



Earth for social housing in Palestine: an alternative for a sustainable refurbishment of building's envelopes

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Abstract

The suitable climates in the cities of Jericho and Gaza boosted the emergence of new attempts to revive earthen architecture on organizational and individual levels. These attempts produced a number of earthen buildings in the last few years following the crucial need to find alternative low cost material instead of natural stone, which is used in a large scale in Palestine. Similar attempts had a certain response to the social needs and economic situation there. This paper focuses on the possibility of using earth as an alternative material to refurbish the envelopes of existing housing units including two categories; firstly, refurbishing envelopes of housing units those were partially destroyed during attacks (ex. in Gaza, about 27% of the housing units were damaged in 2014). Secondly, refurbishing existing houses envelopes to follow the basic environmental considerations. Both categories respect the sustainability dimensions; the social contexts, economic levels of occupants, beside the attention toward the technical and environmental improvements of earth in the future.

Keywords: Earthen envelopes, refurbishment, sustainability, building materials, social and economic aspects.

Mots clés: enveloppes de terre, rénovation, matériaux de construction, aspects sociaux et économiques

1. Social housing situation in Palestine

The Palestinian architecture shows a big leap between the Past and the Present: the excessive use of natural stone in construction following the copy and paste method without paying attention to the identity, the nature, the context, or the economic levels of people. A randomness of urban fabric has emerged recently, losing the social interdependence, buildings are scattered without order, without the existence of a certain architectural style, and a dramatically lack of attention towards environmental and economic aspects. Mostly, the paterfamilias are spending most of their lives to build their own houses, due to the high construction costs, or they have to pay a lot to rent houses. This issue was not a great responsibility upon the paterfamilias previously. The gap between traditional building and current constructions is however usual in many other places in the world. In Palestine there are some critical conditions, produced as a consequence of the peculiar political situation. For this, the humanitarian aspects, in addition to the social, economic, and environmental ones, distinguish the social housing situation there.

1.1. The traditional Palestinian houses

In the Palestine cities or villages the urban fabric was harmonious and homogeneous on the physical and social levels (Amiry & Tamari, 1989). An identity of the architectural styles can be observed, strong extended family relations were existed, and people were involved in the design and construction process of a neighbor's house with the absence of architects' role. Some important influential factors in the formation of urban contexts and the

determination of architectural style were the climatic factors, the construction materials, the site geography, the culture, and other people's living needs. The house-style was evolved through the cooperation of several successive generations starting from using primitive methods of construction without the need for designers (Rapoport, 1969).

The house was not just a haven for the Palestinian family. The functional design of a house was not limited to the finding of physical space to shelter families; it had an integrated system of social activities that extended to the external simple yard as a collective social space (Figure 1). The house form also accompanied by regarding the culture of the conservative community, and the awareness toward the environmental needs. On the level of construction material, they used mainly the natural stone with a limited use of earth in Jericho and in some other regions. The high availability of earth and the suitable climatic conditions there facilitated the use of earth in its common form of bricks.

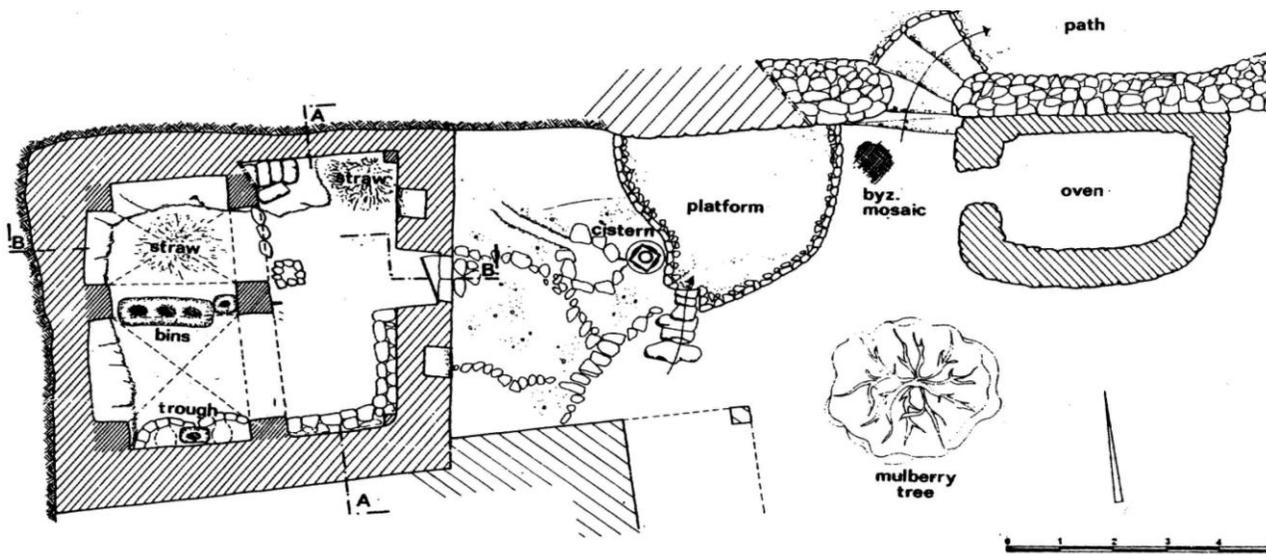


Figure 1: The plan of a typical traditional house, including the external yard, Palestine (Hirschfeld, 1995).

1.2. Contemporary Palestinian houses

The Palestinian contemporary house differs radically from traditional house with no longer of any great interest to respond to the environment, not even the principle of preserving the architectural identity. Most of contemporary buildings do not fit a certain architectural style, with no respect to the climatic conditions. A huge number of buildings have emerged in their random form, and without unity. Houses only share the stone as a construction material; nearly equal sizes of windows in different climatic zones. The use of earth has disappeared, a huge use of natural stone material with exaggeration and overstatement in most cases, which affects the nature by the increasing number of the stone mining locations (Alatawneh et al., 2015). A sporadic and incoherent urban fabric has appeared (Figure 2), with a sort of setbacks between buildings that obscure sunlight and natural ventilation from entering the internal spaces. This leap of transformation has brought environmental problems that began grabbing the attention of architects and researchers, coinciding with the global interest in environmental aspects. Palestine has a slightly different context from other countries, at the time Palestine is facing setbacks in the political and economic spheres due the occupation, where Palestinians do not have the control of their natural resources, or the ability to use urban expansion regions for future development. Accordingly, as in the rest of the world countries, there is a crucial need to rethink of the social housing sector in order to decrease the financial problems, focusing on two main issues: finding alternative viable and low cost resources of construction materials (such as earth), and to exploit the passive solutions in architectural design to decrease the financial problems, and to revive socio-cultural needs within the house. In both of these issues, the reference to the vernacular heritage is a strategic bracing, due to its deep relationships with the specific features in each site.



Figure 2: Contemporary urban fabric of Hebron city, Palestine (Abu Natsheh photography, 2008).

1.3. The housing emergency in Gaza

The Gaza Strip is an isolated region of Palestine whose strategic role is accentuated because it directly adjoins the Mediterranean Sea. Israeli occupation military waged several attacks against Gaza, the last one was in the summer of 2014. These attacks left a huge destruction to a large number of buildings there (Figure 3). Depending on the Palestinian national early recovery and reconstruction plan for Gaza (The Palestine Government's Higher Inter-Ministerial Committee, 2014), nearly 10,000 housing units were damaged totally, severe damage to nearly 10,000 housing units, and partial damage to nearly 40,000 housing units. Those numbers are very large in comparison to the total number of families there (about 220,000 families), which means about 60,000 families became homeless. Entire neighborhoods still lie in rubble; residents cannot rebuild their houses. At the same time, people are not allowed to import building materials (such as steel, cement, etc.) from outside Gaza.

Despite all, some individual efforts of innovation can be observed there, following the necessity to shelter people; some organizations offered the homeless families by a sort of containers to live in, but they were not suitable enough to their basic needs of living, it was just a temporary solution. Some individual efforts of wooden constructed houses, and other efforts — were considered as cheap — are focusing on the reviving of earth as a building material. From another side, 71,000 additional housing units are needed for Gazans in 2020 (UN, 2012) following the population growth, which increases the problem of providing people by suitable houses. Coinciding with the lack of construction materials, this increases the need to rethink of sustainable alternatives.

2. The revival of earthen architecture in Palestine

Earth is considered as the most accessible and cheap material in the world, it was used in different forms, following different needs, achieving intangible traditions, matching the local culture and climate. Several studies have focused on the deep roots of this building material, for which a *technological continuity* common to the whole Mediterranean basin has been evoked (Germanà, 2011/b). In addition, the refreshing of earth techniques for current buildings has often been pointed as a sustainable choice for the architecture of twenty-one century (Mecca et al., 2011; Mileto et al., 2015).

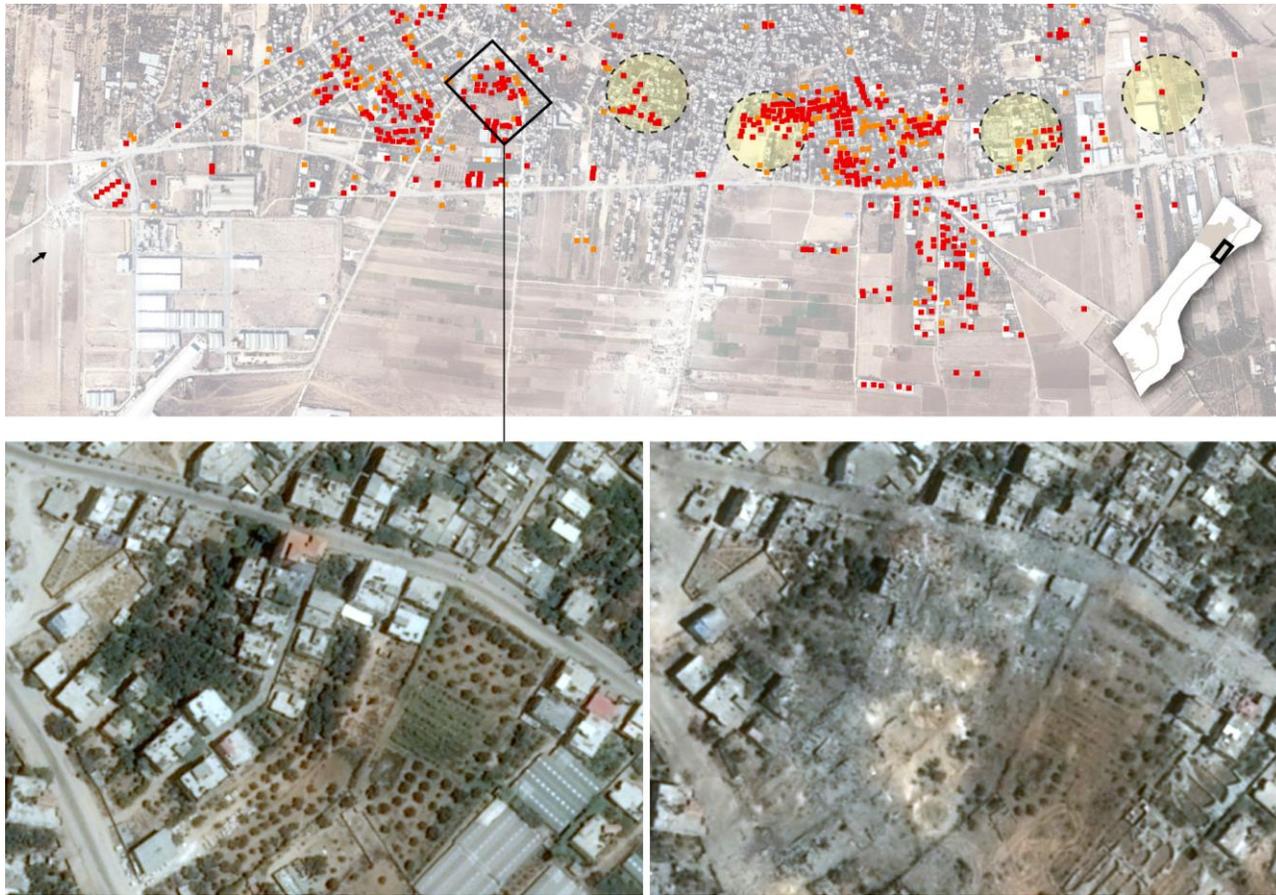


Figure 3: Compared satellite images, from 6th to 25th July 2014, <http://osimint.com/2014/07/27/assessing-the-damage-in-gaza>.

In this general trend, earth architecture is already begun as a tool to face the critical social housing situation, even in Palestine, where this choice is additionally encouraged by the difficulties of importing building materials (steel, concrete, etc.), and by the high financial and environmental costs of the natural stone.

A group of attempts have emerged recently in Palestine to revive the earth as an alternative construction material. This opens up a door to rethink of the achievement of environmental needs, and the enrichment of socio-cultural aspects within the design of the earthen house. Different earthen buildings were implemented since the last decade in the Jordan valley, Jericho city, Dyouk village, Aqbat Jabr refugee camp, Bardalah village, Aqrabaniya village, and Gaza strip (Figures 4, 5). These attempts of reviving earthen architecture in Palestine were carried out and implemented individually or by some non-governmental organizations such as UNESCO, Shams-Ard (Sun-Earth, Environmental design studio), and BGF (Building Green Futures).

The strategies beyond these attempts were to present earthen architecture combined with new and recycled materials that could be found locally, thus reducing costs and difficulties of access associated to a substantive use of solar energy, to be an alternative solution for social housing design and for providing shelters in emergency situations (Tina & Antonelli, 2013). Those implementations have focused on the construction of community centers to be as examples for the society, looking for sources of inspiration, learning from the past for sustainable technological innovation, and locations of high thermal excursion. This was initiated by the public participation in the implementation process, which was considered as one of the focal points in these projects. Following those built earthen buildings, after a number of years after implementations; a certain post-occupancy evaluation should take its place in order to get a direct feedback from occupants about the efficiency of the system, the building, the material, etc.



Figure 4: New earthen buildings in Ramallah, Jericho, and the Jordan Valley, Palestine (UNESCO, Ramallah Office).



Figure 5: New earthen buildings in Jericho and Ramallah, Palestine (Shams-Ard Shams-Ard environment design studio).

2.1. Necessities and possibilities for earthen revival in Gaza

The siege of Gaza imposed by Israeli occupation has made the construction and reconstruction works impossible, since the embargo includes the steel and cement, beside several important materials. The siege has led some Gazans to construct new earthen houses to shelter themselves, by using the compressed earthen bricks, which were produced from soil excavations. According to the Earthen Architecture Database (www.eartharchitecture.org), previous attempts to increase the use of earth as an alternative sustainable material in Gaza, were started in 2008 by the UN as a first phase of the project called for the construction of 120 houses, each house costs approximately 8,000-10,000 Euros. The project were funded from Kuwait and the Red Crescent Society of the United Arab Emirates, it also included a training of the workers to make the earthen bricks from local materials, using an ancient technique, wooden windows frames, and domed roofs that does not require steel. These attempts were successful, and possible for the society use due to the availabilities of materials and techniques (Figure 6). More attention has to be paid by other governmental and non-governmental organizations to improve and increase the use of earth in Gaza, which at least helps to some extent in solving the problem of homelessness. Furthermore, an encouragement of the community to reuse earth has to take a place in this issue.

The aim to reviving earthen architecture in Palestinian social housing so far has mostly regarded the building of new houses. The refurbishment of the existing houses, damaged by attacks or inadequate for various requirements, is a more complex objective that could produce wider results.



Figure 6: Earth production and earthen house in Gaza, Palestine,
http://news.bbc.co.uk/2/hi/middle_east/8068864.stm.

3. Visions for earthen refurbishment of houses envelopes

Based on the mentioned attempts of using earth as an alternative material towards sustainable development of houses in Palestine, this starting point could be considered also as a potential to discuss the possibilities and extents of using earth in two categories of refurbishment. The first category is related to the refurbishment of partially destroyed houses in Gaza, by using new external layer of earthen envelopes instead of the damaged envelopes, within houses those can be restored and repaired, where the possibility to take advantage of the previous concrete structures that were not damaged (this could be determined by the structural engineers, after evaluating the structure capacity of the building). The second category of refurbishment is the possibility of using earthen envelopes as an additional external layer for the existing buildings those were not designed to be thermally efficient in different regions of Palestine, this also can be used to add social, economic and environmental values to the house itself.

In both of the two categories, two main visions can be abstractly proposed here to easily explain the concept of earthen refurbishments of houses envelopes (Figure 7); the first case or vision is used when the new earthen envelope can be attached directly to the existing envelope (without noticeable spaces between the two envelopes). The second case is used when adding a distance between the new and previous envelopes to create a ‘social transitional space’ that is discussed later in this study. Those proposals still abstract and need a deep empirical work to think of the technical issues such as the feasibility of matching two types of materials, taking into account the thermal expansion and contraction.

3.1. Environmental and technical values of earthen refurbishments

Construction by earth bricks adds many environmental values to the building due to its high thermal insulation, the fire resistance, the sound insulation, also its high local availability in Palestine as referring to the analysis and studies carried out by El Jamassi (2013) and Dudeen (2001). Earth can be made in different shapes, colors, or sizes. In addition, it can be compressed and reinforced by fibers, husks, or straw during the production of the mixtures, to achieve the suitable strength, beside the possibility of adding the moisture resistant to fit the climatic and seasonal changes. The study proposals of adding new earthen envelopes to the houses, can be more advanced and can be designed by taking use of the traditional methods and ideas of envelopes those were employed to fit the environmental, social, and cultural contexts. A good lesson can be drawn from the ‘Mashrabiya’ as an example of perforated traditional element within the buildings envelopes. It was used for different functions to enhance the building responsiveness to the local environment and to the community needs.

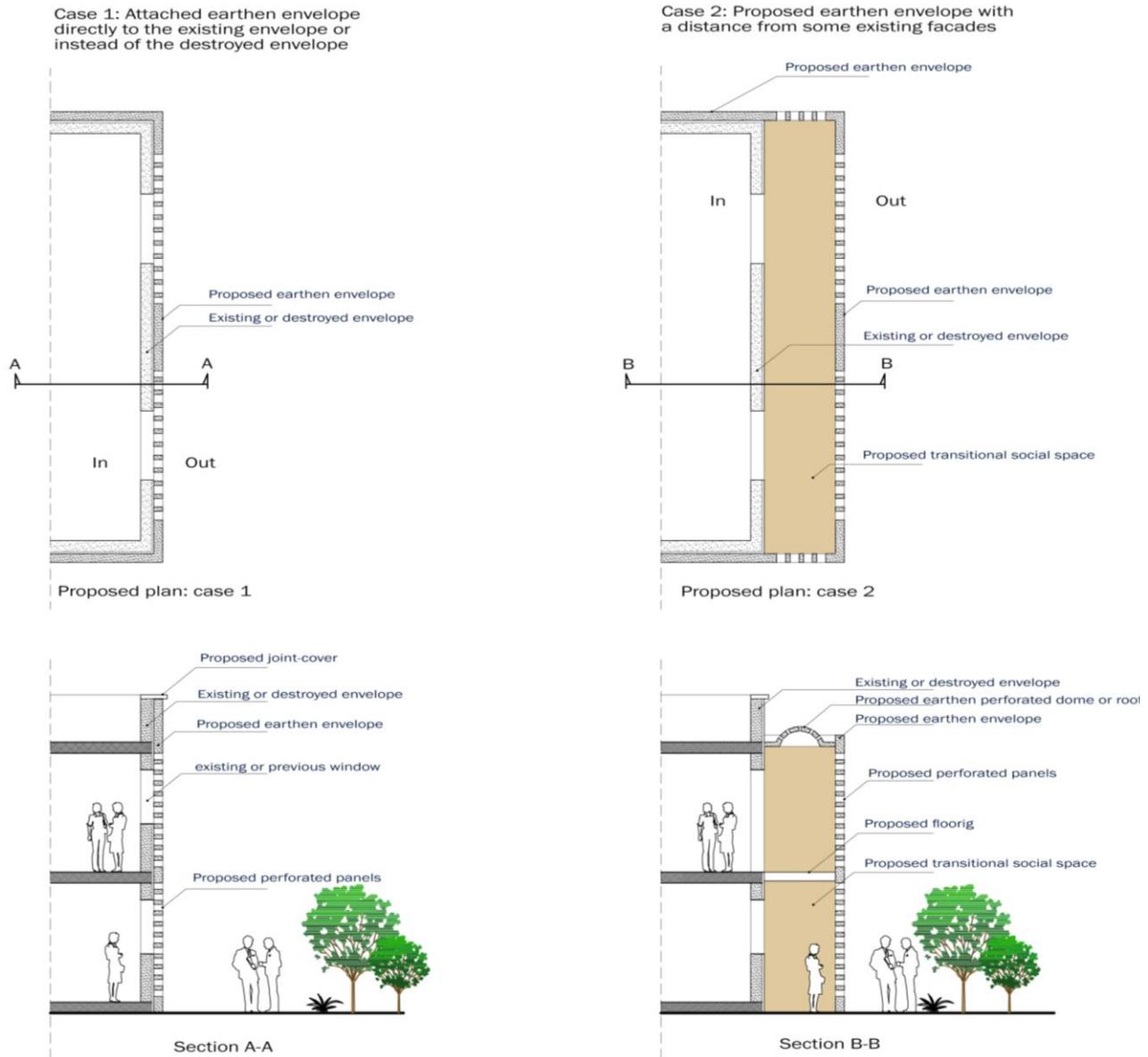


Figure 7: Abstract visions of the proposed earthen refurbishment of houses envelopes, (The authors).

There were many other traditional examples of responsive envelopes; those were used to provide shadow, to control the light passage, to facilitate the natural ventilation, and to keep indoor temperatures stationary during the summer and winter as a method of achieving passive thermal balance. These environmental elements can be improved, developed, and applied, to both proposed categories of houses envelopes refurbishment; in the recovery of houses in Gaza, and in the sustainable adjustment of the random architectural trend in other regions of Palestine. Earth and traditional passive solar techniques have the potentials to be used in these situations. From an operating perspective, the question of the technical compatibility of the new earthen envelope in an existing armed concrete frame arises strongly. Carefully detailed designs and experimental implementations must be developed to evaluate the feasibility of this vision.

3.2. The social value of earthen refurbishments

The traditional houses architecture and the traditional urban fabrics have played a successful role in the matter of social connectivity within the old communities. The adjacent houses occupants acquired their social communication

indirectly by making types of perforations within the house envelope, as the case of ‘Mashrabiya’, which maintained the privacy for the house occupants as an important issue within the conservative culture. At the same time, the occupants came into contact with outsiders or neighbors easily and effectively. Palestine has a conservative community, while privacy and social interaction have been neglected in the recent designs and implementations. The privacy level is determined in a house by the window size (it is mostly closed by a blind or solid shutter, which affects the ventilation process). Children, women, or old people in the same neighborhood have no great contact as before. Hence, here the study discusses the extent to which the new earthen envelopes can be designed to re-fit the social values. There is a chance to design new sustainable envelopes, re-connecting the community, and adding the identity. The house design should not be limited to the repeated window shapes and sizes, which are not well-oriented. There is a possibility to produce a new sort of social spaces locating them between the old and the new added earthen envelopes within the same house. A specific width can be decided, and an external perforation pattern can be made, to provide a social living space for the family (ex. the ‘Mashrabiya’ stone house in Jerusalem, by architect Sinan Abdelqader, Figure 8). In addition, the earth techniques are intrinsically endowed with added social value, because they involve the neighborhood community in the construction process, including different ages and genders.



Figure 8: Mashrabiyya house in Jerusalem, Palestine, www.herskhazeen.com/the-mashrabiya-house.

3.3. The economic value of earthen refurbishments

As the earth is a cheap construction material, it has an economic potential in the refurbishment proposals of houses envelopes. New cheap innovative methods and improvements can be found, to revive the spirit of cultural heritage, using earth features.

In addition, the possibility to refurbish the partially destroyed houses in Gaza by adding new earth envelopes will help in decreasing the costs of constructing the structure, due to the existence of the previous concrete structures. Above all, a decrease in the house running cost will be take its place after adding the earthen envelopes due to its thermal efficiency in decreasing heat gain and heat losses. When talking about other alternative materials for refurbishment such as cement, steel, wood, or other materials, many challenges will appear, such as the acute shortage of these material due to the siege on import in Gaza, beside that these materials are generally expensive in Palestinian in relation to the average income level of citizens. Moreover, the stone fining and construction techniques are also expensive, beside the high running costs of heating and cooling of houses due to the non-use of thermal insulation. In addition to all, and according to the Palestinian per capita income, the cost of creating a Palestinian house is over the ability of persons with middle-income levels, but how are the cases of persons with limited income level? Depending on Shewaka (2011), 80 m² house made of cement would cost around 16000 \$ at least, but an earthen house made from local materials costs just 3000 \$. However, the earth material has a great economic potential to be circulated into the Palestinian context in different categories of use.

4. Conclusion and recommendations

The economic and environmental deteriorations, the energy depletion, the population explosion, the reap of progress crumbs, have led recently to a great emergence of votes to save the human, the environment, and the nature as the components of life. Another side of the world has additional problems related to poverty, homelessness, social segregation, etc. These emergencies require a turning point, a new cultural approach. There is no need of technological innovations or high cost inventions, but a new human, social, and economical point must to be considered.

This was one reason beyond conducting this study, which highlighted several visions of development related to the architectural discipline. Nowadays, the living sphere including buildings and the surrounding environment is facing several challenges related to the use of technologies, and finding sustainable alternatives. Earth plays a good role in this issue, as it retains a group of potentials and advantages for sustainable development in architecture. Earth has the aptitude to be used as self-construction material, which reduces the construction costs beside the running costs of the house. Accordingly, architects should play a great role to find more effective contemporary architecture, which fits the local contexts, to establish a better trend for the future in line with reality. The architects contributions should respect the values and features of the context they are working for, which doesn't mean just laying down the roots in the history or in the modernity without respecting the environment and the temporal requirements, this vision has been emphasized in many studies (Germanà, 2011 and 2011/a).

The recent local, regional, or global attempts of earthen revival have resulted in a several suggestions on the levels of building techniques, improving earthen mixtures, or enhancing passive solar designs, in a whole vision of the building and its surroundings. Some architects started to understand the importance of achieving the sustainability principles in their works. Following these points, the earth labor market is an important factor, the industry of earthen architecture became familiar to some extent, this can open a door for further attempts in the future to increase the earth industry and improve the quality of the earthen bricks that fit the climatic considerations.

This study highlighted different categories where earth can be used in the Palestinian context, but it could be used similarly in other contexts of the world with similar circumstances. The study leads to an understanding of earthen architecture situation in Palestine, and the alternatives for sustainable development of earth starting by the product improvements, to the merging of the reality in contributions, and confidence deeply in solving environmental problems of the Present and Future, as one of the urgent problems. From this point of view, a group of recommendations are highlighted in the follows, to be taken into consideration by architects, organizations, or the governments, in order to plan, to control, and to develop the reality:

- The principles and the work methodology of earthen architecture have to take their place in the recovery plan of Gaza and other similar cases in the world, as the earth has many values and advantages.
- Refurbishment of the existing built houses to fit the sustainability principles is crucial, the earth has the potential to be used in this setting.
- Perforation of earthen envelopes as a passive design technique, has many environmental, cultural, and social values, it could play a good role in the concepts of refurbishing the houses envelopes, in both of the mentioned categories.
- The orientation of the new added earthen envelopes to a house must be carefully determined regarding the climate and the site features, to take use of sunlight, natural ventilation, shade, etc.
- This study introduced the possibility of using earth in refurbishment of envelopes, but an extended empirical work have to take a place to check operating perspective, the technical compatibility of the new earthen envelope in an existing armed concrete frame. Institutions and organizations can do experimental implementations to evaluate the feasibility of this vision to be developed in the future.
- The governmental institutions have to encourage families to refurbish their own houses, the encouragement could not be just economically, it could be technically by generalization of earth construction techniques, mixing methods, and models of earthen houses.
- As a part of public awareness, the local communities should be learnt through their direct involvements in the developmental projects, that the idea of living in an earthen house is not a shame; on the contrary, it is a global contemporary trend that can have the modernity forms, in addition to the identity and other important values.

This study still especially needs some experimental implementations on a technical and operative level that hopefully should be enhanced by national and international organizations and by governmental bodies.

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