JOURNAL OF ENGINEERING AND APPLIED SCIENCE, VOL. 67, NO. 8, DEC. 2020, PP. 2033-2052
FACULTY OF ENGINEERING, CAIRO UNIVERSITY

URBAN HERITAGE LIFE MONITORING: AS A PROACTIVE TOOL FOR SUSTAINABLE HERITAGE AREAS

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ABSTRACT

Heritage areas around the world represent the diversity and the uniqueness of the world's historical and cultural assets. Globalization led to the distortion of urban identity and homogeneity, so, conserving heritage areas for the sake of the current and the future generations, has been among the highest challenges of this century, especially for developing countries. Despite implementation of urban conservation projects, it became difficult to control the urban changes throughout the urban cycle of heritage areas. This paper aims to provide an innovative, practical, and proactive tool that can help urban designers and conservation professionals, in developing countries, to fulfill the aim of sustaining heritage areas. Based on a profound theoretical analysis, the paper proposed an innovated Urban Heritage Life Monitoring Tool, UHLMT that is scientifically based on the integration between the 'Life Cycle Assessment Tool' and the 'Resilience Cycle Theory'. Furthermore, the paper conducted semi-structured interviews aiming to investigate the expected efficiency of the tool. The findings revealed that the UHLMT is expected to have the ability to positively contribute to the aim of monitoring and controlling the urban changes in heritage areas, thus helping in conserving the Egyptian urban heritage.

KEYWORDS: Life cycle assessment, Urban life cycle, Heritage areas, Urban resilience.

1. INTRODUCTION

Urban environment is a complex, dynamic system, as a result of its interaction by social, economic, political, environmental and technological factors. Despite the multiplicity of influencing factors, globalization is the most influencing factor. This thought seeks to establish one dominant global cultural character 'Homogeneity' and eliminate the diversity of local cultures 'Distinction'. Consequently, all countries,

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especially developing countries, face many problems that have led to the disappearance and deterioration of the local urban identity 'Urban Distinction' [1-5].

Egypt generally, and Cairo specifically suffers from a large number of physical, social and economic transformations that have distorted the local identity, and character of heritage areas. According to the United Nations 2014 report, Cairo is one of the 10 largest cities in the world that have undergone urban agglomerations and transformations, that affected negatively its urban distinctive [5].

Despite the urban conservation projects, strategies and policies are implemented aiming to ensure sustainability of the local urban identity of heritage areas, these areas have been deteriorating again. This shows that urban conservation projects, strategies and policies did not take into consideration that these areas represent an irreplaceable urban resource, and will be constantly exposed to threats and changes. Because the change is the basic feature of the continuity of the universe and being in one stable condition is the gradual disappearance and death [1-5]. Therefore, it became difficult to control the urban changes in heritage areas in order to ensure the sustainability of the local identity and urban distinction throughout the urban life cycle of these areas.

Based on literature review of heritage areas [6-17], no study providing an urban monitoring and assessment tool to control the urban changes during urban life cycle of heritage areas in order to ensure sustainability of local urban identity. In addition, New Urban Agenda confirms the need for taking into account protection and resilience of the heritage areas, to reduce the risks they are exposed during their life cycle. As these areas are an irreplaceable resource, which requires continuous monitoring, and maintenance to ensure the preservation of its urban identity and distinction [18].

Therefore, the importance of this research is providing and innovating an applicable proactive tool, that can help urban planners and decision-makers in evaluating the urban life cycle of heritage areas, to understand and determine the urban phases; balance, deterioration, and renewal, in order to set the time for intervention to sustain the local urban distinction, and reduce negative urban changes that can be set. The proposed tool framework as in Fig. 1 is mainly based on utilizing the 'Life Cycle Assessment Tool', and the 'Resilience Cycle Theory' to innovate the required tool. In

addition to develop and prove the applicability of the proposed tool, a semi-structured interview was designed and implemented.

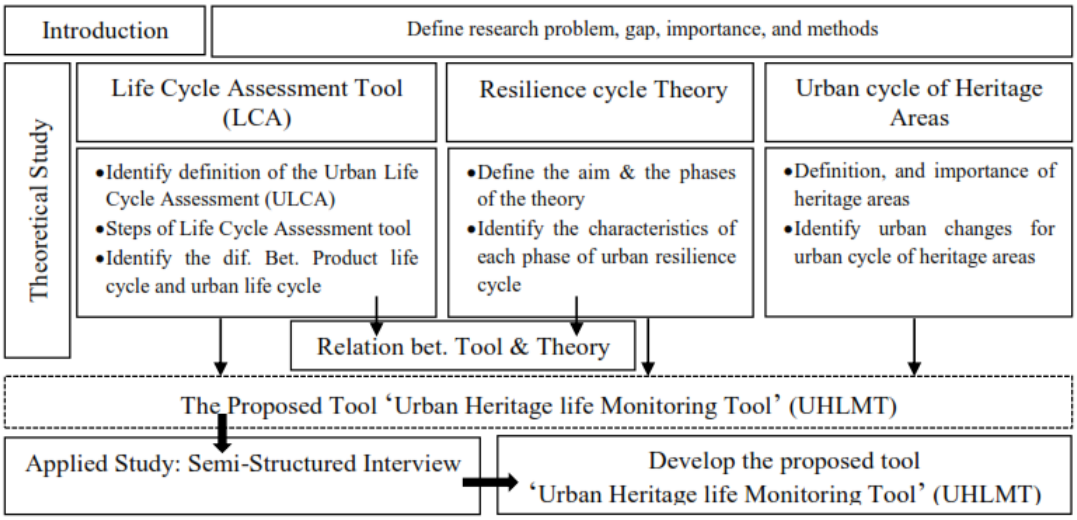

Fig. 1. Research methodology.

2. LIFE CYCLE ASSESSMENT TOOL, LCA

The LCA Approach has emerged as a result of the world's interest in environmental issues during the energy crisis in 1970 and global warming phenomenon in 1980, to sustain environmental resources. This approach is comprised of many environmental tools, methods, policies, programs and strategies that seek to achieve sustainable development for the life cycle of products, companies, buildings and urban areas. These include the LCA Tool, which is considered an environmental assessment and analytical tool [19-21].

2.1 Definition of Urban Life Cycle Assessment ULCA

The International Organization for Standardization (ISO) defines LCA, is a tool for classifying, and evaluating inputs, outputs, and expected impacts on the environmental resources during the product life cycle [22]. Furthermore, another definition, a tool for improving environmental performance of the life cycle of products, and companies, and revealing the potential for environmental preservation [20, 22]. All literature review of LCA has shown that urban scientists have attempted to define and apply this tool from an environmental perspective, as a tool to assess the impacts of building, or city, or neighborhood on environmental resources with the aim

of achieving environmental sustainability in urban development processes [19-24, 27-37]. Also, among the most important studies that utilized LCA in the urban context; Firstly, a study identified the best urban form and density that ensure the least energy use and greenhouse gas emission [27]. Secondly, a study evaluated the impacts over the life cycle of various transportation modes with the aim of taking a support decisions for improving transportation planning to reduce co2 emission, control energy consumption and preserve the human health [32]. Thirdly, a study assessed the impacts of land-uses on the sustainability of soil quality and biodiversity [37].

Based on the above, urban scientists have considered LCA is a tool for urban improvement, in order to reduce the urban environment impacts on non-renewable environmental resources [20, 21, 23]. Accordingly, with applying the same concept on irreplaceable urban resources, for instance, urban identity of heritage areas, the paper defines 'Urban Life Cycle Assessment' UCLA, as a sustainable analytical tool for evaluating urban areas that contain irreplaceable urban resources by determining and classifying the effected factors (input), and the urban transformation (output) during urban life cycle of these areas in order to ensure the sustainability of irreplaceable urban resources, for instance, local urban identity.

2.2 Steps of Life Cycle Assessment Tool

In 2006, the ISO set 4 steps as in Fig. 2 to implement LCA tool on product 'Product Life Cycle Assessment' [19, 20, 22-26], first step 'Definition of Goal and Scope', second step 'Life Cycle Inventory, LCI", third step 'Life Cycle Impact Assessment, LCIA', and fourth step 'Life Cycle Interpretation, LCI'. Based on the literature review, although, urban scientists applied the idea of the tool on buildings 'Building Life Cycle Assessment', and districts 'Urban Life Cycle Assessment' with the aim of solving the environmental issues, and sustaining the non-renewable environmental resources, they faced struggles with applying the four steps that set by ISO, and not concluded to a clear framework or steps to apply LCA tool on the urban environment [19, 22, 24, 27-37], as a result of the expected difference between applying the tool on the urban context and not on the products. The product life cycle

has limited stages, inputs and outputs, so the amount of the inputs can be controlled to reduce the negative impacts of the cycle. While urban life cycle deals with a lot of users differ in ages, need, etc., and diversity of the inputs that cannot be controlled such as, social, economic, and political, etc. In addition to the diversity of the urban environment components that have a comprehensive of effect on each other.

Hence, the paper targets a research gap area concerning the applicability of LCA tool on urban environment to reduce urban issues that related to irreplaceable urban resources, for instance, identity, and distinctive urban character, as activating LCA tool on heritage areas is expected to positively contribute to the sustainability of the irreplaceable urban resource, improving the image of the city, and increasing the efficiency of the built environment, by providing an applicable proactive sustainable tool for monitoring and controlling urban changes of heritage areas.

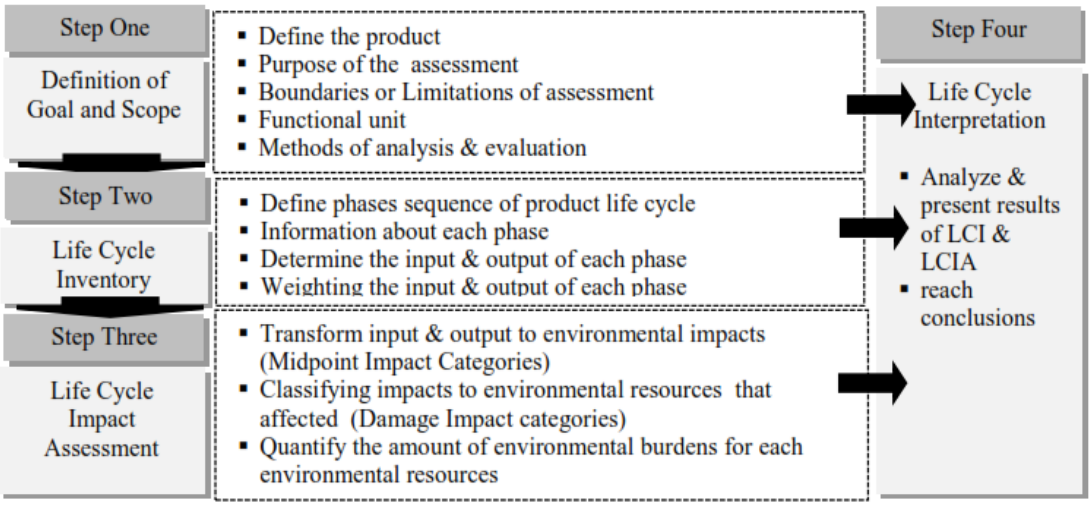

Fig. 2. Steps of product life cycle assessment tool [19, 20, 22, 24].

3. RESILIENCE CYCLE THEORY

Resilience is the amount of changes in the system with the ability to sustain its function, structure, and identity after facing any threats [38]. Consequently, any system must experience a cycle of several stages to be resilient and sustainable, which is called the resilience cycle [39-41].

The resilience theory aims to understand the life cycle of complex systems, for example, urban system, estimate the amount of transformation which the system can undergo and still preserve its function, structure, and identity, and also explore the

ability of the system to change and renewal [38, 39, 42, 43]. It is demonstrated by (∞) sign, as the system renews every period of time in order to ensure its sustainability, and survival from threats, as in Fig. 3. It is divided into four phases; Phase (1) balance, expresses the balanced growth and optimal investment strategies, Phase (2) crisis or deterioration, expresses the system's exposure to threats, till it reached a peak point where it demolishes or creates a new opportunity to ensure its sustainability. Phase (3) release, the creation of new survival ideas, Phase (4) reorganization or renewal, transforming all new ideas into implementation to reorganize the system. The transition from phase to phase is based on three elements; potential, connectedness, and resilience [38, 41, 42, 43, 44].

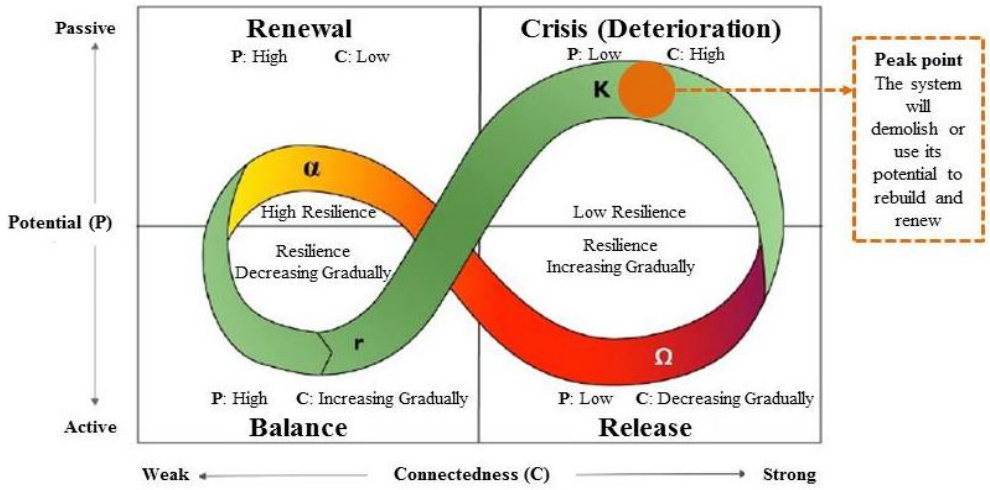

Fig. 3. Resilience cycle theory [38, 42, 43].

The Resilience Cycle Theory is applied on both environmental systems, and social-economic systems, with the aim of understanding how these systems rebuild, and rebalance itself, and adapt to changes after facing threats that could have destroyed it, for instance, rebalancing gradually economic system of city after facing any international or local threats such as, covid-19, flood, and revolution, etc. Nowadays, based on literature review and New Urban Agenda of sustainability, the concept of resilience is utilized by urban designers and planners in the city's urban development to promote sustainability of urban context while facing and adapting to environmental threats, and changes, for instance, flood and climate changes, etc. [38, 39, 42, 43]. Although, urban studies have attempted to link the resilience concept with urban form

and morphology, aiming to set design solutions or characteristics in the urban context to ensure its sustainability and adaptation to changes and threats, effective results have not been established till now [39, 44]. A serious practical study has also tried to apply resilience cycle theory on two cities to assess and understand how the urban system of each city have changed, adapted and survived in order to take the decisions that ensure conservation and sustainability of urban system [38].

According to the above, the paper first defines urban resilience as an urban system that is capable of achieving sustainable urban transformations while preserving its function, identity and original structure. Secondly, the theory represents a guiding tool for explaining the dynamics of complex systems, as no study uptill now attempts to address a specific characteristics of each phase to be applicable for urban system. The paper thus targets the applicability of the theory on urban context of heritage areas with aiming the sustainability of urban identity.

4. RELATION BETWEEN LCA TOOL AND RESILIENCE CYCLE THEORY

Based on the theoretical study of ‘LCA Tool’ and ‘Resilience Cycle Theory’, concluded that the LCA tool is concerned with evaluating and assessing the whole urban life cycle phases; pre-design, design, construction, operation, and maintenance. While ‘Resilience Cycle Theory’ is concerned with understanding the urban operation /use phase; balance, deterioration, release, and renewal. Therefore, the resilience cycle theory is considered a part in the applicability of the LCA tool, as the theory helps to classify the urban operation phase in which phases; balance, or deterioration or release or renewal, in order to set the time for intervention to sustain urban distinction and reduce urban changes that affect negatively urban identity as in Fig. 4. As the paper concern with evaluating the operation stage of the heritage areas, hence, the integration of ‘Resilience Cycle Theory’, and LCA tool, will contribute to provide a tool that positively achieving a sustainable and resilient urban identity for heritage areas.

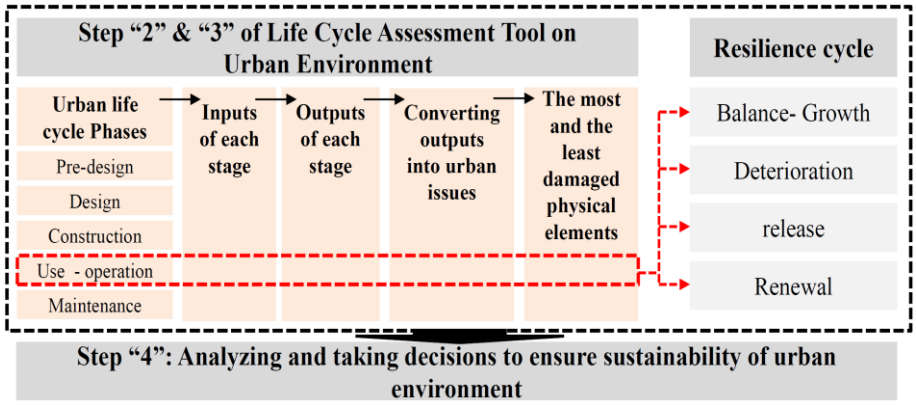

Fig. 4. Relation between steps of LCA tool and phases of resilience cycle theory.

5. URBAN CYCLE OF HERITAGE AREAS

The paper depends on the heritage area's definition of the Egyptian Unified Building Law no. 119 in 2008, which stated the heritage area is comprised one or more distinct values, architecture, or urban, or symbolic, or natural, or aesthetic, and require to deal with these areas as an integrated unit to ensure its preservation [45]. These areas are considered the main driver of sustainable development in the aspects of economic, social, urban, and environmental, because of its contribution to the sustainability of local urban identity, the recovery of the economy, and increasing quality of life [2-4, 8, 9].

According to the literature review, the urban cycle of heritage areas is divided into three phases as described in Table 1. While, urban changes that identify each phase are concluded based on results and findings of profound studies as following; Firstly, a comparative analysis between some previous studies that concerned with urban heritage balance, deterioration, and renewal [1-3, 6, 7, 10-15]. Secondly, an analytical study for two selected international heritage areas; Beirut, Lebanon, and Isparta, Turkey, aiming to understand how each city adapted to threats and changes, rebuild after deterioration, and sustain its local urban identity. Furthermore, concluding urban changes that occurred in each phase, and expressed the urban balance or urban deterioration or urban renewal [46, 47]. Accordingly, elements of urban changes were concluded from theoretical study and from cases of international heritage areas, as mentioned in the framework of the proposed tool in the next section.

Table 1. Description of urban cycle of heritage areas [1-3, 6, 7, 10-15].

Urban Balance Phase	Urban Deterioration Phase	Urban Renewal Phase
This phase expresses the compatibility of urban growth with the building codes of each heritage area.	This phase describes that distinctive urbanism is exposed to various threats that led to its deterioration.	This phase expresses that peak of the deterioration lead to the necessity of urban conversation projects in order to ensure the urban balance, as was mentioned in the resilience cycle theory.
The most significant urban component that reflect the balanced urban growth are historical buildings, local activities, green and public spaces, urban pattern, skyline, and visual image.	The most significant urban changes that express the urban deterioration are the visual pollution, loss of the local activities, and the urban pattern changes that incompatible with the urban codes of each distinctive district.	The most significant urban changes that express the urban renewal are the regeneration of the historical buildings and local activities.

6. PROPOSED URBAN HERITAGE LIFE MONITORING TOOL UHLMT

The innovated UHLMT was composed based on the integration of the results of the three profound studies conducted early in the research targets the LCA tool, urban resilience cycle theory, and urban cycle of heritage areas as shown in Table 2. The component of the proposed UHLMT is divided into three stages as presented in Fig. 5.

Table 2. Composition of the proposed UHLMT framework.

Theoretical Study		Proposed UHLMT Framework		
		Stage One	Stage Two	Stage Three
Steps of Life Cycle Assessment Tool	Step 1: Definition of Goal and Scope			
	Step 2: Life Cycle Inventory LCI			
	Step 3: Life Cycle Impact Assessment LCIA			
	Step 4: Life Cycle Interpretation			
Phases of Resilience Cycle Theory				
Urban changes of urban cycle of heritage areas				

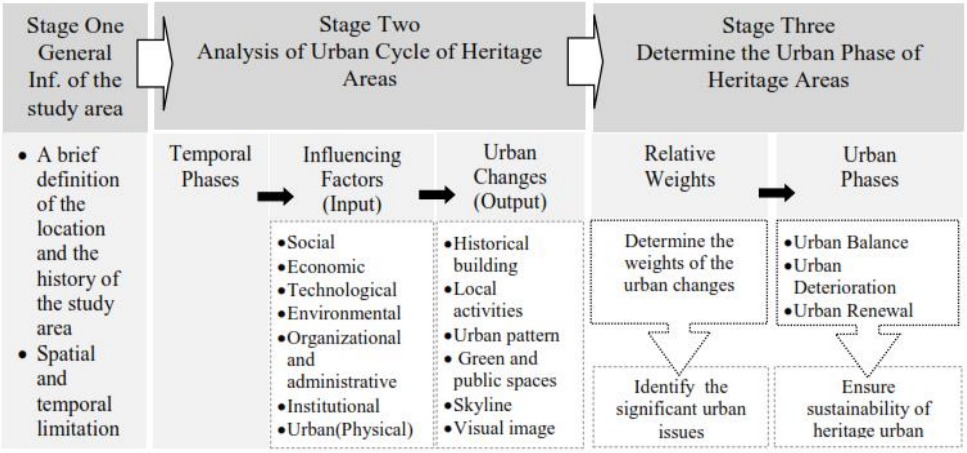

Fig. 5. Proposed framework for UHLMT

6.1 Stage One: Definition of the Study Area

Based on the first stage of the LCA tool, this stage concerned with a brief definition of the location and the history of the study area, besides determining the spatial and temporal limitation.

6.2 Stage Two: Analysis of Urban Cycle of Heritage Areas

Based on the second stage of the LCA tool and the findings of the study of urban cycle of heritage areas, this stage concerned with analyzing the temporal phases by identifying the influencing factors of each phase (input), and urban changes (outputs) of each phase as presented in Table 3.

6.3 Stage Three: Determine Urban Phase of Heritage Areas

Based on the third and fourth stage of the LCA tool, and the resilience cycle theory, this stage concerned with concluding the weights of urban changes to identify the most and the least affected urban element. In addition, determining the urban phase of the study area; urban balance, or urban deterioration, or urban renewal, with aiming to ensure the sustainability of distinctive urban, and urban identity.

Taking into account that in the ‘Resilience Cycle Theory’, the third stage ‘Release’, it is excluded, as it was considered a stage for innovating the ideas (without implementation) that driving the urban change, with aiming to renew the urban system after deterioration. Therefore, it is considered an input phase without implementation any urban changes that could be observed or evaluated.

7. RESULTS OF SEMI-STRUCTURED INTERVIEWS

Semi-structured interviews have been conducted, with a targeted sample of 20 academic and professional experts specialized in the urban design and architectural field of the heritage areas. The targeted sample was selected by using random stratified cluster samples, as the selection of academic experts depended on doing academic researches in the field of heritage areas, while the professional experts are urban consultants for conserving heritage areas or working in one of the institutions that concerning of heritage areas.

Table 3. Initial urban changes of the urban cycle of heritage areas based on the theoretical study of urban cycle of heritage areas [1-3, 8-13, 47-50].

Urban Phases	Urban Balance Phase	Urban Deterioration Phase	Urban Renewal Phase
Heritage building	Presence of heritage buildings with good building structure	• Demolition of historical buildings • Reusing historical building by a negative influencing uses / activities • Absence of maintenance and abandonment of historical buildings	Restoration, & regeneration of historic building
Local Activities	• Diversity of local activities • Continuous growth of local activities • Presence of learning heritage crafts centers	• Loss of old local activities • Changing to a new activities, incompatible with the identity	New activities compatible with the identity, based on urban regeneration projects
Public & Green spaces	• Diversity of public and green spaces • Preserving public and green spaces, if any	• Building on green & public spaces • Removing green & public spaces without reusing it • Changing proportion of urban spaces	Development and improvement of public, and green spaces, in addition to spaces between buildings
Sky Line	Adherence to the heights of the building codes for old and new buildings	Vertical densification of old, and new buildings, in contradiction to building code	Removing the heights (floors), that are in contradiction to building code
Visual Image	• Existence of physical values • Homogeneity and distinction of urban visual image	Visual pollution of historical building, urban spaces and streets	• Removal of visual pollution • Using special architecture designs on façades to preserve the physical character
Urban pattern	• Changing building density, while preserving the old urban pattern • Adherence to the building codes of each study area (plots, blocks, streets, etc) • New buildings compatible with the building code • High Permeability • Availability of good quality Pedestrian paths • Stability of horizontal built up area	• New buildings incompatible with the building code and do not have identity • Lack of parking • Pedestrian paths, contain walking obstacles. • Demolition parts of the old urban pattern • Urban growth, incompatible with old pattern, and building code: • Different sizes, proportions and dimensions of plots, blocks, streets and buildings • New traffic and pedestrian paths, in compatible with old roads network	• Removing buildings that incompatible with the building code to ensure sustainability of old urban pattern • Developing and improving the road network, taking into account the preservation of the old urban pattern • Providing parking spaces • Development and improvement of pedestrian paths

Urban changes, theoretical studies Urban changes, International case studies

The statistical analysis was performed by using SPSS program. The purpose of this study is to develop and investigate the applicability of the proposed UHLMT within the Egyptian urban context. The semi-structured interview consists of four parts.

- Part One: ranking the priority of the urban elements of the heritage areas to ensure the sustainability of urban identity.
- Parts Two, Three, and Four: determining the effective and non-effective urban changes that identifying each urban phase of the heritage areas; urban balance, urban deterioration and urban renewal. In the statistical analysis, the paper selected the effective urban changes are on ranging average from 0.6 to 1, and excluded the urban changes are on average less than 0.6, as they considered non-effective.

7.1 Analysis of Part One: Ranking of Main Urban Element of Heritage Areas

As presented in Figs. 6 and 7, the rank of the urban elements of heritage areas with the highest to the least rated are in the following order: historical building with average almost 5; local activities and urban pattern have the same average almost 4; Visual image with average 3; urban spaces with average 2. In addition, all experts agreed that the skyline is considered a part of the visual image, and must merged.

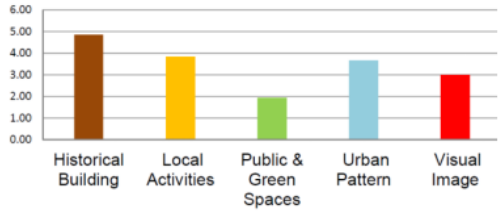

Fig. 6. Average (Mean) ranking of urban elements of heritage areas.

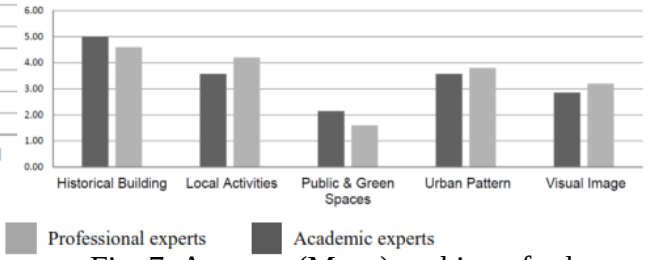

Fig. 7. Average (Mean) ranking of urban elements of heritage areas for each group of experts.

The significance of correlation test results between the different urban elements of heritage areas was established, results showed that it is an inverse relation between some of urban elements in the range from 0.58 to 0.75 as in Table 4.

7.2 Analysis of Part Two: Urban Changes that Identifying the Urban Balance Phase

Figure 8 presents the statistical results of the most weighting effective urban changes with an average on ranging from 0.9 to 1, the medium effectively urban changes with an average on ranging from 0.7 to 0.9 and the non-effective (excluded) urban changes with an average less than 0.6. Figure 9 presents the agreement and the

difference between the 2 group of experts on the significance of the effective urban changes.

Table 4. Correlation analysis between urban elements of the heritage areas.

	Heritage building	Local Activities	Public & Green spaces	Urban pattern	Visual Image
Heritage building	1	-0.759**	0.157	0.380	-0.183
Local Activities	-0.759**	1	0.085	-0.588**	0.000
Public & Green spaces	0.157	0.085	1	-0.017	0.344
Urban pattern	0.380	-0.588*	-0.017	1	0.248
Visual Image	-0.183	0.000	0.344	0.248	1

** correlation is significant at the 0.01 level (2-tailed)

* correlation is significant at the 0.05 level (2-tailed)

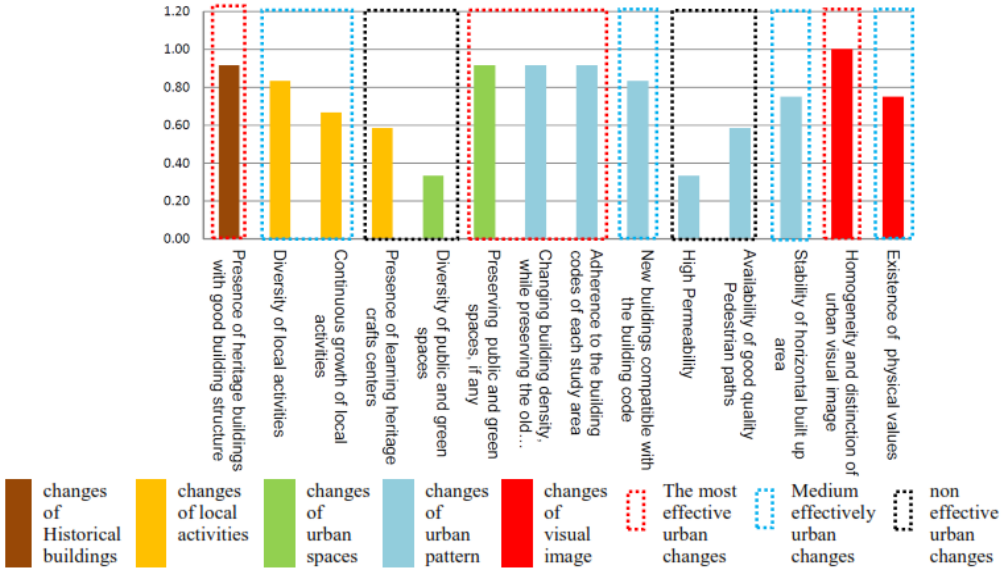

Fig. 8. Average (Mean) of the urban changes that determining the urban balance phase of heritage areas.

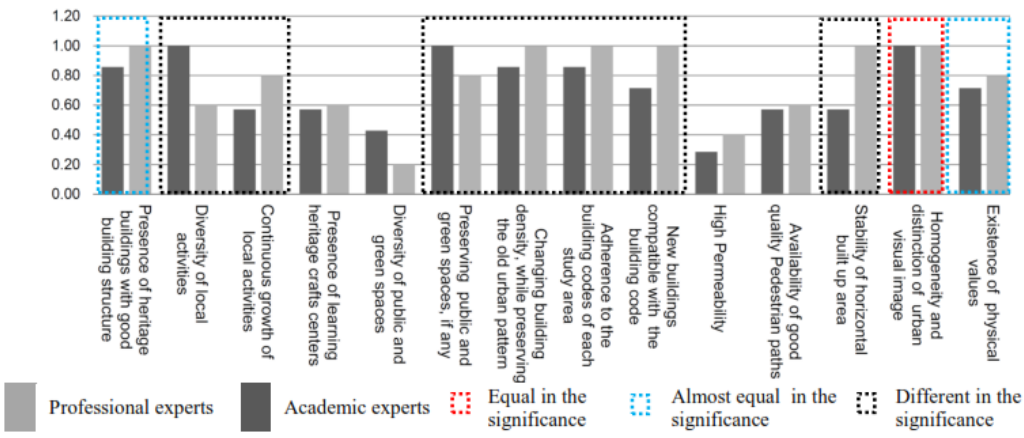

Fig. 9. Average (Mean) of urban changes that determining the urban balance phase of heritage areas for academic and professional experts.

7.3 Analysis of Part Three: Urban Changes that Identifying the Urban Deterioration Phase

Based on Figs. 10 and 11, the statistical results proved that the 2 groups of experts agreed with the same average 1 for the most weighting effective and significance urban Changes. While the medium effectively urban changes are varied in their significant with an average on ranging from 0.8 to 0.92.

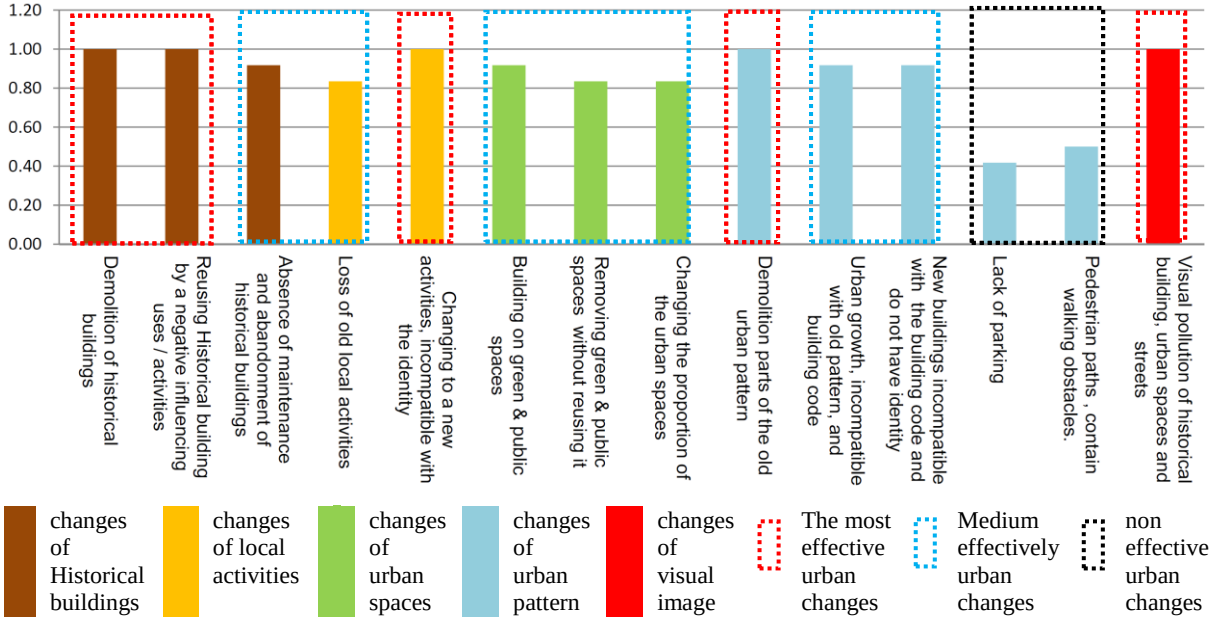

Fig. 10. Average (Mean) of the urban changes that determining the urban deterioration phase of heritage areas.

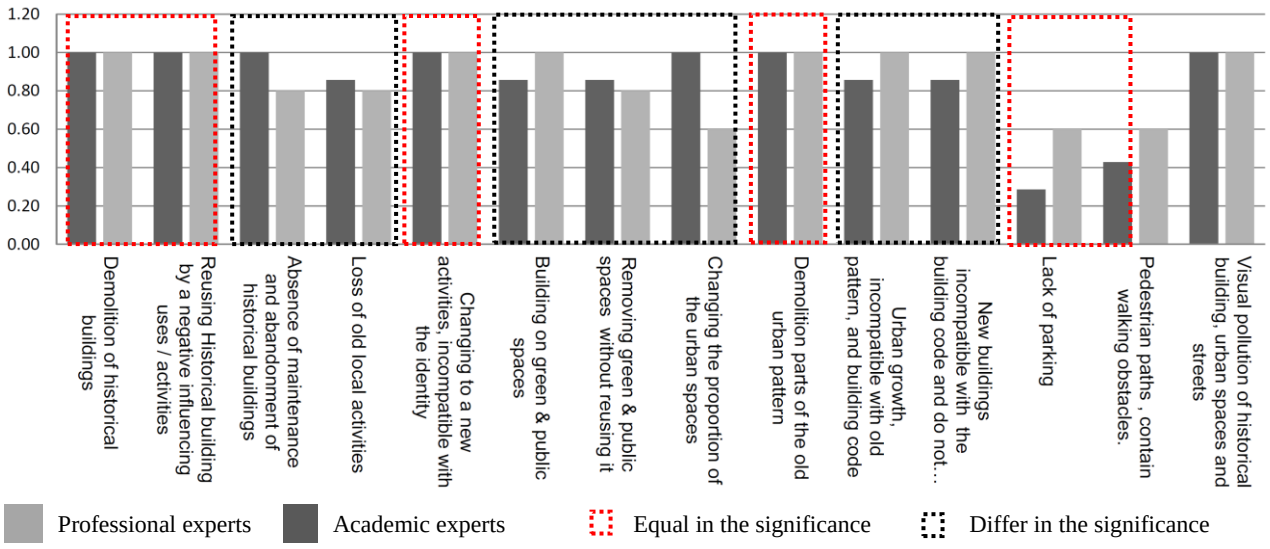

Fig. 11. Average (Mean) of the urban changes that determining the urban deterioration phase of heritage areas for academic and professional experts.

7.4 Analysis of Part Four: Urban Changes that Identifying the Urban Renewal Phase

Based on Fig. 12, concluded that both groups of experts agreed that all urban renewal changes are effective with mean more than 0.6, as the most weighting effective urban changes have the same average 1, and the other effective urban changes with an average on ranging from 0.75 to 0.92.

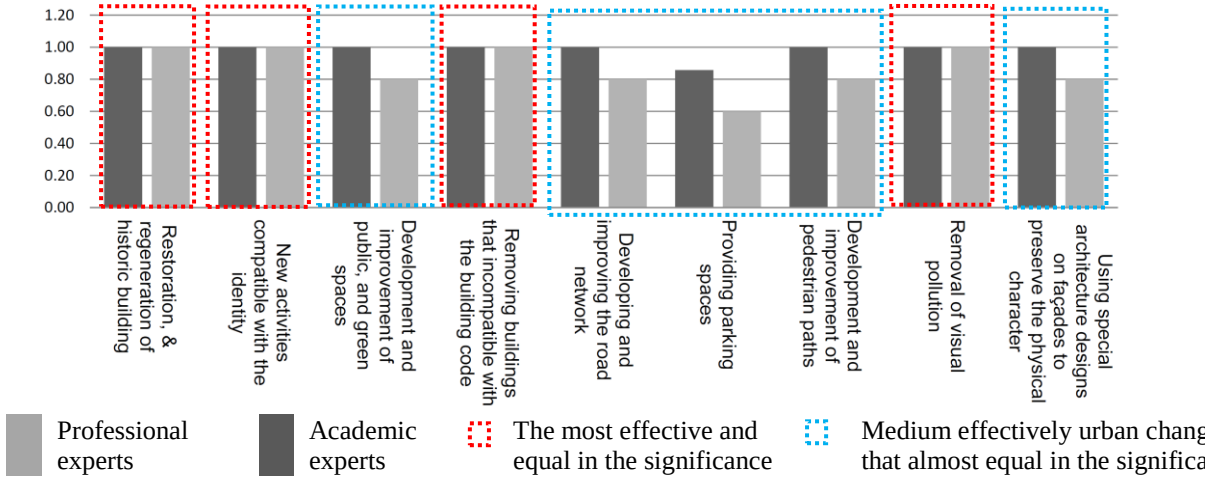

Fig. 12. Average (Mean) of the urban changes that determining the urban renewal phase of heritage areas for academic and professional experts.

7.5 Findings of the Field Survey

Based on the statistical results and analysis of the semi-structured interview, highlighting the priority of the urban elements, and the most effective and weighing urban changes for each urban phase of the urban cycle of Egyptian heritage areas as in Table 5, and excluded the urban changes that are non-effective. Furthermore, the experts have approved the applicability of the proposed tool as an initial attempt for monitoring the operation stage of the urban cycle of Egyptian heritage areas.

8. DISCUSSION

This paper proposes UHLMT, as a simple proactive tool that can help the urban designers, architects, and decision makers in determining the heritage area in which urban phase, in order to set, policies, or strategies, or conservation projects, etc., that help to ensure heritage areas in urban balance phase.

Table 5. The final effective urban element for the UHLMT.

Urban Phases	Urban Balance Phase	Urban Deterioration Phase	Urban Renewal Phase
Heritage building	Presence of heritage buildings with good building structure	• Demolition of historical buildings • Reusing historical building by a negative influencing uses / activities	Restoration, & regeneration of historic building
		• Absence of maintenance and abandonment of historical buildings	
Local Activities	• Diversity of local activities • growth of local activities	Loss of old local activities	New activities compatible with the identity, based on urban regeneration projects
	• Presence of learning heritage crafts centers	Changing to a new activities, incompatible with the identity	
Urban pattern	• Changing building density, while preserving the old urban pattern • Adherence to the building codes of each study area (plots, blocks, streets, etc)	• Demolition parts of the old urban pattern	Removing buildings that incompatible with the building code to ensure sustainability of old urban pattern.
		• New buildings incompatible with the building code and do not have identity	
	• New buildings compatible with the building code • Stability of horizontal urban growth	• Urban growth, incompatible with old pattern, and building code: • Different sizes, proportions and dimensions of plots, blocks, streets and buildings • New traffic and pedestrian paths, in compatible with old roads network	• Developing and improving the road network, taking into account the preservation of the old urban pattern • Providing parking spaces • Improvement of pedestrian paths
	• High Permeability • Availability of good quality Pedestrian paths	• Lack of parking • Pedestrian paths, contain walking obstacles.	
Visual Image	• Existence of physical values	• Visual pollution of historical building, urban spaces and streets	• Removal of visual pollution
	• Homogeneity and distinction of urban visual image		• Using special architecture designs on façades to preserve the physical character
Public & Green spaces	• Preserving public and green spaces, if any	• Building on green & public spaces • Removing green & public spaces without reusing it • Changing proportion of urban spaces	• Development and improvement of public, and green spaces, in addition to spaces between buildings
	• Diversity of public and green spaces		

Ranking the main urban element of heritage areas from the most effective one to the least

The most weighting effective urban changes in determining each phase

The Least weighting (medium) effective urban changes in determining each phase

Non-effective (excluded) urban changes

Urban designers, architects, and decision makers can apply easily the proposed tool by considering Table 5 a checklist (yes or No), to determine which urban changes that occurred in every urban phase, for instance, if all the most and least effective urban changes of urban balance phase have occurred and also some of the least effective urban changes in the urban deterioration phase, therefore, it means that the

heritage area is beginning to deteriorate and should intervene to not reach the peak of deterioration and distort urban identity.

9. CONCLUSIONS

Based on the results of a profound theoretical analysis for both the 'Life Cycle Assessment Tool' and the 'Resilience Cycle Theory', the paper has managed to innovate and compose a practical proactive monitoring tool (UHLMT) as presented in Fig. 5 and Table 3. The UHLMT was created with an aim to monitor and evaluate urban cycle of Egyptian heritage areas, and ensure the urban changes are compatible with the building codes and urban identity. In order to investigate the efficiency of the tool, semi-structured interviews were designed and implemented. The interview population was mainly targeting academics and professionals in the field of urban heritage conservation. Based on the findings and the statistical analysis of the semi-structured interviews by using SPSS program, the required refinement has been done to the tool thus concluding the final proposed UHLMT as presented in Table 5. Also, the semi-structured interview has indicated a highly expectation among the respondent regarding the efficiency of the UHLMT tool for acting as a practical, proactive monitoring and controlling tool for sustaining urban identity of the Egyptian urban heritage areas. Further research required regarding the applicability and implementation of the proposed tool, and comprehensive, for example, setting a percentage weighting for each element of urban change, and addressing the management aspect of the heritage areas to reduce the contradiction decisions that led to distort the urban identity. Additionally, more studies are targeting social, and environmental aspects in the monitoring process of the heritage areas, are for some recommended points for future studies.

DECLARATION OF CONFLICT OF INTERESTS

The authors have declared no conflict of interests.

REFERENCES

1. El-Daidamony, M., and Shetawy, A., "Gentrification Indicators in the Historic Cairo City", Journal of Social and Behavioral Sciences, Vol. 225, pp. 107-118, 2016.

2. Gur, E., "Regeneration of the Historical Urban Center and Changing Housing Market Dynamics: Fener-Balat", International Journal of Architectural Research, Vol. 9, No.1, pp. 232-246, 2015.
3. Evans, G., "Measure for Measure: Evaluating the Evidence of Culture's Contribution to Regeneration", Journal of Urban Studies, Vol. 42, pp. 959–983, 2005.
4. Hosagrahar, J., Soule, J., Fusco Girard, L., and Potts, A., "Cultural Heritage: The UN Sustainable Development Goals, and the New Urban Agenda", International Council on Monuments and Sites ICOMOS, 2016. http://www.usicomos.org/wp-content/uploads/2016/05/Final-Concept-Note.pdf (Accessed 19/11/2018).
5. United Nation, "World Urbanization Prospects Highlights", Department of Economic and Social Affairs, Population Division, New York, USA, 2014.
6. Elzayat, A., "The Urban Character of Canal Cities", M. Sc. Thesis, Faculty of Fine Arts, Alexandria University, 2010.
7. National Organization for Urban Harmony NOUH, "The Regulations of Heritage Buildings and Areas Report", 2010.
8. Kiera, A., "The Local Identity and Design Code as Tool of Urban Conservation, a Core Component of Sustainable Urban Development–The Case of Fremantle, Western Australia", Journal City and Time, Vol. 5, No. 1, pp. 3-17, 2011.
9. Esmail, A. Y., "Sustainability between Urban Heritage and Tourism Development by Participation in Al-Qasr", Journal of Engineering and Applied Science, Vol. 66, No. 4, pp. 429-450, 2019.
10. Montgomery, J., "Cultural Quarters as Mechanisms for Urban Regeneration. Part 1: Conceptualising Cultural Quarters", Planning Practice and Research, Vol. 18, No. 4, pp. 293-306, 2003.
11. Mostafa, A. M., "Quality of Life Indicators in Value Urban Areas: Kasr Elnile Street in Cairo", Journal of Procedia-Social and Behavioral Sciences, Vol. 50, pp. 254-270, 2012.
12. Faculty of Urban and Regional Planning FURP, The Academy of Scientific Research and Technology (ASRT), and Housing and Building National Research Center, "The Study of visual pollution in Cairo Report", 2004.
13. Altarek, A., "Character Constituents of Distinct Character Districts in Cairo: End of 19th Century-Mid 20th Century: Case Study-Maady El Sarayat", Master Thesis, Faculty of Engineering, Cairo University, 2005.
14. Gamie, S., "Dynamism of Change and Deterioration in Classy Housing Areas of Heritage Value", Master Thesis, Faculty of Engineering, Cairo University, 2005.
15. Ghonim, M., "Physical Change in Architectural Heritage Areas: With Special Reference to Cairo, an Approach towards Conservation and Control", M.Sc. Thesis, Faculty of Engineering, Cairo University, 1992.
16. Abdelaziz, K., "New Development in Heritage Areas on the Relationship between the Context and Development Control Guidelines", M.Sc. Thesis, Faculty of Engineering, Cairo University, 1999.
17. Bashandy, S., "The Visual Character of Urban Areas", M.Sc. Thesis, Faculty of Engineering, Cairo University, 1984.
18. United Nation, "The Sustainable Development Goals Report", New York, 2017.
19. Department of Environmental Affairs and Tourism DEAT, "Life Cycle Assessment: Integrated Environmental Management Information Series", South Africa, 2004.
20. Filimonau, V., "The Life Cycle Thinking Approach and the Method of Life Cycle Assessment", in Life Cycle Assessment and Life Cycle Analysis in Tourism Book, pp. 9-42, Springer, 2016

21. Roberts, S., "A Critical Evaluation of the City Life Cycle Idea", Urban Geography, Vol. 12, No. 5, pp. 431-449, 1991.
22. Khasreen, M., Banfill, P., and Menzies, G., "Life-Cycle Assessment and the Environmental Impact of Buildings: A Review", Journal of Sustainability, Vol. 1, No. 3, pp. 674-701, 2009.
23. United Nation Environment Programme UNEP, and Society of Environmental Toxicology and Chemistry SETAC Life Cycle Initiative, "Towards a Life Cycle Sustainability Assessment: Making Informed choices on Products", 2011.
24. United Nation Environment Programme UNEP, and Society of Environmental Toxicology and Chemistry SETAC Life Cycle Initiative, "Life Cycle Approaches: The Road from Analysis to Practice", 2005.
25. International Organization of Standardization ISO, "Environmental Management-Life Cycle Assessment-Principles and Framework-14040", Geneva, Switzerland, 2006.
26. http://www.lema.ulg.ac.be/research/Suit/download/SUIT5.2f_PPaper.pdf (Accessed 10/10/2020).
27. Norman, J., MacLean, H. L., and Kennedy, C. A., "Comparing High and Low Residential Density: Life-Cycle Analysis of Energy Use and Greenhouse Gas Emissions", Journal of Urban Planning and Development, Vol. 132, No. 1, 2006.
28. Kusumawanto, A., Astuti, Z. B., Millati, R., and Lourenco, J. M., "Life Cycle Analysis of Zero Waste Management for Gongol Green City", the 7th International Conference of Sustainable Development in Building and Environment, United Kingdom, 2015.
29. Herfray, G., Vorger, E., and Peuportier, B., "Life Cycle Assessment Applied to Urban Settlements and Urban Morphology Studies", Paris Institute of Technology, France, 2011.
30. Du, P., Wood, A., and Stephens, B., "Life Cycle Assessment of Urban vs. Suburban Residential Mobility in Chicago", Architectural Research Center Consortium ARCC Conference, the Future of Architectural Research, Chicago, 2015.
31. Brunner, H., Hirz, M., and Fabian, J., "Life Cycle Assessment of Urban Mobility", FISITA World Congress, Maastricht, Netherlands, 2014.
32. Eckelman, M. J., "Life Cycle Assessment in Support of Sustainable Transportation", Journal of Environmental Research Letters, Vol. 8, No. 2, 2013.
33. Yang, X., Wang, H., and YAO, J., "Evaluation of Urban Settlements Whole Life Cycle Environmental Value", International Conference on Construction and Real Estate Management ICCREM, pp. 1608-1618, 2014.
34. Spatari, S., Yu, Z., and Montalto, F. A., "Life Cycle Implications of Urban Green Infrastructure", Journal of Environmental Pollution, Vol. 159, No. 8-9, pp. 2174-2179, 2011.
35. Weiler, V., Harter, H., and Eicker, U., "Life Cycle Assessment of Buildings and City Quarters Comparing Demolition and Reconstruction with Refurbishment", Journal of Energy and Buildings, Vol. 134, pp.319–328, 2017.
36. Goldstein, B., Birkved, M., Quitzau, M., and Hauschild, M., "Quantification of Urban Metabolism through Coupling with the Life Cycle Assessment Framework: Concept Development and Case Study", Environmental Research Letters, Vol. 8, No. 3, 2013.
37. Trigauxa, D., Allackera, K., and De Troyera, F., "Life Cycle Assessment of Land-Use in Neighborhoods", Journal of Procedia Environmental Sciences, Vol. 38, pp. 595-602, 2017.
38. Nel, D., "Exploring a Complex Adaptive Systems Approach to the Study of Urban Change", Master Thesis, University of Pretoria, 2015.

39. Forgaci, C., and Van-Timmeren, A., "Urban Form and Fitness: Towards a Space Morphological Approach to General Urban", the 20th Annual International Sustainable Development Research Conference, University of Science and Technology, Trondheim, Norway, 2014.
40. Meerow, S., and P.Newell, J., "Urban Resilience for Whom, What, When, Where, Why?", Journal of Urban Geography, Vol. 40, No. 3, pp. 309-329, 2016.
41. Aytac, D. O., Arslan, T. V., and Durak, S., "Adaptive Reuse as a Strategy toward Urban Resilience", European Journal of Sustainable Development, Vol. 5, No. 4, pp. 523-532, 2016.
42. Chelleri, L., "From the Resilient City to Urban Resilience", Documents d'Anàlisi Geogràfica, Vol. 58, No. 2, pp. 287-306, 2012.
43. Westerveld, J., "The Adaptive Cycle of Change: an Exploratory Study of Uncertainty and Resilience within Organizations", M. Sc. Thesis, University of Amsterdam, Faculty of Natural Sciences, Mathematics and Informatics, 2014.
44. Marcus, L., and Colding, J., "Toward an Integrated Theory of Spatial Morphology and Resilient Urban", Journal of Ecology and Society, Vol. 19, No. 4, 2014.
45. "The Egyptian Unified Building Law 119", 2008.
46. S.Gülin, B., and Gurkan, U. C., "Analyzing the Relationship between Urban Identity and Urban Transformation Implementations in Historical Process: The Case of Isparta", International Journal of Architectural Research, Vol. 9, PP. 158-180, 2015.
47. ETH Studio Basel Contemporary City institute, "French Mandate Report", Beirut, 2009.

تقييم دورة حياة التراث العمراني: كأداة لتفعيل استدامة المناطق ذات القيمة التراثية

تأثرت المناطق ذات القيمة التراثية بالعديد من العوامل وبالأخص فكر العولمة الذي ساهم في فقدان الهوية العمرانية المحلية، وأصبح من الصعوبة السيطرة على التغيرات العمرانية التي تحدث بتلك المناطق خلال المراحل الزمنية المختلفة رغم تنفيذ العديد من مشاريع الحفاظ والاستراتيجيات والسياسات العمرانية لتعزيز الهوية العمرانية للمناطق ذات القيمة التراثية. لذلك يهدف البحث إلى تفعيل إحدى أدوات التنمية المستدامة "أداة تقييم دورة الحياة" ونظرية "دورة الصمود" من أجل اقتراح أداة لتقييم ومتابعة دورة حياة التراث العمراني بهدف استدامة المناطق ذات القيمة التراثية والهوية العمرانية المحلية. وتمثل هذه الأداة نظام متابعة ورصد وتقييم دوري لعمران المناطق ذات القيمة التراثية بهدف ضمان استدامتها على مدار المراحل الزمنية المختلفة. ثم تم اختبار وتأكيد صلاحية تفعيل الأداة عن طريق دراسة ميدانية مع مجموعة من الخبراء العمرانيين والمعماريين في مجال الحفاظ العمراني، وبناءً على تلك الدراسة تم التوصل إلى تدقيق عناصر الأداة وتحديد المتغيرات العمرانية الأكثر والاقل فعالية في تقييم ومتابعة ورصد مراحل دورة عمران المناطق ذات القيمة التراثية المصرية.