the spatial units being analyzed.

In this regard, the results shown in Map 7 should be considered in conjunction with the interpretation of the characteristics of the groups in regard to each factor studied. Taking into consideration the specific aspects of the various areas, these factors may vary in different senses, compromising the possibility to scale the different categories of vulnerability.

Final Considerations

This article has presented a theoretical and methodological discussion on the use of the concept of social vulnerability for studying the distinct capabilities of demographic groups living in different parts of the municipality of Campinas to face the adversities that plague them. Based on the assumption that this capacity can be measured by the physical-financial, human and social assets that characterize families and individuals, spatialized indicators were constructed which define *zones of vulnerability* in Campinas.

This tentative stage of analysis suggests that the perspectives are promising. First, the census data proved to be sensitive to the statistical treatment applied to them, and the factors are solid and consistent with socio-spatial explanations of vulnerability. Secondly, the factors divide the municipal territory into forty-nine units of analysis. This procedure shows that the territory is not uniform nor are the differences random, confirming a pattern of social segregation. It also reveals different sub-regions in the municipality. The pattern found is not identical for all three dimensions analyzed here, and it is these differences that indicate the direction for a more complete and factual understanding of the situation of the population.

The success in identifying distinct zones makes it possible to draw up a strategy for (1) detecting *in loco* the consistency of this analysis and (2) developing further research techniques to supplement and broaden the situation indicated by the census data, especially in terms of the social capital dimension. A household sample survey based on more elaborate questionnaires will allow the use of more refined indicators of the three types of capital and the confrontation of the scale of vulnerability that results from this study with empirical indicators of inclusion, of success in dealing with urban adversities, and the *socio-spatiality* of social vulnerability. It will also enable incorporation of other dimensions such as environmental factors that were treated only superficially in the present article, through information regarding access to basic sanitary services.

The theoretical-methodological perspective presented in this paper will be an important tool for understanding more recent features of social exclusion. The present analysis clearly showed that there are other factors besides income level that constitute obstacles for reducing the vulnerability of urban populations.

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