

Preservation of Kandovan, Based on Pathology of Population Decline

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ABSTRACT: The following study aims to present a consistent framework for the sustainable development of the troglodyte village of Kandovan, taking into consideration the present situation of the village and the paramount importance of preserving its unique way of life with the ultimate goal of making efficient improvements on the living conditions of its inhabitants. Located in north-western Iran, this tourist location, which is the sole troglodyte village in the world still occupied by human dwellers, is carved entirely out of a chain of cliffs. This stone-age lifestyle in the midst of our modern times has bestowed incomparable charms to Kandovan, turning it into a major source of wonderment and fascination. Regrettably, however, the emigration of its inhabitants has placed the village and what it stands for under serious threat. This research will attempt to identify and analyze the reasons for the diminishing of the local population, and goes some way to providing practical solutions to tackle this problem, utilizing an effective application of the principles of sustainable development on both environmental and architectural aspects.

Keywords: *Kandovan village, Human life, Sustainable development, Tourism, Revival.*

INTRODUCTION

This is a research paper on the wonders of Kandovan, a troglodyte village situated 60 km south of the provincial capital Tabriz in Osku county, East Azerbaijan province. Few of the numerous papers and conferences on Kandovan village have focused on the key factors distinguishing it from the other similar structures in the world – such as the rock houses in Cappadocia, Turkey and the cliff dwellings in Mesa Verde, Colorado, USA – all of which are long deserted. The purpose of this research paper is to discover the main elements of the village's unequalled attraction as well as to seek practicable ways of discouraging the emigration of its inhabitants. Haunted by the prospect of this last remaining inhabited troglodyte village turning into a ghost town, the writers of this paper have set out to explore the baleful consequences of the prevalent emigration on the economy of the village, with an eye to seeking out economic and cultural incentives for the local inhabitants to remain. Ultimately, our goal will be to facilitate the steady progress of the quality of life in the village while preserving its unrivalled architectural integrity. Over 850 years old (Sabri, 2008, 51), the village of Kandovan showcases houses and barns carved entirely inside pyramidal cliffs. The architectural methods used are the most practical ways of utilizing the dome-shaped cliffs to make inhabitable places. The village is situated in the Sahand mountains, whose lush pastures hold great appeal for many nomadic tribes in search of food for their livestock. According to renowned archeologists David Roll and Peter Martini, Kandovan dates back to ancient times. They even go so far as to claim it as

the Garden of Eden, where Adam and Eve lived (Moghimi Oskoei & Mosazade, 2007, 221). Whilst the veracity of such claims has yet to be proven scientifically, the prehistoric roots of this unique location on earth is undeniable. Throughout ages, the extraordinary forms of nature in Kandovan have lured humans, particularly those in desperate need of a safe haven during turbulent times (Najafi, 2005, 15). Kandovan's geographical proximity to the main summit of the Sahand mountain chain has proven an advantage. The Sahand boasts 17 peaks over 3000 meters in altitude, with hundreds of rivers and streams originating from it, which provide farming irrigation for the nearby villagers. Also, the Sahand and its abundant natural beauties are a major tourist attraction, making mountain climbing and winter sports potential development sources for Kandovan (Akrami, 2008, 64). The running waters of the volcanic Sahand mountains have eroded considerable segments between the cliffs, generating separate pyramidal protrusions (called "kran"s by the locals) which have been turned into dwellings. These dwellings are often connected to one another with wooden bridges arching over the furrows created by the natural course of ancient streams (Fig. 1). Abundance of agricultural land, food for the livestock and water from the Kandovan River are among the main reasons why this village has remained functional and inhabited through the years (Akbari & Bemanian, 2009, 131). The intimate, intrinsic relation between man, nature and architecture is clearly visible in this village. It is often said that architecture is the art of creating space in nature, but here humans, instead of constructing space in nature, have managed to extract it from the very heart of nature (Rezaei, 2003, 68).

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Kandovan's Mineral Water

A mineral water spring located in the center of the village produces 0.5 liters of water per second (Baker & Smith, 2001, 140). Classified as a cold sulfuric calcite spring, it can dissolve phosphoric rocks; hence, the perfect natural remedy for kidney stones. Specifically, research shows that the water from this spring is effective against certain kinds of kidney stones (Table 1), turning it into a mecca for thousands of kidney stone patients annually.

Current Condition of Kandovan

The new developments are concentrated in the south, near the village entrance (Azimi & Jamshidian, 2006). The

main reasons for digression from the traditional architecture are moisture within the cave dwellings and insufficient income to adequately furnish and equip them (Haji Ebrahimi Zargar, 1995, 51). Such inhomogeneous development is an eyesore, severely affecting the traditional texture of the village (Fig. 2). In traditional houses, first floors, which are spacious with low light, are usually used as barns, where the heat emanating from the body of animals is put to good use. Second floors and above are allocated to human residence (Fig. 3).

Entrances to these residential units are through open-air steep alleyways with stairways extremely difficult to climb (Fig. 4).

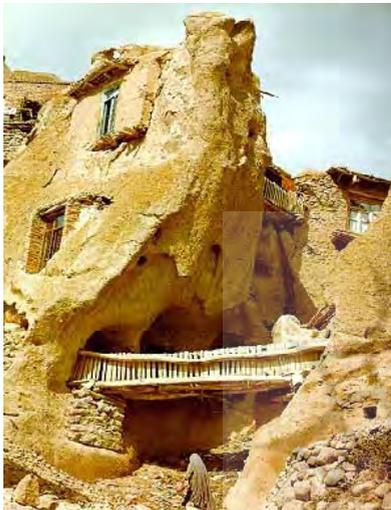


Fig. 1: A bridge connecting dwellings



Fig. 2: A general view of the village

Table 1: Kandovan's water properties from physical and chemical analysis (Source: Arefi Oskooi, 1999, 15)

Sampling date	1993	Full dry residue (at 180° C)	63 mg/l
Source	Spring water	Free CO ₂	15 mg/l
Color	Clear	Na ⁺	9 mg/l
Odor	None	K ⁺	3 mg/l
Taste	Slightly pungent	Ca ⁺	11 mg/l
View	Clear	Mg ⁻	9 mg/l
Temperature	20 ° C	NO ₃ ⁻	Negative
Specific conductance	115	Alkaline HCO ₃ ⁻	12 mg/l
pH	6.6	SO ₄ ⁻	54 mg/l
Full heaviness (by CaCO ₃)	64 mg/l	Cl ⁻	4.5 mg/l
Permanent heaviness (by CaCO ₃)	54 mg/l	NH ₄ ⁺	Negative
Full alkalinity (by CaCO ₃)	70 mg/l	NO ₂ ⁺	Negative
Permanent alkalinity (by CaCO ₃)	61 mg/l	SiO ₃	1 mg/l



Fig. 3: Cross-section (left part) and plan (right part) for the ground floor of a residential unit



Fig. 4: Long stairways with tall stairs in entrances

Kandovan and Eco-Tourism

Construction of the four-star Laleh Hotel in the heart of Kandovan has undoubtedly proven a major boost to the economy of the region (Bahraini, 1992,120). Masterfully carved out of the cliffs and incorporating several existing cave dwellings, the first phase in the construction of the hotel has been completed, with plans for further expansion in motion. Upwards of 300,000 tourists (one-third of whom were international visitors) visited Kandovan in 2009 justifying the one-million-dollar investment (Hamidpour, 2010,43) made for the completion of the first phase of the hotel's construction. Developments like this hotel as well as shopping centers will create employment for the locals and at the same time prevent and even reverse emigration from the village (Roberts & Hall, 2001,54). The general census held approximately every 10 years indicates a slight increase in the period between 1969 and 1987 but a small decrease in Kandovan's population in the following decade (Ahmadnia, 2006). Investment in the eco-tourism industry of the region is bound to generate jobs, with a large proportion of the income going to the locals as the most competent work force readily available. Naturally, care must be given to ensuring tourist developments of any kind will not disrupt the natural heritage of the area (Akbari & Bemanian, 2009,136).

Sustainable Development; a Definition

Sustainable development, appearing for the first time in an IUCN² report in 1980, is in effect creating a balance between development and the environment. In this report entitled Preservation of Natural Resources, sustainable

development was defined as a developmental strategy which is not only harmless but even beneficial to the environment. Sustainable development does not focus solely on environmental issues but takes into consideration economic, cultural, and political factors as well. In short, sustainable development is where society, economy and environment meet (McInerney Lankford & Lavanya Rajamani, 2011, 51). In the World Summit on Sustainable Development (WSSD) convened by the United Nations in 2002, the following was agreed upon:

- a) Reduction of the global population without access to self-sustained water by half by 2015,
- b) Minimizing use of chemicals harmful to humans and the environment by 2010,
- c) Reduction of the depletion rate of oceanic resources by half by 2015,
- d) Minimizing the rate of biodiversity disappearance by 2010,
- e) Increasing the use of renewable energy resources,
- f) And taking the first steps toward a working proposal on global sustainable development issues for the next 10 years.

In the words of Wolfgang Sachs³: "From now on development without sustainability and sustainability without development will be meaningless" revealing a profound bond between the two. This new way of thinking demands the type of development with best possible regard for the environment and proper use of natural resources (Bruckmeier & Tovey, 2009, 71). It is our inalienable right to prosper, but we must safeguard the many riches of the earth for future generations, never losing sight of the future of our planet. Each and every country has to be involved in

this endeavor and take responsibility for their actions accordingly (McInerney Lankford, & Lavanya Rajamani, 2011).

MATERIALS AND METHODS

This research has been carried out using descriptive and analytical applied methods, combining field study with desk research. Especially-designed questionnaires were used to interview the village inhabitants. The reports based on the interviewing were subsequently combined with the statistics and data available from relevant organizations in order to complete the analysis. In this study, the population, housing, infrastructure and architectural methods of Kandovan will be analyzed.

Population Demography

The permanent population of the village, based on the last census in 1997 has been put at 629 people in 137 households, which shows a marked decrease of approximately 22% compared to 765 people in 152 households in 1987, mainly due to emigration of the residents. Based on the interviews with the residents as well as members of the town council (Ahmadnia, 1997), the main reasons for this immigration are lack of employment and facilities in the village (Table 2).

Land Allocation

The village covers a total area of 122,040.09 sq. m, over 35% of which consists of residential and public amenities (Table 3).

Table 2: Population change in Kandovan (Source: Ahmadnia, 2006)

Polling year	Population	No. of households	Rate of change
1967	774	157	-
1977	661	134	-1.56
1987	765	152	1.47
1997	629	137	-1.93

Table 3: Current land allocation in Kandovan (Source: Ahmadnia, 2006)

Allocation	Of total (%)	Per capita	Area (sq. m)
Residential	13.4	25.52	16372.27
Educational	0.78	1.5	962.65
Medical/health	0.35	0.68	437.95
Cave dwellings	15.50	29.5	18920.05
Commercial	2.57	4.9	3144.80
Religious	0.31	0.59	382.82
Public services	0.31	0.60	387.93
Public roads	21.66	41.25	26445.06
Barren/vacant	1.37	2.61	1676.33
Agricultural	4.33	8.25	8290.71
Waterways	4.42	8.42	5400.76
Touristic/ Parks	17.75	33.79	21665.06
Storage/barns	2.41	4.59	2944.43
Vacant hills	14.44	27.5	17630.03
Total	100	190.39	122040.90

Communication Network

The rather randomly-created public road network in the village remains organic with no distinguishable pattern. The sole exception is the main street, the backbone of the village, to which all the smaller streets lead. This street begins at the village's south-easternmost and traverses the southern side before bending and continuing northward. In general, most of the streets and alleyways run either north-south or east-west, with the former used more frequently (Ghobadian, 2003, 114). In general, southern streets are accessible to cars, whereas the northern alleyways, which generally lead to the houses, are for pedestrian use only.

The Cliff Architecture of the Village

The most prominent feature of the structures carved inside the cliffs is the forced adaptation of the built areas with the natural forms of the rocks ("qaya"s in the vernacular) serving as the main construction material for the houses ("kran"s in the vernacular). In the Sassanid period (Sabri, 2008, 70), the insides of the pyramidal cliffs were chiseled out in order to yield cavities. These cavities were then enlarged sufficiently depending on the intended use of the location, i.e. residential or public. When encountered with huge boulders in the process, the builders would either have them removed if possible, or work around them. The coned shape of the cliffs have limited the scope of carving feasible, in effect forcing the builders to construct partitions, additional platforms or ledges inside and outside, invariably aiming to create as much space as possible. Moreover, left-over rocks from previous carvings are mixed with mud to make new construction materials for building staircases and extra partitioning walls (Akbari & Bemanian, 2009, 145). In constructing cliff houses, other parameters such as security and form have been taken into account. Through the decades, the softer parts of the walls have been eroded by strong winds and abundant precipitation in the area, leaving intact only the hard volcanic tuff, a natural insulator (Homayoon, 1977). As a result, indoor temperatures remain moderate all year long. In addition, the pyramidal shape of the cliffs helps break high winds; hence, care has been given to ensure all doors and windows face downwind so as to prevent snow and rain from penetrating indoors (Moghimi Oskoei & Mosazade, 2007, 230). In stark contrast to other villages in the area, the pyramidal shape and small size of the cliffs have encouraged a vertical development of the dwellings, with a least two floors constructed in each house in most cases. The cliffs are the result of the ancient volcanic activities of the Sahand mountains, in the final stages of which dome shaped cliffs were created. Overtime, as the lava cooled off, the trapped gases inside these structures diffused and escaped, creating small caverns and holes inside the cliffs. Such holes play an important role in natural ventilation and lighting of the dwellings today (Akbari & Bemanian, 2009, 137).

RESULTS AND DISCUSSION

Analysis of Population Data

Current Status

Emigration from Kandovan tends to be limited to the departure of young and able-bodied, while whole-family migration trends are observed elsewhere. According to the

national census of 1997, an alarming 72.2% of the families in the village have members living in other cities. Most young natives of the village choose to reside in the nearby city of Oksu or the provincial capital Tabriz. This can be primarily attributed to a lack of employment opportunities, particularly in the cold, long months of winter, as well as a lack of public amenities in the village (Ahmadnia, 1997).

Past and Future Trends

The population growth rate has steadily declined from 1.56% in the period between 1967-1977 to 11.47% between 1977-1987, plummeting to an all-time low of -1.93% between 1987-1997. The medical records at the local Red Crescent clinic indicate a still negative growth rate as scant as -0.42% for the decade following the 1997 official census. Emigration from the village is the main reason for the population growth rate to come an approximate halt. Projection of the available data places the population of Kandovan at 742 for the next ten years.

The Limiting Factors of Physical Growth

Topography and the surrounding land usage are the two major factors affecting the physical growth of any village. Kandovan is surrounded by mountains to the north, by agricultural fields to the north-east and north-west, and by a valley to the south. This has severely blocked the growth of the village in almost any direction; nevertheless, there is potential for growth in the north as well as the Kandovan River basin.

Analysis of Problems with Public Amenities

Uncontrolled construction in the past has led to numerous problems in the implementation of public services today, including the following:

The haphazard road infrastructure in the village has led to the creation of streets and alleyway too long and narrow to be effective. All major public amenities such as the village clinic, commercial centers, and the telecommunication center are concentrated in one location, the entrance to the village, depriving the majority of the inhabitants from easy access. Furthermore, no domestic natural gas is available. In absence of a proper sewage system, households resort to digging shallow wells to deposit toilet sewage in and disposing of their waste water in the village streets and alleyways. A major factor in spreading epidemics, such as unsanitary practices have resulted in the contamination of underground water supplies.

Guidelines for Improvement

Since factors such as natural elements, socio-economic characteristics and historical events have all affected the physical evolution of the village, it stands to reason that the optimum designs for the development of the village should be an effective amalgamation of those elements with modern scientific methods. By default, such a design should:

- Prioritize the economic gain of the majority;
- Favor design elements in congruence with the vernacular architecture;
- Avoid the destruction of the agricultural land as far as possible;
- Fortify the village architectural structure generally, and the traditional segments specifically;

Comply with the technical regulations necessary for construction of a new transportation infrastructure inside and around the village;

Encourage use of raw materials with high heat-retention capacity;

Consider an inclination of 5 to 30 degrees toward the east in order to maximize total sunshine received inside houses;

And use local raw materials both in the construction of new houses and restoration of old ones.

A Sustainable Development Plan

Considering the aforementioned general guidelines, our suggestion for the sustainable development of Kandovan is presented here in the following four categories (Table 4).

Land Allocation

In conjunction with the projected increase in the total population of the village from 706 in 2006 to 742 in 2016 (based on the 2006 figures from the Red Crescent clinic in

Osku), it is proposed an 5.72% increase⁴ in the total area of the village, yielding 129,020.9 sq. km or 173.88 sq. m. per capita.

This increase of 9,223 sq. m in which vacant and idle lots within the village have been incorporated, is crucial in revitalizing the public infrastructure of the village. The land allocation will be as follows.

Residential Use

In the light of the aforementioned projections of population increase and in order to maintain the existing residential per capita area of 25.54 sq. m., we recommend an addition of 900 sq. m. to the village's residential area, bringing the total from the existing 16372.27 sq. m. to 17272.2 sq. m

Educational Use

Currently, there is one elementary and one secondary school in the village, covering 964 sq. m (0.78% of the total area), which will be sufficient for the next decade given

Table 4: Land allocation in Kandovan: current and suggested

Allocation	Current Area(Ahmadnia,2006)			Suggested Area			
	% (of total)	Per capita (sq. m)	Total (sq. m)	Addition (sq. m)	% (of total)	Per capita (sq. m)	Total (sq. m)
Residential	13.41	25.52	16372.27	900	14.24	25.47	17272.2
Educational	Kindergarten	-	-	500	0.38	0.68	500
	Elementary	0.13	0.25	165.24	-	0.12	165.24
	Junior High	0.65	1.24	797.41	-	0.60	797.41
Medical/health (House of Hygiene)	0.35	0.68	436.95	-	0.33	0.59	436.95
Cave dwellings	15.50	29.5	18920.05	-	14.43	25.81	18920.05
Commercial	2.57	4.9	3144.80	1200	3.31	5.92	4344.8
Religious	0.31	0.59	382.82	-	0.29	0.52	382.82
Cultural	-	-	-	180	0.13	0.24	180
Public services	0.31	0.60	387.93	-	0.29	0.52	387.93
Public roads	21.66	41.25	26445.06	1600	21.39	38.26	28045.06
Barren/vacant	1.37	2.61	1676.33	-	-	-	-
Agricultural	4.33	8.25	8290.71	-	4.03	7.21	5290.71
Athletic	-	-	-	2000	1.52	2.72	2000
Waterways	4.42	8.42	5400.76	-	4.12	7.36	5400.76
Touristic/ Parks	17.75	33.79	21665.06	4000	19.58	3.63	25665.06
Storage/barns	2.41	4.59	2944.43	-	1.56	2.78	2044.43
Vacant hills	14.44	27.5	17630.03	-	13.45	24.05	17630.03
Total	100	190.39	122040.90	6980	100	179.08	129020.9

the negative rate of population growth. However, there is a need for a kindergarten of about 500 sq. m in order to provide schooling for over 100 children under 7 years of age (Table 5). The north-western corner, being the most accessible location, is strongly recommended for the purpose (Fig. 5).

Commercial Use

The total commercially-used land covers an area of 3,145 sq. m (2.57% of total) at the moment, spread throughout the village (Table 3). Based on accessibility and the residents' preferences (Field study database), an increase of 4,344 sq. m to 5.92 sq. m per capita along the main road is recommended (Fig. 5).

Administrative Use

The village council and other official services would require an area of 200 sq. m in total, the ideal location for which being the northern corner of the village in close proximity to the Red Cross clinic.

Athletic Use

A 2000-square-meter piece of land (2.72 sq. m per capita) needs to be dedicated to the construction of a sport centre in the north of the village, where a relatively flat lot near the main road can provide easy public access (Fig. 5).

Sanitary/ Medical Use

The simple multipurpose Red Cross clinic known as "The House of Hygiene" shall suffice providing various health

and medical services to a village of this size. Similarly, the convenient public bath house will be adequate and there will be no need for enlarging or relocating it.

Cultural Use

To provide a variety of cultural activities for the local residents, an area of 180 sq. m should be dedicated to facilities such as library, exhibition, and handicraft center.

Infrastructural Modifications

Collection of Surface Waters

Currently, there doesn't exist a system to collect rain/snow waters and wastewater, which following the inherent slope in the village create an unsanitary flow in the dirt alleyways of the village and eventually pour into the Kandovan River. By constructing proper water ways on both sides of the streets and alleyways (with a minimum width of 40 cm on each side), this grave situation can be dealt with effectively.

Electricity

Considering the negative rate of population growth, no new electric power generation installations will be required for the next decade.

Water Supply

With the projected population of 742 in the next decade in mind, water supplies are sufficient, obviating the need to make any modifications on the water distribution system.

Table 5: The population of Kandovan by age group/ gender (Source: Ahmadnia, 2006)

Age Group	Male			Female			Total			% (of total)		
	'03	'04	'05	'03	'04	'05	'03	'04	'05	'03	'04	'05
0-4	24	20	22	30	30	37	63	54	50	9.82	9.2	9.6
5-9	28	29	30	28	27	31	61	56	56	9.51	9.5	9.5
10-14	31	32	33	40	41	42	71	73	75	11.7	12.4	14.4
15-19	44	39	37	48	45	44	92	84	71	14.35	14.3	13.6
20-24	43	34	33	30	28	27	73	62	60	11.38	10.5	11.5
25-29	38	33	30	25	22	21	55	51	63	9.82	9.3	9.8
30-34	19	18	17	16	14	15	35	32	32	5.46	5.4	6.1
35-39	9	6	6	7	7	6	16	13	12	2.49	2.7	2.3
40-44	7	7	6	16	16	15	23	23	21	3.58	2.2	2.3
45-49	13	13	12	9	8	8	22	21	20	3.43	3.9	4.1
50-54	11	10	9	21	21	21	32	31	30	4.99	3.5	3.8
55-59	7	6	6	18	17	17	25	23	23	3.9	5.2	5.7
60-64	13	12	11	9	9	9	22	17	20	3.43	3.9	4.4
65 and over	29	28	28	14	13	13	43	42	41	6.7	7.1	7.8
Total	320	287	226	321	229	295	641	586	521	100	100	100



Fig. 5: Land allocation in Kandovan: current and suggested⁵

Sewage System

In lack of a proper sewage network, the sewage is collected in shallow wells especially dug for the purpose for each house. Clearly, equipping these wells with septic tanks should essentially be coupled with constant monitoring by the relevant authorities to prevent environmental or sanitary disasters.

Road Network

To improve the transport infrastructure in the village, it is indispensable to widen the main road (and the only entry to) in the village as well as the alleyways between the cliff dwellings. This will ensure safe and efficient passage for the inhabitants as well as the tourists.

Residential Modifications

Though diverse in form and design, Iranian villages share common factors in architecture which should be applied to Kandovan as well. The following suggestions are based on three main criteria: natural beauty//aesthetics, general improvement and touristic issues. Traditionally, villages make use of locally available materials. In Kandovan, stone and wood have been utilized as raw materials. While old dwellings have been carved inside cliffs, new houses use stone as the primary building material, with wood used in doors, windows and occasionally roofs. It should also be borne in mind that most houses are built by family members with minimum assistance from outsiders (Gaffari, 2003). Unlike city houses, design for village houses should be kept simple with minimum need for future repairs and, even then, completely achievable by villagers themselves (due to the low economic status of most villagers) (Wates,1996). It is

essential that village houses should remain affordable. By using inexpensive materials and labor locally available, construction costs can be minimized. Additionally, the local climate should invariably be kept in mind. In the case of Kandovan, freezing temperatures and long winters with heavy snowfall mark the climatic conditions, making wood – an excellent insulator of heat - the ideal material for doors and windows. Furthermore, doors should be refrained from the north-eastern side, where colder winter winds blow. In the same way, all architectural designs must pay heed to the socio-economic condition of the residents. Design must therefore consider that village houses are more often than not both living and working quarters at the same time and, in turn, allow ample room for animal husbandry, carpet weaving, farming products and tools as well as cleaning areas for tools and clothes. Most importantly, as a general rule, all suggested designs must be completely compatible with the traditional architecture of the village. In Kandovan, for instance, the newly built houses should be built as high as the cliff dwellings and only in direct continuation of their physical location so as to keep the historical character of the village intact.

CONCLUSION

This paper emphasizes the importance of preserving and safeguarding the traditional architecture of the village using sustainable development so as to improve the living conditions of the residents. The proposed changes should be applied gradually and continuously in order to ensure a practical and stable transition without the risk of cultural and habitual clashes due to resistance to change. It should never be forgotten that human resources take far greater

precedence in any development than heavy financial investments. That is why recruiting local residents and utilizing their knowledge and experience is the only sure way to preserve the uniqueness of the village and at the same time converting it into an economically viable tourist resort. The stated recommendations not only resuscitate the social and economic life of the village but also boost its tourism industry, producing new employment opportunities for the inhabitants.

The guidelines for improving the village conditions can be categorized as follows:

General Considerations

Designs should be multipurpose.

Necessary improvements must be prioritized according to urgency.

Easy access to every section of the village for all inhabitants must be ensured.

Local residents must be allowed to participate in making all decisions regarding the village.

New buildings must conform with the prevalent traditional form of the village.

The interior space in the cliff dwellings needs to be increased.

The security of public streets and alleyways as well as public amenities has to be facilitated.

Aesthetic Considerations

Ground floors of the cliff dwellings need to be rendered attractive.

Repairs must be implemented with due consideration of the vernacular architecture.

All new construction as well as the skyline should be kept strictly controlled.

Historical locations must be restored and preserved.

Environmental Considerations

Pedestrian paths and interior spaces must be provided with natural sunlight.

The dampness inside the houses should be curtailed.

Traditional, native models must be incorporated in designs.

Safe and effective waste disposal must be implemented.

ENDNOTES

1- According to the research conducted in the University of Tabriz, The Dept. of Pharmaceuticals in 1993 ...

2- International Union for Conservation of Nature

3- Wolfgang Sachs (PhD) is an internationally recognized scholar in environmental sociology and development studies. He is a director of research in globalization studies and new models of wealth at the Wuppertal Institute for Climate, Environment and Energy. Furthermore, he is a Honorary Professor at the University of Kassel, Germany, a regular Scholar-in-Residence at the Schumacher College, England, and has been teaching at the universities of Pennsylvania, Berkeley, Rome, Siena, and Aalborg.

4- Proportionate to the increase in the residential and tourist population (Ahmadnia, 1998).

5- Source: Author Based on Google.Maps. (2013). Retrieved from <https://maps.google.com,0220.2013>.

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