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Impacts of unplanned urbanization on the implementation of drinking water supply projects in the suburbs of Bamako

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Abstract

The United Nations General Assembly, in its 2010 resolution, officially recognized the right to safe, clean, accessible, and affordable drinking water as a fundamental human right, essential to the full enjoyment of life and the effective exercise of all other fundamental rights. The objective of this study is to determine the impact of population growth on drinking water supply in the suburbs of Bamako. Population growth is a key variable in assessing water stress, as it directly influences anthropogenic pressure on water resources and their potential for mobilization. In these outlying districts of Bamako, this dynamic has been observed through a number of factors relating to adverse natural circumstances, the emergence and proliferation of restaurants and bars, and the development of socio-economic infrastructure. The total population of these areas is estimated at 428,589 inhabitants. Surveys show that only 15% of the population, or 64,287 inhabitants, do not have access to drinking water. Narrow roads, illegal occupation of public rights of way, and the heterogeneity of pipelines are among the impacts of uncontrolled urbanization, which subsequently leads to the exorbitant cost of drinking water supply works.

Keywords: Drinking water supply; Suburbs of Bamako; Unplanned urbanization

1. Introduction

Water is an essential resource for all aspects of life. [1]. With an estimated volume of approximately 1,420 km^3, or 75% of its total volume [2], The earth now leaves 2.1 billion people without any access to a source of drinking water [1, 3]. As a “right for all, not a luxury” [4], Water is an economic resource that must be managed [5, 6]. Despite these clear intentions, the problems associated with this commodity remain unresolved. Moreover, according to Kanta Kumari Rigaud and al, millions of people will be forced to leave less viable areas where water is less available [7] because cities play an essential role in ensuring widespread access to this precious commodity [8]. This delicate situation, which causes nearly one million deaths per year, affects low- and middle-income countries much more, where a significant portion of the population does not have access to clean drinking water services that are locally available and easily accessible [8, 9, 10, 11]. The city of Bamako, like most capitals in Africa, is not immune to these difficulties, which are mainly linked to unplanned urbanization [12]. It is facing rapid urbanization, which has developed due to two factors: population explosion and massive migration [13]. Notable examples include water shortages in outlying neighborhoods, failure to comply with standards when installing water supply pipes, and inadequate sanitation and hygiene measures. Even more seriously, given the security situation in the country in recent years, the influx of refugees into these neighborhoods is exacerbating this increasingly recurrent problem. Thus, the social and economic situation of households in these outlying areas, as elsewhere on the continent, leads them to use several types of water, most of which are polluted by solid and liquid waste, as these areas are dumps and sources of waterborne diseases [14]. The water sector is therefore a key concern in the development and planning of Bamako, both in terms of groundwater and

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surface water resources [15]. People living in the capital lack sufficient water and have to travel long distances to obtain it, sometimes paying high prices. Others who feel marginalized or deprived of a right are now creating disputes. The fundamental objective is to send a heartfelt appeal to administrative and political authorities and planners for a properly planned urbanization approach in line with population growth, in order to best meet drinking water needs, access to which remains a challenge at the national level.

2. Methodology

2.1. Presentation of the study area

Founded around the 16th century, the city of Bamako, located at 12°40 north latitude and 7°59 west longitude, is the capital and largest city of Mali. Covering an area of 2,992 km^2 with a population of 3,529,300 inhabitants, or a density of 1,180 inhabitants per km^2, it is crossed by the Niger River. As in almost all African capitals, its urbanization is increasing. Since independence, it has continued to engulf its suburbs and/or neighboring towns.

According to Table 1 published by the National Institute of Statistics, the populations, which are key data in determining drinking water needs in the suburbs, are as follows:

Table 1 Population growth in the suburbs of Bamako

Peripheries/Years	1960	1991	2002	2025
Kati	10327	39041	62582	186931
Kalaban coro	190	13568	61729	126178
Sangarebougou	18	2610	15309	28532
Sikoroni	876	2200	9500	22000
Dialakorodji	145	5656	15607	45880
Moribabougou	20	1923	9677	19068
Total	11 576	64 998	174 404	428 589

2.2. Data collection

In order to gather the information needed to supply drinking water to the outlying districts of Bamako, interviews were held with the departments responsible for drinking water (Malian Drinking Water Management Company (SOMAGEP), Malian Drinking Water Heritage Company (SOMAPEP) and drinking water user associations). These interviews focused on network design, the type of connections and user satisfaction levels. The results are shown in Table 2:

Table 2 Supply methods in the suburbs of Bamako

Procurement method	users	Percentage of the population served
Individual connection	150 007	35
Water Fountains	214 295	50
Purchasers of drinking water	64 287	15
Total	428 589	100

In general and theoretically, it appears that 15% of the population (approximately 64,287 inhabitants) still do not have access to drinking water despite the policies that have been put in place.

2.3. Processing and analysis

Our data processing consisted of analyzing this data in accordance with the sustainable development goals set out in Mali's national water policy documents.

In concrete terms, this involves observing the supply conditions in these areas based on:

- Maximum distance to be covered: according to national water policy (I Policy Document), this should not exceed 300 m per inhabitant ;
- The price of drinking water services: setting the price per cubic meter at 500 CFA francs in non-concession areas. ;
- Water volume per user per day: should not exceed 20 liters according to the WHO [16];
- User safety: demonstrating that consumers do not have to cross a national road to obtain drinking water and
- Waiting time: stating that to minimize this time, the flow rate at each public connection must be at least $1m^3$ per hour.

3. Results

3.1. Uncontrolled housing developments without infrastructure planning

From the advent of democracy (1991) to the present day, urbanization has been increasing steadily in Bamako. Without planning or concrete policy, the city is now expanding beyond its geographical boundaries, engulfing its surroundings. Rural areas have therefore given way to urban areas [13]. Unfortunately, this has not been accompanied by any plans to build infrastructure (water supply, sanitation, electricity, etc.) in accordance with best practice. As for the water supply network, has its implementation suffered from institutional decisions, or has it given way to frequent DIY solutions by the population ? [17]

Contrary to the principle of extending drinking water supply networks, in some neighborhoods, the heterogeneity between pipes is undeniable: sometimes cast iron connected to PVC-P, sometimes cast iron connected to HDPE, etc. Also, a succession of non-compliant diameters is very common in these areas. More seriously, work is carried out by individuals without the involvement of SOMAGEP, which is responsible for managing the service. The network can simply be perceived as a string.

(a) Obstruction of public roads by buildings

(b) Blockage of pipes by structures

Figure 1 Views of unregulated occupation in Kalaban Coro (source : DIARRA, 2025)

3.2. Insufficient right-of-way for pipelines

As a result of this uncontrolled development, public roads and areas where pipes are laid no longer comply with technical requirements.

One of the main difficulties with the major project known as “AEP de Kabala, volet BAD,” which focuses on certain suburbs of Bamako such as Dialakorodji and Sikoroni, where roads are very narrow, was managing local residents during the installation process. Despite the provision of support measures to address the damage caused, there was a significant negative impact on the project timeline.

The same was true for compliance in the construction of trenches.

Furthermore, during this work, temporary detours are virtually impossible, which has a considerable impact on traffic.

a) Occupations of the pipe laying area

(b) Difficulties in handling the equipment during installation

Figure 2 Narrow tracks for pipe laying work (source : DIARRA, 2025)

3.3. Saturation of existing networks

Around Bamako, demand far exceeds supply. With all these areas now added to the network, there is widespread illegal tapping. With these connections, people feel that they are somehow benefiting from the urban standard of living. Even more seriously, these new areas always go hand in hand with the creation of a number of infrastructures : schools, places of worship (mosques, churches), manufacturing units, and large shopping centers for greater convenience. Thus, while decision-makers defend a high theoretical rate of access to drinking water, a significant proportion of the population now suffers from a lack of it [18]. In these areas, access to adequate sanitation is in turn becoming a chore, further limiting the assurance of sufficient water at all times and the satisfaction associated with it per individual [19].

a) Overloading of connections in Sikoroni

(b) Non-compliant connections to the network in Dialakorodji

Figure 3 Illegal connections to the network in Bamako (source : DIARRA, 2025)

3.4. Unequal access to water

The uneven distribution of drinking water networks in outlying neighborhoods continues to cause difficulties in supplying drinking water [14].

As the streets cannot be connected to the water mains, large numbers of people (sometimes as many as 850 inhabitants) share public fountains, and structures that have been out of service for a long time now confine the issue of water to a marginal one.

a) The challenge of accessing drinking water in Kalancoro

(b) Discontent over access to drinking water in Sikoroni

Figure 4 Difficulties accessing water in the vicinity of Bamako (source: DIARRA, 2025)

4. Discussions

The impact of unplanned urbanization on the development of drinking water supply networks in the outlying districts of Bamako is significant. This fact is reflected in the presence of a number of related factors. The present discussion will be based on the results presented above.

4.1. Uncontrolled housing developments without infrastructure planning

Difficulties arising from illegal occupation without planning are never surprising in Bamako. Indeed, people attracted to the capital would rather put up with deplorable conditions than move away from administrative advantages. However, meeting the requirements in certain areas, such as drinking water, remains a major challenge. As in the Democratic Republic of Congo, where the capacity to expand drinking water supply networks has not been able to keep pace with population growth, water problems are also likely to arise in the outskirts of Bamako [20].

A recent survey shows that some users in Kalaban Coro and Sikoroni have to travel 1,100 meters to obtain water, as conditions do not allow for the installation of standpipes. Others in Titibougou are forced to cross the RN 27 (Koulikoro road) to access the resource, with all the risks that this entails.

Elsewhere, in Dialakorodji, those living on the hillsides remain in a permanent state of shortage because the configuration of the site (the terrain and the narrowness of the streets) simply does not allow for the installation of such infrastructure. The same observation was made by Ibrahim Mamadou during his studies on Zinder in Niger [21].

With regard to technical failures, we agree with the fundamental principles of booklet 71 on technical and specific requirements for drinking water supply, which aim to prevent, among other things, loose joints and drastic drops in operating pressure in pipes, etc. [22].

As in mining projects, the integration of informal urbanization into development master plans and better coordination between urban planning departments and local authorities will be useful in addressing overcrowding in Bamako.

4.2. Insufficient right-of-way for pipelines

In an drinking water supply project, one of the most important things is to have sufficient space to dig trenches for the pipes. Unlike in areas where the networks are installed in existing buildings, it is impossible to comply with the standards set out in the regulations in force. This often leads to conflicts over evictions or additional compensation

payments. This analysis echoes that of Ibrahim Mamadou regarding discontent related to water supply projects in Africa, who proposes community awareness-raising before covering all the needs programmed by ongoing projects, namely the Kabala water supply project [21].

In addition, other concerns related to narrow access roads may arise during operations, as they often involve the use of earth-moving equipment, the effects of which have a significant impact on nearby buildings.

In fact, according to very specific standards, trenches must have well-defined dimensions.

One of these standards is mainly as follows [12]:

- Minimum pipe width ≥0,40 m+ Outer diameter of the pipe
- Minimum pipe height≥0.50m+ Outer diameter of the pipe

Contrary to these requirements, surveys carried out following numerous problems on some of these networks have revealed that the width of the trenches is significantly smaller in some places. DN160 pipes are often laid in trenches measuring 25 cm instead of (40 cm + 16 cm = 56 cm) due to the small size of the right-of-way.

4.3. Saturation of existing networks

Without a doubt, the design of any drinking water supply system must prioritize the number of inhabitants within the project's timeframe. However, with an exponentially high growth rate in these areas, meeting water needs is becoming a real challenge. With demand growing in particular as a result of urbanization, the correlation between flow and pressure is becoming increasingly complicated as distribution no longer follows the forecasts of the supervisory authority. This result is in line with that of H. VASILCHINA, according to whom pressure and flow must always be linked to the size of the locality and topographical data [1].

Still faced with this problem of water shortages in the area, Malick Alhousseyni, then Minister of Energy and Water in 2018, stated on ORTM that: “the outskirts of Bamako can never be satisfied with drinking water given the state of the network, which has seen very little expansion since its establishment in 1956.” This supports the conclusions of TOURE Alassane and al, who propose maintaining water volume as a priority before supplying each draw-off point [1].

In light of these considerations, the saturation of the network has a considerable impact on its normal functioning. Pressure tests carried out in Sikoroni on certain nodes during the capacity-building phase of the Kabala Structural Project show the values according to the diagram below.

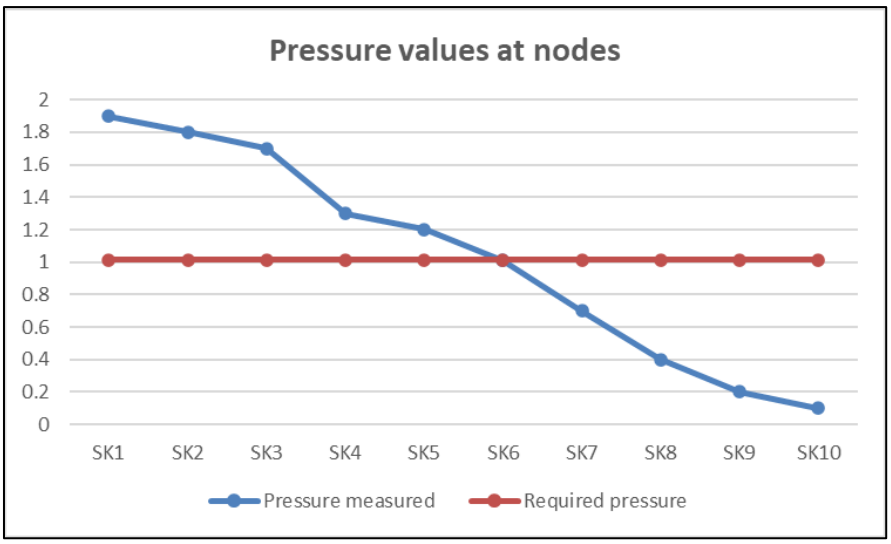

Figure 4 Difference between required pressure and 10 knots tested at Sikoroni

Range 1 (in blue) shows the pressure values measured at sample nodes (10 nodes) that are lower than the pressure required (in orange) for normal water flow at the tap outlets. That said, the tapping points located at SK6, SK7, SK8, SK9, and SK10 may not be supplied correctly. This is confirmed by the work of [23].

In this regard, we note that more than 1,000 nodes in Banconi and Sikoroni are currently not receiving water.

4.4. Unequal access to water

In situations where water resources are insufficient, unequal access to water automatically becomes an issue. This inequality becomes more pronounced as one moves further into the outskirts, where shortages are observed. This is entirely normal due to pressure from altitude or distance during flow [24]. Thus, the low availability of this resource, combined with poor management and planning (failure to keep pace with changing needs, weak expansion of the distribution network), increases the scarcity and cost of water [21]. Unfortunately, in these areas of the capital, water is still sold at a very high price: a 20-liter container often costs 100F, which is equivalent to 200 liters from the distribution service. This painful situation, which water resellers reserve for themselves, is simply due to the fact that, in these conditions of social inequality, it is up to them to ensure regulation, even though water is a right and not a luxury [22].

This price gouging always creates social unrest, which sometimes leads to violent riots that cause damage to managers (the government and private water service providers) who are seen as enemies.

While some have to wait until late at night to get water, others, as mentioned above, are forced to walk more than 1,000 meters to get the minimum amount. This situation is contrary to Mali's national water policy, which stipulates a maximum of 400 meters [25].

5. Conclusion

The aim of this research was to identify the consequences of excessive human concentration around large African cities in general, and Bamako in particular.

The findings show that population explosion and massive migration to the outskirts of Bamako have had a negative impact on equitable access to drinking water and have led to unplanned urbanization in its suburbs. As a result, it is clear that the supply rate in these areas is well below the population's demand for water. These challenges are exacerbated not only by constraints related to the configuration of the terrain (topography), which causes failures in the distribution network, thereby increasing the cost of supplying water to 35% of the population through individual connections, 50% through public connections (standpipes), and 15% through resellers. Investigations carried out in this context reveal that fountains are the main sources of supply, which leads to exorbitant costs that can sometimes reach 100 CFA francs per 20-liter container. Given the lack of water potential and hydraulic infrastructure, the approach adopted for water supply in these municipalities by the ministry responsible for drinking water management through SOMAGEP is intercalation by zone. In addition, uncontrolled urbanization has a negative impact on the reality. Given the lack of water resources and hydraulic infrastructure, the approach adopted for water supply in these municipalities by the ministry responsible for drinking water management through SOMAGEP is zone-based interconnection. In addition, uncontrolled urbanization has a negative impact on the completion of water infrastructure works due to unregulated connections (non-compliance with the technical and specific requirements set out in the regulations in force). To remedy this situation, the government of the Republic of Mali, as part of the implementation of its national drinking water policy, must promote strategies that can adequately support the rapid population growth, as rainwater and runoff, which are alternative solutions, are in most cases polluted due to a lack of appropriate sanitation infrastructure (open defecation), which is a source of waterborne diseases.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed

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