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Environmental Rehabilitation Projects a Tool for Placemaking. Case of Batna, Algeria.

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Abstarct

Due to the geographical nature, many cities contain wadis, which are a natural element that fragments the urban plan, ensures the flow and direction of flash floods, in return, its surroundings most often suffer from water problems, hygiene, rainwater overflow and visual pollution. The quality of life in this type of urban space cannot be improved solely by environmental solutions, but pollution control and urban planning must be taken into account with the same care. In order to make the city more livable, several environmental rehabilitation projects have been carried out around the world, such as the Wadi cover project (WCP), which transformed useless space into useful space, and affected the urban form through four aspects: Street network; Architectural quality; Land useandsocial relations. Its effectiveness was assessed using the method developed by the organization Project for Public Spaces (PPS) that attempts to assess the success of public space based on four characteristics. This method was examined by the use of a combinatorial approach, one is a spatial analysis method grounded in the space syntax theory, and the other is based on the social survey where the satisfaction of the inhabitants was measured by the approach of post-occupancy evaluation (POE). The results highlight the importance of the Access & Linkages category to boost other spatial quality. Also, they indicate that environmental rehabilitation remains an excellent tool for creating a healthy environment, a placemaking strategy and a methodological means to revitalize the urban landscape.

Key words: Wadi cover project, placemaking, quality of life, post occupancy evaluation, space syntax

INTRODUCTION

Most urban policies in the world aim to achieve sustainable development goals, mainly by preserving the environment and people's health and making the city more liveable. The environment is considered the fundamental pillar of sustainable development. Its quality is an important aspect of people's quality of life (Pacione, 2003; Nasution and Zahrah, 2017; Praliya and Garg, 2019). Several programmes and projects worldwide have sought to control pollution and preserve human health. These resolutions align with the placemaking approach, which has been identified as an innovative tool for achieving sustainability goals (Marsden, 2013; Ghavampour and Vale ,2019), making open public spaces more successful. Similarly, (Praliya and Garg, 2019) highlighted that public spaces enhance liveability, environmental quality and sustainability, so they are platforms that also provide many functions to inhabitants, such as leisure, mobility and enable social interaction.

The search for urban quality involves many fundamental factors, including those related to the imaginability of the urban composition (Lynch,1960) and other indicators related to sustainable development (pollution control and public health). In this sense, various studies have been mainly aimed at providing guidelines for urban design, to which the literature review reveals a lack of research on placemaking through environmental rehabilitation. It has focused mainly on identifying the attributes of the quality of public spaces (Whyte ,1980; Gehl ,1987; Karacor, 2014; Alzahrani et al., 2017; Nasution and Zahrah, 2017) and how to promote their psychological comfort, safety, access, clarity and ease of movement (Carr ,1992; Rivlin, 1994; PPS, 2000).

Some cities in developing countries like Algeria contain several Wadis (dry river), called wastelands, which cause the deterioration of the living environment (overflowing wastewater, frequent flooding, sanitation and hygiene problems, unpleasant landscapes and displacement). This degraded area can extend its influence over the whole city. It is a space for challenge and debate, where planning healthy and favourable spaces become necessary. Faced with this bitter

observation, the first measures were taken to adopt a hygienic approach, such as the rehabilitation operations generally on the banks or the bottom of the Dry Rivers, which often have a strong aesthetic dimension and offer new landscapes.

The Wadi represents a physical barrier that hinders the continuity of the urban form. It is an important part of the open space system, facilitating the drainage and channelling of floodwaters. With climate change, many watercourses will experience drought, which will inevitably lead to the expansion of the phenomenon of abandoned areas, and negative impacts on the environment and the urban landscape. This indicates that future urban planning should focus more on transforming these abandoned areas into useful and usable places, as the remarkable example shows the case of Wadi El-Akik, which has been transformed into a place for walking and recreation (Figure 1).



Figure 1. Environmental rehabilitation of wadi al-'aqiq, almadinahalmunawrah –arabiasaoudit. (Source : https://salco-sa.com/en/portfolio_page/wadi-al-aqiq-environmental-rehabilitation-and-development).

This study aims to understand and evaluate through a case study where environmental rehabilitation project was introduced to transform and improve an abandoned open space (wadi). It investigates how the concern for clean-up and pollution control could change the urban form and become a strategy for placemaking. Furthermore, the study seeks to find the appropriate tool to measure the success of the placemaking process to help policymakers, planners and designers to improve their design and satisfy users.

Placemaking

Placemaking is a concept that emerged in the 1960s after people spoke out against problems such as unhealthy living conditions, social inequality and a criminal environment (Aravot, 2002; Karacor, 2014). It was supported by the innovative ideas of (Jacobs, 1961; Whyte, 1980), who stressed the importance of lively neighbourhoods and welcoming public spaces. The concept of placemaking aims to transform spaces into places characterized by functions, activities and uses (Gehl, 1987).

Strategic placemaking is among the different types of design processes that are interested in open public spaces. It focuses on creating new development at the neighbourhood or city level, through a top-down approach with a high level of investment, often by governments or private developers (Shaw and Montana, 2016 ;Lew ,2017). It is an essential component of the spatial planning system. It should be based on the identification of needs and problems and the assets and capacities of the local community to enable community participation and thus create meaningful places (Arefi, 2014). The approaches focus on strategic interventions in a place and aim to change the meaning and value of that place for the local population (Whyte, 1980; Gehl, 1987; Carmona et al., 2003).

Public spaces represent the spatial content in which the external population functions and activities take place in all their components and forms. The presence of pedestrians in the urban spaces and their movement through it is one of the most important signs of its vitality, in this context the criteria that constitute successful public spaces have been researched for quite a long time. In the literature, many studies have identified criteria relating to the quality of excellent public space design, such as (Gehl ,1987; Carmona ,2010; Gehl ,1987; Carmona ,2010; Ewing and Clemente ,2013; Mehta ,2014). Also, include a significant work by the organization of Project for Public Spaces (PPS) that attempts to implement Whyte's ideas and evaluates public spaces along four qualities: Comfort & Image; Access & Linkages; Uses & Activities; and Sociability (Figure 2).

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Figure 2. Placemaking assessment categories. (Source: PPS, 2003).

While others approaches use computational methods for space analysis, among of them is Space Syntax, which believed that spatial configuration has great impact on human social activities. It builds upon graph theory from discrete mathematics for the calculation of spatial relationships between streets in the built environment (Hillier, 1996). It attempts to represent the public space by two methods, namely the convex polygon and axial line, the latter would be used in the current research to evaluate the performance of the publics spaces. Where the main measures of this approach is spatial integration, through which (Hillier et al., 1993) have shown a correlation between it and pedestrian flows and argue that this dimension seems to be a good indicator of pedestrian mobility.

Besides the quantitative and qualitative criteria, developing a successful public space is associated with satisfying human needs and demands (Whyte, 1980; Meht, 2014). Many approaches seek to improve user needs, such as the Post Occupancy Evaluation (POE) approach, which focuses mainly on assessing user satisfaction in a building (Hay et al., 2018;Cranz et al., 2021), but has also been extended to evaluating public open spaces. It identifies the success or failure of any design, solves problems, improves performance and provides a sound basis for future design (Wolfgand et al., 1988; Ismail and Said, 2015). In addition, it aims to improve the quality of life in cities and make corrections to meet the needs of the inhabitants better. From what has been said, the study tries to evaluate the performance of spaces generated by the WCP according to PPS categories, using a combined method between two approaches mentioned above (space syntax and POE).

CASE STUDY

This research was conducted in Batna, located in eastern Algeria, surrounded by a mountain range, which exposes it to flooding that often causes severe damage. Its urban plan is crossed by numerous Wadis, where some occupy the central place and fragment it into several parts (Figure 3). Over time, these Wadis become dumping grounds for all kinds of waste, which are a source of danger, thus pushing the population away.



Figure 3. Study area showing the location and sections of the WCP. (Source: Authors 2022)

Since the 2000s, the inhabitants have constantly sent complaints and petitions to the municipal administration, denouncing the persistence of odours, wastewater, mosquitoes and insalubrity resulting from the presence of the Wadi (Figure 4). To end these complaints, satisfy the inhabitants, and ensure public health, the authorities opted for a solution that categorically removes the Wadi from the urban landscape by transforming it into an underground canal. This operation reflects the government's interest in environmental protection, urban regeneration and sustainable development.



Figure 4. Aerial view in 2011 showing the state of section 3 before the WCP.(Source: Authors 2022)

The WCP belongs to the field of civil engineering, it considered one of the most emblematic operations in the region, extends over 3.5 km in the form of a reinforced concrete tunnel, made in four sections (Figure 3), its construction was launched in 2011 under the supervision of the Hydraulic office. After its completion in 2016, the urban development project above the cover slab was entrusted to another department specialized in urban planning, whose mission was to design and monitor the development program consisting mainly of new public spaces, such as street, crosswalk, parking, playground, square and green area.

APPROACH AND METHOD

In order to study the impact of environmental rehabilitation on placemaking, the research method followed was divided into two main stages. The first includes spatial analysis, where graphic documents (maps, plans, photos) related to the project were obtained and then followed by on-site observations to determine the current situation of the public spaces. To understand the WCP effect on the spatial configuration, the Space Syntax method via its digital tools applications was used, in which, the urban grid of the study area (pre- and post-WCP) was drawn in AutoCAD and then exported as a DXF file, where it was converted into an axial map and analyzed using Depthmap software. The important objective of this step is to establish a comparative analysis to determine the resulting differences, which only those places that have undergone major and more significant transformations are presented in this study.

The second stage aims to evaluate the success of placemaking after five years of use. For this purpose, the study adopts the POE approach, which focuses on evaluating the performance of the new public spaces through the satisfaction or dissatisfaction of the inhabitants. Respondents were asked to express their opinion according to the five-point Likert scale, based on a rating from 1, "very dissatisfied" to 5, "very satisfied". The survey criteria were chosen according to their relation to the spatial analysis, in total twelve indicators were selected and organized according to the categories used by the PPS(Figure 2), which has devised four qualities common to all successful public spaces. The questions were formulated according to these indicators (Table 1). Then the questionnaire was distributed on-site during weekends, where the target population is estimated to be 100 families, randomly selected among the houses located along the Wadi. After collecting responses, the statistical software "Sphinx IQ 2" processed and analyzed the data.

Catégories	Indicators	Questions			
Comfort & image	Safety	Do the current public spaces make you feel safe and secure?			
	Cleanliness	Has the architectural character and urban landscape become more beautiful and cleaner with the new public spaces?			
	Comfort	Has the physical design of the new public spaces promoted a sense of comfort and relaxation?			
Access & linkage	Walkability	Do the new public spaces promote movement and walking?			
	Visibility	Is the visibility of your neighbourhood increased with the new public spaces?			
	Accessibility	Has accessibility become easy and fluid with the new public spaces?			
Uses & activities	Mixity	Have the new public spaces allowed for the emergence of commercial and se spaces?			
	Space occupation	Are the current uses of the new public spaces adequate and appropriate?			
	Diversity	Have the new public spaces brought more diversity to your neighbourhood?			
Sociability	Conviviality	Have the new public spaces made your neighbourhood more convivial?			
	Interaction	Have the new public spaces promote interaction and friendship between different social groups?			
	Cooperation	Have the new public spaces promoted a spirit of consultation and cooperation between inhabitants?			

Table 1. Classification of public spaces attributes and questions formulation

(Source: Authors, 2022)

RESULTS AND DISCUSSION

Results of the Spatial Analysis

The spatial analysis of landscape features based on a visual comparison through the overlay of maps and images of the pre- and post-WCP showed the consequences of environmental rehabilitation on creating places. This operation not only removed pollution but also affected the elements of urban form, which will be classified and illustrated as follows:

Street network

In the past, inhabitants had to cross a few bridges to get from one side of the river to the other, making the area less integrated into the city. However, the newly constructed streets and pedestrian crossings have helped to integrate the study area well into the city and improve urban transportation. These facts were confirmed by analyzing the axial map using Depthmap with a radius of (R800m), where the Figure 5 and Table 2 were produced as the result of the connectivity and integration measures. According to (Hillier and Hanson, 1984), the axial map connectivity corresponds to the number of lines crossed by each axial line, where the new street illustrated in (Figure 5a) has enhanced the degree of connectivity by 7.79%. This result shows how that the new street allowed achieving continuity of street grid. Also, this means that it has the highest number of users among other streets.

	Connectivty			Integration			
	Min	Average	Max	Min	Average	Max	
Befor the WCP	0	2.87293	18	0.210897	0.759227	1.17791	
Current situation	0	3.09677	17	0.210897	0.909808	1.49174	
The Difference	0	0.22384	1	0	1.669035	0.31383	

Table 2. Axial m	ap indicators	of connectivity	and integration.
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(Source: Authors, 2022)

Regarding the integration map, it is considered as a measure corresponding to accessibility, where the more accessible axes will be treated as more integrated and vice versa. The Figure 5b shows that the new street created above the Wadi represented by the red line has the highest integration value, which clearly show that this axis was the most integrated destination, and referring to Table 2, it contains the maximum value that equals to 1.49174. This fact explain how this street becomes more accessible and attractive to "through-movement" of pedestrian and open new choices to navigate the internal structure of the site, thus the number of motor vehicles passing this street is considerably high.



Figure 5. Axial analysis maps: before (left) and after (right) the WCP.(Source: Authors 2022).

Land Use

Previously, the Wadi area was devoid of utility, making it more attractive to attackers and less frequented by people. In contrast, the WCP engendered a higher degree of street connectivity (Figure 5a) which is consistently associated with the higher quantity of walking activities according to studies conducted by (Al-Sayed,2014;Koohsari et al., 2019). Also, Figure 6 show the new public spaces program (street, crosswalk, playground, recreation area, green space and parking) has encouraged people to come and sit and move around. Through this development, great importance has been given to street frontages, allowing inhabitants to transform the ground floors of their houses into commercial spaces.

Architectural Quality

Before the WCP, the neighbourhood had suffered from poor hygiene unpleasant and odours, which prevented the inhabitants from opening the windows and doors of their houses towards it. This situation generated completely blind and unpleasant urban facades. In contrast, the neighbourhood's visibility increased after the WCP, specifically through the new street. Its image appeared from several points, which enhanced the architectural aspect of the surrounding public buildings and encouraged the inhabitants to improve and decorate their houses (Figure 7).



Figure 6. Public space of section 1 before (above) and after (low) the WCP.(Source: authors 2021)



Figure 7. Before (left) and after (right) the WCP, highlighting the aesthetic aspect of the public buildings and the architectural quality of the houses.(Source: Authors based on the observation survey,2022).

Social Relations

In the past, the dirt and stinking water of the Wadi area were the main reasons people, regardless of gender and age, did not want to use the outdoor environment. However, with the installation of urban furniture (pavements, street lighting, benches, flowerpots, dustbins), the public space has become more attractive, offering many activities that strengthen the bonds between inhabitants. This agrees with (Gehl, 1987) who suggests that when urban spaces are efficient, they increase walkability and thus social interaction. Also, the new street created above the wadi indicated by a red line (Figure 5b) has a strong integration value, which makes it more walkable. In addition, commercial activities, shops and services implanted on the edge of it give more chances of meeting and interaction between people, from where, inhabitants have shown their willingness and ability to volunteer to keep their environment clean, thus strengthening the sense of belonging and attachment.

Assessment of the Level of Satisfaction According to the PPS Categories

After analyzing the collected answers, the survey results indicate that in the item Comfort & Image, the respondents showed a strong trend of satisfaction regarding the criteria of Safety, Cleanliness & Comfort, which are well perceived by the population (Table 3). When the VS is higher than 70%, this supports that the PCW has made the neighbourhood cleaner, thus influencing the inhabitants' comfort and well-being. In second place comes the Safety criterion with a satisfaction rate (VS = 77%), also showing a positive correlation with the criteria of Cleanliness (0.578, p < 0.001) and Walkability (0.632, p < 0.001).



Figure 8. Distributions of satisfaction values by PPS categories. (Source: Authorsbased on the POE survey, 2022)

Regarding the comfort variable, inhabitants declared their dissatisfaction (VD = 8.66%) with the aesthetic aspect of the urban façades built on the street side. This result can be explained because, after the WCP, most inhabitants modified their façades by opening garages and windows uncontrollably. However, due to their poverty, others kept the same façade, which led to an uneven embellishment of the urban façade. This observation indicates that the architectural quality of the neighbourhood was not considered from the beginning by the project managers. It is left to the choice of the owners. Furthermore, this observation reveals that placemaking should be considered at the plan and elevation levels in this type of urban intervention.

In the Access & Linkages category, the inhabitants' well-perceived criteria of such as Walkability, Visibility, & Accessibility, where their VS percentage exceeds 70% (Table 3). This level explains that the new public spaces (streets) have reduced displacement and increased cohesion between different parts of the city, this confirms the results obtained by the syntactic analysis, which highlighted the major contribution of the new street in increasing the values of the connectivity and integration measures (Fig.5). Furthermore, the result shows a positive correlation between the criteria of Visibility & Accessibility (0.748, p<0.001). Thus, the criterion of Accessibility became very smooth and easy, giving access to different modes of transport. On the contrary, the percentage (VD=4.66%) represents a low degree that can be explained by the inhabitants' dissatisfaction with the noise generated by motorized traffic.

As for the variables of the category Uses & Activities, the respondents are very satisfied with the criteria of Mixity & Diversity, where their VS percentage is respectively equal to 38% and 40% (Table 3). This explains that the new streets have offered the opportunity to the inhabitants to open commercial spaces in their houses, such as shops, cafeterias and services. But, the percentage (VD=40%) reflects that the respondents are dissatisfied with the occupation of some

spaces, which means they hope some vacant spaces will be well-developed. Furthermore, the study shows that the criterion of Mixity has a strong positive correlation with space occupation (0.863, p < 0.001) and diversity (0.798, p < 0.001).

Catégories	Indicators	VD	D	S	VS	Mean	Std
ort ge	Safety	5%	5%	24%	66%	3,51	0,81
mfc	Cleanliness	1%	4%	25%	70%	3,64	0,61
Co) & i	Comfort	20%	13%	16%	51%	2,89	1,16
ଷ ଜୁ	Walkability	5%	4%	14%	77%	3,63	0,79
cess	Visibility	5%	6%	15%	74%	3,58	0,82
Ace	Accessibility	4%	6%	16%	74%	3,60	0,78
es	Mixity	32%	14%	16%	38%	2,60	1,29
es {	Space occupation	40%	11%	17%	32%	2,41	1,30
Us acti	Diversity	34%	21%	5%	40%	2,57	1,32
lity	Conviviality	40%	15%	8%	37%	2,42	1,34
ciabi	Interaction	30%	22%	10%	38%	2,56	1,27
So	Cooperation	68%	21%	6%	5%	1,48	0,82
VD: very dissatisfied; D: dissatisfied; S: satisfied; VS: very satisfied							

Table 3. Analysis on satisfaction level after the wcp, according to the categories of pps's criteria.

(Source: Authors, 2022)

In the category of Sociability, the highest level of satisfaction was attributed to the criteria of Interaction (VS=38%) and Conviviality (VS=37%). This result explains that the new public spaces encourage neighbours to meet outside and children to play together, contributing to creating friendships. This is consistent with the value of the complementarity scale shown in Figure 5b, which provides an indication of co-presence that enhances social interactions. In addition, the Mixity variable shows a strong correlation with the criteria of Interaction (0.834, p<0.001) and Conviviality (0.800, p<0.001), but the criterion of Cooperation shows the lowest level of satisfaction (VD=5%), which explains that the PCW was carried out without consulting and involving the inhabitants in the decision-making process.

To assess whether the placemaking was a success, the Figure 8 shows the degree of satisfaction related to the four categories of PPS, where the category Access & Linkages occupies the first place with the highest score (VS=75%). The second position is occupied by the Comfort & Image (VS= 62.34%), followed by the Uses & Activities category (VS=36.67%), and in the last position is the Sociability category with the lowest satisfaction level (VS=26.67%). This result indicates that placemaking through introducing a new path promotes the criterion of Walkability. Furthermore, it offers many opportunities for the emergence of commercial activities, thus increasing the attributes of public space such as diversity, Mixity, Conviviality and social Interaction. Finally, the survey results underline the importance of POE approach to reveal the strengths and weaknesses of public spaces to enhance their performance in future urban projects.

CONCLUSION

Environmental rehabilitation is an ideal tool to regenerate cities, improve life quality and beautify the urban landscape. It is a real driving force for the sustainable development of cities. From this perspective, the paper highlighted the importance of environmental rehabilitation on the feeling of well-being and its interests in place making. Furthermore, the significant contribution of this research is the evaluation of the performance of public spaces using the success criteria cited by the PPS and examined simultaneously by both approaches POE and Spatial Syntax, the latter through the axial map analysis proving to be a great importance in the quantitative analysis of the Access & Linkages category.

Wadi area belongs to the city's open space system, which should be well used and managed. The study has demonstrated the ability to move from environmental concerns such as pollution control to creating successful public spaces. It highlights the need for coordination between the environmental sector and urban planning. Moreover, a successful

place is not only determined by its spatial qualities but also by its architectural quality. In this context, placemaking primarily improves the quality of life by introducing new activities, beautifying the landscape, ensuring connectivity and social interaction. Still, it also affects the architectural aspect of the surrounding buildings, which indicates that the latter dimension should be considered early in the placemaking process.

Public spaces and especially streets are important for mobility, spatial cohesion and social interaction. In this sense, the study argues that the Access & Linkages is the main category of the PPS that should be considered first for designing successful public spaces. It motivates the other categories, such as Comfort & Image, Uses & Activities, and Sociability. This finding confirms that placemaking by introducing a new street promotes Walkability, offers many opportunities to emerge commercial activities and consequently, social interaction flourishes. Also, the results show that the inhabitants' opinion is the key indicator of successful placemaking, where decision-makers, architects and planners should consider the need for community participation from the beginning of any urban project. Finally, this study can be seen as a methodological approach to developing and revitalizing cities that suffer from the presence of dry rivers.

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