Socio-spatial impact of slum dwellers relocation in Algiers: a flow analysis using Qgis

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Abstract: Since 2014, we have witnessed an acceleration of the pace of massive relocation operations in Algerian cities, particularly in the capital, with the ambition of making the city of Algiers the first African capital without slums. This article presents an evaluation of the relocation operations carried out during the period from 2014 to 2016. The objective is to identify the socio-spatial impacts of massive relocation on the province of Algiers and the neighboring cities. For this purpose, we adopted a method based on the flow analysis of slum dwellers relocated with the data visualization technique, widely used in GIS. The results show that a large number of inhabitants were relocated in a relatively short time and that there was a random distribution of slum dwellers from the capital to communes within or outside its administrative boundaries, with negative impacts on socio-spatial transformations of Algiers.

1. Introduction

1.1. Overall context: The negative effects of slum dwellers' relocation to make way for development projects are diverse; it sometimes hinders the rights of the populations concerned by accentuating their precariousness and aggravating their poverty (Cavalheiro and Abiko, 2015). Despite progress in the planning and implementation of resettlement operations, the medium- and long-term consequences have not been sufficiently anticipated and considered (Takesada et al., 2008), which explains the need for a solid knowledge base in adopting appropriate intervention policies and methods.

As traditional methods of planning resettlement operations are not sufficient to analyze and anticipate their socio-spatial impacts, alternative methods could be useful to provide reliable results, including spatial reference. Numerous studies related to slum issues, based on data visualization using GIS, have been carried out notably in Asia (Roy et al., 2020; Santra et al., 2017; Kohli et al., 2012) and in Africa (Khadr et al., 2010; Togarepi et al., 2016; Mahabir et al., 2020), but there are few such studies on Algerian cities (Lamri et al., 2020).

The present research attempts to integrate the data visualization technique using flow maps in studies related to relocation operations of slum dwellers in Algeria. Flow maps are widely used to study geographical movements; they also allow the impacts of these movements to be visualized. This type of map is widely used in various fields such as infectious disease transmissions (Angelo et al., 2017), urban spatial changes caused by the relocation of industries (Choi and Oh, 2010), studies related to population migration (Stephen and Jenny, 2017), as well as research related to transport and urban mobility (Sobral et al., 2019).

1.2. Local context: In Algeria, several housing and slum clearance programs have been implemented since the colonial period and continued after independence (Table 1). According to the research work of (Safar Zitoun, 2012a), these programs are part of a global approach that is purely political and closely related to a classical rent economy based on the distribution of oil revenues on citizens. Despite the government's efforts in terms of reforms and reconfigurations of financing methods and intervention modalities over the years, the housing crisis persists in the face of growing demography and acceleration of informal urban practices (Safar Zitoun, 2012 b).

Table 1. Housing Policy in Algeria (retrospective)

Context		Public action
Colonial period		
1950	Discrimination against the rural population, Expropriations, socio-spatial segregation.	Constantine Plan, Habitat Bon Marché (HBM), Habitat à Loyer Modéré (HLM), Prefabricated building.
Post-colonial period		
1970	Socialism, modernization, industrialization.	Occupation of vacant properties, Completion of Constantine Plan Projects, Construction of the ZHUN, Construction of 1000 peasant villages.
1980	Selective eviction, Economic crisis/ Oil shocks, Structural adjustment/ debt compensation word bank, Multiple shortages, Political crisis (1988 protests or Algerian Spring), Significant decrease in the housing program.	Transfer of slum dwellers to their hometowns, However, slum dwellers with a work place are provided with social housing or land, Securitization of permanent structures, built before the building permit was granted.

1990	Sale of the vacant properties, Cessation of land reserves to the municipalities, Multipartism / Halt of the electoral process (elections won by the Islamic salvation party), Power in the hands of the army The population flees from terrorism.	Housing programs are at a standstill, The security issue is a priority, Implementation in 1998 of the "Résorption de l'habitat précaire" Programme with the support of the world Bank.
2000	Oil price increase, Economic recovery, National agreement and return to social peace, Strengthening of the State.	Construction of 2 million housing units by 2029. 300.000 for slum dwellers between 1999-2014, Priority given to the "poorest classes", Relaunch of the "Résorption de l'habitat précaire" program and Implementation of the 2008 Act, Substantial financing (3700 billion DA for the five- year period 1999-2014), Slum clearance all over the country by 2017, Making Algiers the first African capital without slums by the end of 2016, Facilitating and promoting access to housing.

Source: (Chabou Othmani, 2018), table made by Flissi, 2021

The United Nations Millennium Declaration, signed by Algeria, recognizes the right to adequate housing and the need to improve the living conditions of slum dwellers. According to (Rolink, 2011)¹, the Algerian government has taken into consideration the issue of housing as a major responsibility towards the population. Despite efforts to build a large housing stock for low-income slum dwellers, the situation is increasingly deficient and demand has been rising. According to the UN Special Rapporteur, the reasons and factors for the increase in this housing deficit from the country's independence to the present day are varied and include strong demographic growth, the concentration of the population in the northern part of the country, the deterioration of the existing housing stock (vacant properties abandoned by the colonists and resettlement cities built during the colonial era), the vulnerability of housing to natural disasters (earthquakes, floods,

¹ Special Rapporteur on adequate housing as a component of the right to an adequate standard of living, and on the right to non-discrimination in this context.

landslides, etc.), as well as the effects of the political crisis of the 1990s (massive rural-urban migration fleeing the terrorists and proliferation of slums)².

From the 2000s, Algeria had financial ease, favored by the increase in the price of oil, which allowed the government to invest in four successive quinquennial development programs (2000-2004, 2005-2009, 2010-2014, 2015-2019). The intention was to restore the dynamic for national reconstruction. In the housing sector, Algeria has devoted USD 65 billion to the construction of 2.2 million housing units of all types across³ all the country's provinces during the period from 2010 to 2014 (Ministry of Housing, 2010). In the same context, a massive relocation program is dedicated particularly to inhabitants in precarious situations and urban poverty. Its main objective is to eliminate all forms of urban insecurity and poverty, following the objectives of sustainable development and the standards prescribed by the international organizations affiliated with the United Nations⁴. The government's ambition was also to make Algiers the first African capital without slums by 2016. To achieve this, a census of families concerned by this program was carried out in 2007, updated in 2013. This allowed the identification of five forms of precarious housing: slums, colonial resettlement cities, temporary housing⁵, buildings in danger of collapse (IMR)⁶, cellars, and rooftops (Figure 1).

Indeed, the cadence of relocation operations accelerated during the period from 2014 to 2016; 55 471 families were relocated (i.e. 76% of the slum dwellers counted in 2013) during the 21 relocation operations carried out by the Algerian authorities. In addition, 395 ha of surfaces were reclaimed, including 180 ha during 2015 (Ministry of Housing, 2016). This has allowed the launch of major structuring projects provided for in the master plan for development and urban planning of Algiers PDAU⁷ for 2035, such as the construction of the Oued Ouchayah viaduct following the eradication of the Erramli slum⁸.

Although these massive relocation operations contribute to reducing the tension on the supply of social housing, they are not without consequences for the slum dwellers and the urban space. These programs have contributed to the exclusion and marginalization

² The outbreak of the black decade: political and economic instability following conflicts between the Algerian government and Islamist groups (1991-2002). The Algerian government's priority was to secure the country and fight terrorism.

³ A program for inhabitants with higher incomes "Logement Public Promotionnel LPP". Another program of type rent-sale intended for the middle classes of populations AADL. A new forms of access to housing "Logement Social Participatif LSP" and "Logement Promotionnel Aidé LPA" intended for the below middle classes, and lastly the program of "Logement Public Locatif" intended for the slum dwellers with low incomes (less than 24.000.00DA/ month that is to say 180,06 Dollars/month).

⁴ The first goal is "eradicating poverty and insecurity" and the eleventh goal is "building sustainable cities and communities".

⁵ Prefabricated dwellings were installed by the Algerian authorities to take care of families affected by the earthquake in Boumerdes in 2003. These temporary dwellings have largely outlived their usefulness and have become slums.

⁶ Buildings or houses with a safety hazard to the occupants, neighbors, or passers-by.

⁷ An instrument for spatial planning and urban management at the level of the municipality or a group of municipalities.

⁸ The largest slum in Algiers is located in the commune of Gué de Constantine a few kilometers from the center of Algiers. The eradication of the Erramli slum has released approximately 56 ha and allowed the relocation of nearly 2,500 slum dwellers.

of the poorest populations (Semmoud, 2007), and have in turn contributed to the creation of concrete-cities (Sidi Boumedine, 2016) and socio-spatial fragmentation (Safar Zitoun, 2001): the new host cities are generally located on the periphery of cities, the relocated slum dwellers suffer from a lack of local services, shops, and means of transportation, and they are not necessarily satisfied with their new residential situation. In this context, the Urbanis Agency⁹ has established updated digital cartography of Algiers that takes into account the housing sector, particularly that intended for low-income slum dwellers. The thematic maps made it possible to locate the sites of the eradicated slums and those to be eradicated, to identify the number of slum dwellers concerned by the relocation operations, and to estimate the reclaimed surfaces, which will be re-used for the construction of development projects. However, the approach adopted by the Urbanis Agency is mainly interested in the land released without taking into account the socio-spatial impacts that may arise following the massive movement of populations to large host cities. To this end, and to optimize the success of a relocation operation, a global approach is needed which correlates the departure sites, the arrival sites, and the flows of relocated slum dwellers. Does this research attempt to understand how to identify the socio-spatial impacts of massive relocation in Algiers using GIS?

Figure 1. Report of relocating actions up to 2016 (number of slum dwellers registered and relocated)

Source: Ministry of Housing., 2016, graph made by Flissi, 2021

1.3. Hypotheses and research objectives: The present research examines the new relocation policy, whose operations are underway, by trying to identify the socio-spatial impacts of the massive relocation in Algiers. For this purpose, we propose the integration of the data visualization technique using maps of socio-spatial flows. This type of map illustrates the movements of populations from different sources to several destinations by representing locations by nodes and movements by edges (Ni et al., 2017). We hypothesize that this technique, widely used in GIS, would allow for comprehensive visualization of the trajectories of relocated slum dwellers, helping to anticipate negative impacts by creating reliable geospatial databases, and contribute to the success of relocation projects.

2. Materials and methods

2.1. Study area: Algiers is the capital of Algeria and is located on the Mediterranean Sea, at 36° 45' 9 north latitude and 3° 2' 31 E longitude. The city of Algiers is made up of

⁹ A public agency of an industrial and commercial nature EPIC was created in 1997.

13 administrative districts and 57 communes (Figure 2). It is one of the largest North African cities, with 3 500 000 inhabitants in 2011 according to the statistics of the province of Algiers. This article focuses on the period from 2014 to 2016. This period is marked by an acceleration of the relocating process of slum dwellers and the implementation of some structuring projects registered in the framework of the PDAU, and is relevant for the availability of information allowing us to carry out our analysis of flows.

Figure 2. Location of the study area

2.2. Description of the used method: Our methodology was implemented in three main steps: data collection, database design and flow analysis. We collected information on relocation operations of slum dwellers in the city of Algiers since 2014, through investigations at the level of the public organizations involved in the relocation process¹⁰.

¹⁰ In this case, the relocating unit of Algiers, the housing department and the three offices for the promotion and management of the real estate in Algiers (OPGI): OPGI Dar El Beida, OPGI Hussein Dey, and OPGI Bir Mourad Rais.

These data are assigned to spatial layers in vector format and defined in the same projection system WGS 84/ UTM zone 31N (Figure 3). The data analysis was carried out using the data visualization technique. It consists of the geographical visualization of the flow data using the QGIS 3.16.1 tool. The objective is to see more effectively the movement of relocated families from one place to another and to visualize - through flow maps - the socio-spatial transformations of Algiers following this massive relocation.

Figure 3. Description of the spatial layers designed for our research

3. Results and discussions

3.1. Data visualization and flow analysis: The results of the flow analysis are presented in the four thematic maps (Figure 4, Figure 5, Figure 6, Figure 7). These maps illustrate the movements of the populations concerned by the relocation, showing the flows of the trajectories of the relocated slum dwellers (departure sites and arrival sites).

Figure 4. Trajectories of relocated slum dwellers (central municipalities)

The analysis of the flows shows the following:

- 45 municipalities of Algiers (i.e. 79% of the municipalities of Algiers) and 3 communes of neighboring cities were concerned by these relocation operations.
- The municipality Gué de Constantine had the largest flow of departures, more than 4,000 slum dwellers from the Erramli slum (Figure 5, Figure 7), while the flow of arrivals to this same municipality was very low (around 100 slum dwellers Figure 7).
- The municipality of El Harrach had the largest inflow (nearly 3000 slum dwellers Figure 4, Figure 5, Figure 6, and Figure 7), whereas the outflow from this municipality did not exceed 500 (Figure 7).

Figure 5. Trajectories of relocated slum dwellers (intermediate municipalities)

- The peripheral municipalities of Ouled Chebel, Rouiba, Heuraoua, Eucalyptus, Khraissia, Bordj El Bahri, Birtouta, and Rahmania received large flows (between 1,000 and 2,000 slum dwellers, Figure 6 and Figure 7), whereas the initial flows were small (between 50 and 100 slum dwellers Figure 6 and Figure 7).
- The municipalities of Larbaa, Si Mustapha, and Meftah are located outside the administrative boundaries of Algiers. They received significant flows from the municipalities of Algiers (between 1000 and 2000 slum dwellers Figure 5, Figure 6, Figure 7).

3.2. Data interpretation and discussions: The flow maps illustrate a large number of inhabitants relocated in a relatively short period and a random distribution of slum dwellers from the capital to municipalities located within or outside its administrative boundaries. This has had an impact on the socio-spatial transformations of Algiers.

3.2.1. Spatial impact: The slum eradication project is part of a global approach purely political and closely linked to the economic recovery of the early 2000s. The Algerian government has strongly publicized the relocation operations as a unique and exemplary project in Africa, making it possible to achieve the Millennium Development Goals by relocating slum dwellers in decent housing.

Figure 6. Trajectories of relocated slum dwellers (peripheral municipalities)

However, behind this political mediatization of the project, with international proportions, there were other interests. The first was to quickly release land located in central areas with high land value for possible re-use (Navez-Bouchanine et al., 2002) : this can be explained by the rapid construction of certain structural projects planned in the PDAU of Algiers on the sites of the eradicated slums. We can cite as examples the case of the great mosque of Algiers or the development of the banks of Oued El Harrach. Thus, the main interest was the recovery and re-use of land in the central zone for the construction of public or private projects. These will serve the middle classes and commercial enterprises (Chabou Othmani, 2018; Chabou Othmani, 2017).

**Figure 7. Number of relocated slum dwellers (municipalities of departure/
municipalities of arrival)**

The second interest was socio-political. Indeed, to remedy the social consequences of the black decade (exodus of populations threatened by terrorism, the emergence of new slums, etc.), the government urgently set up a program reserved particularly for the poorest social classes (Le Tellier, 2010).

Concerning the location of the new host cities, the flow analysis shows that: the peripheral municipalities (Ouled Chebel, Rouiba, Heuraoua, Eucalyptus, Khraissia, Bordj El Bahri, Birtouta, and Rahmania), the peripheries of the intermediate municipalities (El Harrach and Draria) as well as the two neighboring provinces (Boumerdes and Blida) have also received large flows of inhabitants (between 1 000 and 2 000 slum dwellers).

Indeed, the saturation of the central zone in terms of urbanization and the need to quickly release the sites occupied by slums for structural projects are the two factors that guided the choice of the reception sites. Moreover, the new settlements built on natural sites out of the city, such as the Rachid Kourifa host city, located in agricultural land on the southern periphery of El Harrach.

The urgency of carrying out planned projects, on the one hand, and social crisis (slum dwellers who have been waiting for access to housing for several decades), on the other hand, have exerted such pressure that decision-makers have no choice but to resort to immediate solutions within a relatively short period. This precipitation, encouraged by the economic recovery that Algeria had at the beginning of the 2000s, was a quick and easier solution that left little time for effective planning and could have anticipated the consequences of these massive relocating operations. In addition, the construction of host cities on peripheries contributes to urban sprawl on agricultural land. This accentuates environmental problems and aggravate transport and mobility problems by increasing mobility and creating additional flows between the new places of residence and the workplaces, which are generally located near the old places of residence.

3.2.2. Social impact: This massive relocation of populations, although solving the problem of urban precariousness in terms of quantity, has consequences on the social situation of relocated slum dwellers. In a fragile situation, these inhabitants, despite their consent to be relocated, were forced to leave their original social environment for new destinations, unknown to them, and located several kilometers (50 km in some cases (Figure 8)) from their place of origin.

Figure 8. Number of relocated slum dwellers (distance: departure / arrival)

The move of slum dwellers from central, intermediate, and peripheral municipalities 'within the administrative boundaries of Algiers' to other peripheral municipalities, or even to neighboring towns (Figure 4, Figure 5, Figure 6); generates social problems. The inhabitants have been detached and uprooted from their original sites, which they had sometimes lived in for several decades, and where both their workplaces and the local facilities (school, health center, etc.) that constituted their daily environment were located. These advantages are no longer available in their new host cities. Moreover, the flow maps illustrate a random distribution of slum dwellers, without taking into consideration the grouping of relocated inhabitants according to their origin. This accentuates their poverty and marginalization and contributes to the creation of spaces of exclusion. This puts back on the agenda the question of the right to the city, which is not taken into consideration in this relocating policy adopted by the Algerian authorities (Lefebvre et al., 2009).

3.3. Contribution of research to the advancement of the field: This research reveals the importance of using GIS to understand the policy of relocation slum dwellers and to measure, on the one hand, its social impact, illustrated by a large number of families relocated, detached from their original sites and excluded from the city due to the random distribution of slum dwellers, and, on the other hand, its spatial impact, by the transformations induced by an accelerated process of urbanization, which has resulted in the sprawl of agricultural land and the sporadic consumption of space.

These findings confirm previous research results on the use of GIS in this area. According to Li et al., 2011, the success of a relocation operation depends on a good selection of new sites and analysis of various factors such as social compatibility. In addition, Muczyński et al., 2021 found that new geo-information technologies allow to evaluate actual problems and future scenarios for dwellers' relocation projects. Last but

not least, the success of urban operations in general depends on the communication with those involved (Fantazi et al., 2019).

Also, the use of flow maps, allowed us to visualize the relocation operations carried out during the period from 2014 to 2016 in terms of places of origin (from), places of destination (to), and the number of slum dwellers relocated (flow). Thus, GIS can be used to estimate and classify the land to be released for possible re-use in the development and construction of new projects according to their characteristics (surface, location, etc.). The data visualization technique using flow maps, proposed in our research, presents an analysis tool that could contribute to the reduction of the negative impact of massive relocation on the space and the relocated populations. This tool could also be used to refine future relocation operations. This confirms our initial hypothesis.

Furthermore, the results of this research have to be interpreted taking into consideration the urban policies in place (Randazzo and Lanza, 2020). The combination of the results of the upstream flow analysis and the socio-spatial context of the study area would help to anticipate the consequences of a possible relocating operation. In other words, the use of flow maps - as revealed in our case study - when planning a relocating operation, would make it possible to consider the possibility of grouping the relocated inhabitants according to their sites of origin and their places of work. This would prevent the recreation of new areas of exclusion of poor populations.

To this end, we recommend the use of GIS and flow maps in the technical documents of planning during the process of urban management to anticipate possible consequences. For better efficiency, this tool should be used according to a multi-scale approach: a regional scale (Development Plan of Wilaya PAW), a communal scale (PDAU), and a local scale (Land Use Plan POS).

Similarly, we suggest that decision-makers, professionals, and representatives of the populations concerned collaborate to address individual and collective interests. This interdisciplinary approach would contribute to the constitution of a participatory governance model for the project, which could be adopted by ensuring social support for the relocated slum dwellers, through the establishment of cells managed by representatives of local authorities, professionals (architects, urban planners, sociologists, etc.), associations and neighborhood committees. This model would, on the one hand, ensure better integration of heterogeneous populations in their new living environment and, on the other hand, establish a collaborative and participatory approach to the relocation of slum dwellers.

4. Conclusion

This article is a contribution to the comprehension of the Algerian policy of relocating and slum clearance, and its impact on spatial and social transformations. The results of this research illustrate, through a flow analysis according to the from-to-flow matrix, the impacts of massive relocation operations in the province of Algiers and highlight the use of flow maps as an analytical tool that could be considered as a planning tool for future relocation operations.

The research is also important for providing new insights regarding the way of dealing with the problem of derogatory planning and its consequences. Previous studies

carried out in coastal cities and regions revealed the potential of illegal developments to expose more people to natural hazards (Randazzo et al., 2013, Hamma et al., 2018) and generate environmental impacts (Nguyen et al., 2020, Petrișor et al., 2020), contributing to the degradation of coastal regions, which are important ecologically due to their ecosystem services, provided to a large population, and vulnerability (Lanza and Randazzo, 2013; Randazzo et al., 2014; Petrișor et al., 2020). All these justify the need for seeking new solutions against slums, considering all the positive and negative effects of each solution; from this perspective, the present research makes an important contribution to developing coherent urban policies against the proliferation of slums.

In conclusion, this contribution opens up new research perspectives on the fate of slum dwellers in their new residential situation, and their participation in coping with problems of marginalization and social stigmatization. Furthermore, the results can be transferred and adapted to other regions to prevent and control spatial, social, and environmental changes due to future relocation operations.

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