World Academy of Science, Engineering and Technology
International Journal of Urban and Civil Engineering
Vol:15, No:6, 2021

Analysis of Differences between Public and Experts' Views Regarding Sustainable Development of Developing Cities: A Case Study in the Iraqi Capital Baghdad

Marwah Mohsin, Thomas Beach, Alan Kwan, Mahdi Ismail

***Abstract*—**This paper describes the differences in views on sustainable development between the general public and experts in a developing country, Iraq. This paper will answer the question: How do the views of the public differ from the generally accepted view of experts in the context of sustainable urban development in Iraq? In order to answer this question, the views of both the public and the experts will be analysed. These results are taken from a public survey and a Delphi questionnaire. These will be analysed using statistical methods in order to identify the significant differences. This will enable investigation of the different perceptions between the public perceptions and the experts' views towards urban sustainable development factors. This is important due to the fact that different viewpoints between policy-makers and the public will impact on the acceptance by the public of any future sustainable development work that is undertaken. The brief findings of the statistical analysis show that the views of both the public and the experts are considered different in most of the variables except six variables show no differences. Those variables are 'The importance of establishing sustainable cities in Iraq', 'Mitigate traffic congestion', 'Waste recycling and separating', 'Use wastewater recycling', 'Parks and green spaces', and 'Promote investment'.

***Keywords*—**Urban sustainable development, experts' views, public views, statistical analysis.

I. Introduction

GLOBALLY cities are the engines of economic and social development and are also responsible for the majority of energy consumption and global CO_2 emissions. Currently, more than 50% of the global population live in cities [1], [2]. Due to rapid urbanisation, this figure is projected to increase to nearly 70% by 2050 [2]. Globally cities are the engines of economic and social development [3] and are also responsible for the majority of energy consumption emitting more than 70% of global CO_2 emissions [5]. The most recent increases in demand for energy, transportation, social services, and economic activities are in developing countries, especially China, India, and the Middle-East regions [4]. This results in rapid urbanisation rates and population inflation. Currently, urbanisation rates in developing economies are higher than in developed countries [6]. Consequently, the urban population in developing regions is forecast to increase from 46% in 2010 to 65% by 2050 [7]. Based on this evidence, there is a broad consensus on the need to adopt practical solutions to address urban challenges, for both new urban developments and redevelopment of existing cities. This will mitigate local issues, including environmental, social, and economic aspects. It will also achieve an adequate balance between various aspects of sustainability issues.

The concept of sustainable development emerged from the United Nations Conference on Environment and Development (UNCED), 1992. The importance of adopting urban sustainable development to address urbanisation across diverse cities has since been widely agreed [3], [5].

The concept of sustainable development can be defined as the flexibility of urban areas to achieve a quality and standard of living in both the current and coming years without affecting the needs of future generations and reduce the undesirable effects of environmental pollution [7].

Urban design factors, specifically those relating to urban planning, are generally adopted from different global countries, but there is an urgent need to identify the key factors fit for tackling locality-specific issues. These factors are linked in many aspects, such as population density, employment, social services and standard of living.

Currently, urban sustainable development and the need to improve the quality of life are emphasised to control rapid urbanisation, declining resource consumption, environmental pollution, preserve the ecosystem, and promote investment [6]. Thus, urban sustainability has become popular in many countries, as reflected in the development of new urban areas, strict regulations and the new built environment while promoting sustainable methods to mitigate undesirable effects in current applications and future practices.

Urban sustainable development is one of the most important areas in urban design and development. However, an urban sustainability framework is required to help policy-makers, city developers and professionals to identify the significant aspects related to the standard of living and environmental issues at different project stages [8].

The aim of this paper to analyse the differences views

M Mohsin is PhD researcher with the BRE Centre for Sustainable Construction of School of Engineering, Cardiff University, Cardiff, UK (corresponding author, phone: 0044(7909298983); e-mail: MohsinMM@ Cardiff.ac.UK).

Dr. Beach is Senior Lecturer and Prof. Kwan is a Professor with the BRE Centre for Sustainable Construction of School of Engineering, Cardiff University, Cardiff, UK (e-mail: BeachTH@Cardiff.ac.UK, Kwan@ Cardiff.ac.UK).

Dr. Ismail is an international expert with the UNDP program in Iraq and the Ministry of Planning (e-mail: alalak_mm@ yahoo.com).

between both the experts and the general public views towards urban sustainability issues. The following sections of this paper will discuss the general public awareness on urban sustainability issues, experts' views on urban sustainability, methodology for analysing the differing views of experts and the general public. Then, in Section VI this paper analyses the differing views of experts and the general public, including the use of statistical methods approach. Finally Section VII concludes the paper.

II. General Public Awareness towards Urban Sustainability Issues

A public survey was conducted to assess social awareness towards sustainability issues. The findings of respondents (n = 750) show that citizens are informed and interested in multiple issues of sustainable urban development, in so far as they expressed their willingness to pay extra to live in sustainable regions in the coming years.

In terms of the aspects of the sustainable cities, as shown in Fig. 1, '33%' of the respondents voted that they are moderately concerned and also informed, followed by 25% claiming the concept 'very concerned' while, 6.5% only of the participants did not know much knowledge regards sustainability issues; this means that the local community needs training programmes to raise their knowledge of sustainability issues. Consequently, nearly two-thirds of the respondents (68.4%) totally agreed that the Iraqi cities should be developed in sustainable ways (Fig. 2). Fig. 3 presents that 71.6% of the participants have a willingness to pay extra fee to live in a sustainable city, this is a significant indication of public awareness. This is a positive result for Iraqi policy makers who plan to adopt sustainability issues as an effective strategy to address urban challenges in order to meet the current and future requirements needs of the local community and respecting social and cultural background.

From the findings discussed above, the results revealed that the willingness to pay extra in order to live in a sustainable city, reflecting the respondents' concerned towards applications of urban sustainability issues and their awareness regarding the development of Iraqi cities should be achieved under sustainable methods.

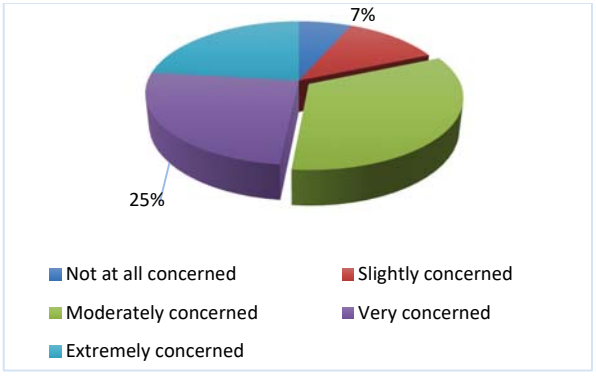

Fig. 1 Concern towards sustainability issues in Iraq

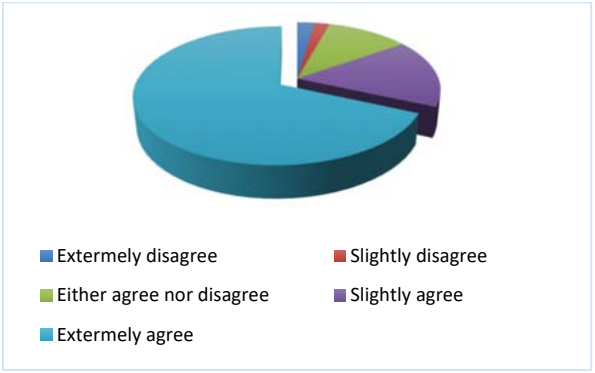

Fig. 2 The development of Iraqi cities by sustainable methods

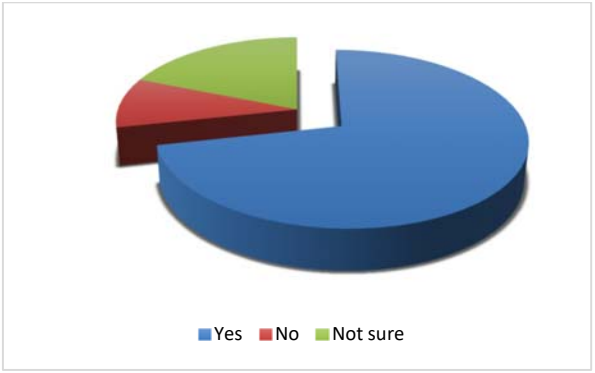

Fig. 3 Willingness to pay additional fees to live in a sustainable city

III. Experts' Views on Urban Sustainability

This section will describe the views of sustainability that were gathered from the experts' panel via a Delphi Survey. To gather this information the experts were asked to rank a series of urban sustainability indicators through three rounds of the Delphi survey. These indicators as a set of sustainability indicators that were generated from the Delphi Survey were based on three rounds of consultation with the experts panel. Many of the suggested indicators were considered very important or important and added as additional indicators integrated throughout each of the categories. Table I documents the detailed indicators, sub-indicators, and the additional indicators with their results as a set of urban sustainability factors, which is represented the third dimension of the proposed framework, while the following text discusses each category in more detail:

Environmental Indicators: include six factors from the environmental indicators and four factors from the ecology indicator. Most of these environmental and ecology factors were rated very important and important, the average mean rank between 4 and 4.5. The results show the top factor in this category was to reduce pollution, ranked 4.85, followed by green areas e.g. parks, rated 4.81 out of 5. This was followed by waste separation and recycling, rated at 4.77. The least important item was water bodies, rated 4.04.

Water indicators: The most significant factor is water indicator in hot dry regions including Iraq. This country has recently experienced water shortages because of an increase in

desertification. There are different strategies to monitor water usage for future applications and enhance the efficiency of the water system. This category involves 5 factors. The findings revealed that 'water conservation', 'provide onsite water quality' and 'efficient water systems' were deemed to be very important with mean ranks of 4.8, 4.71 and 4.7, respectively. The remaining factors 'diversity of water resources' and 'wastewater recycling' were rated as important with means of 4.14 and 4.45, respectively as listed in Table I. Regarding energy indicators, this study emphasised the minimisation of energy consumption as one of the most important factors to reduce CO_2 emissions and environmental pollution. The findings of three Delphi rounds showed that 'use alternative renewable energy e.g. PV solar' and 'minimising energy consumption' were rated the most important indicators with means of 4.57 and 4.55, respectively. This study also focused on the using of solar energy techniques for new buildings, but some suggested techniques were not rated as functional e.g. 'use solar wall techniques' and 'PV on external windows'.

Transportation, infrastructure and public services and utility factors: these included public transport, walkability, and safe streets. The most popular factors were 'mitigate traffic congestion' and 'walkability' (means = 4.77) to tackle the major problem of traffic congestion in the capital, Baghdad. The third important factor was 'diversity of transport modes' (mean = 4.53) as compensation for the acute shortage of alternative transport solutions including buses, subways and trains. The lowest rated factor was 'use of private car' (mean = 2.89) as an essential method of transportation. Current acute traffic congestion is the result of the use of private cars by local families as there are no other modes of public transport available.

Cultural factors: this category includes four urban factors that deal with community culture. The most important indicator was 'preservation of traditional building' rated with a mean of 4.58. This was followed by 'promote the use of natural lighting for diversity building' (mean = 4.42). The lowest rated factor was 'promote traditional design for the new buildings' (mean = 3.99). In the context of social factors, there are three urban indicators in terms of social context, a further two indicators added by the expert panel. The most important factor was 'fines for violators' (mean = 4.67) including those who tamper with public services, violate laws and regulations thus increasing social problems. The next important indicator was 'provide social awareness programs' through educational system (curriculum) (mean = 4.57). The remaining indicators were considered to be the least important and included 'promote intensive social programs', 'stakeholders' participation in decision–making', 'skills improvements programs', and 'women involvement'.

In terms of innovation factors, the five factors related to the innovation indicators were all rated as less important because the experts considered this category as secondary to the need to enhance essential requirements. That said, the most important indicator was 'use of innovative methods' (mean = 4.37) because of the aim to develop current and future applications.

Safety and security factors: the experts rated safety and security indicators as a significant issue because of policy problems and deteriorations in security. Four safety indicators emphasised identifying protection policy, both at the city and individual building level. The most important indicator in this context was 'provide camera security onsite' and 'provide smart existing doors' (means = 4.49) because of the aim to improve difficult living conditions in politically-unstable regions. 'Fire alarm system' was rated to be the important factor.

One of the most important factors is economic factors; this category includes eight indicators all of which were rated as important to the development of the local economy. That said, two were rated as less important than the others; 'foreign experience' and 'commercial awareness programs onsite' (means of 3.96) because of encouragement from the experts to employ locals to reduce the high percentage of employment. 'Diversity of economic activities instead of a single economy (oil)' has occupied the most important position (mean = 4.9) among a set of overall urban sustainability indicators due to the sharp decrease in the state budget which is dependent on the export of oil, this declining from time to time. As a result, this issue has negatively affected the labour market and the economy of the country. This was followed by, 'employment' (4.75) as the second important factor, strongly related to the previous indicator.

Management factors, there are six factors in this section which were rated as important or very important, the experts considering these key to enhance public services and facilities for the local population. One of the most significant indicators was 'ensure long-term maintenance' (mean = 4.66) followed by 'use an electronic governance system' (mean = 4.61) because of the need to change the traditional system. In addition, 'mitigate traffic congestion' and 'comprehensive updates schemes' were rated as very important factors (means = 4.51) due to the essential need to mitigate traffic problems and develop institutional work i.e. municipality activities and research, as illustrated in Table I.

IV. Methodology for Analyzing the Differing Views of Experts and the General Public

This section compares the views of experts and the general public, which will reveal any differences in the public's and experts' views of urban sustainable development goals. This is important as differences in viewpoints will identify areas of the developed framework that will face increased tension when deployed in reality.

To compare the views of respondents, 19 urban sustainable development goals were analysed to show the differences between the public's perceptions and the experts' viewpoints. There are 19 common elements between the public survey and the expert questionnaire, which are drawn from a set of urban sustainable development goals and which have been tested via statistical methods (internal consistency and reliability by using Cronbach's alpha coefficient; sample adequacy with Bartlet's test; factor analysis principal component analysis, PCA) to generate a significance value for each variable and to

identify the significant factors depending on the characterisation of a group of correlated variables. The t-test will then be applied to identify the differences among the 19 common items, as shown in Tables II-IV.

TABLE I
THE INDICATORS AND SUB-INDICATORS FOR A SET OF URBAN SUSTAINABLE DEVELOPMENT FACTORS

Indicator	Sub-indicators	Round 1		Round 2		Round 3		Status
		Mean	SD	Mean	SD	Mean	SD	
Environment and Ecology	Reduce pollution	4.72	0.53	4.85	0.36	-	-	Achieved
	Vegetation cover and green areas	4.7	0.53	4.81	0.5	-	-	Achieved
	Site micro-climate	4.37	0.69	4.45	0.66	-	-	Achieved
	Waste separation and recycling	4.6	0.65	4.77	0.46	-	-	Achieved
	Use sustainable construction materials	4.26	0.75	4.34	0.7	-	-	Achieved
	Shaded streets and protected open spaces	4.36	0.71	4.51	0.66	-	-	Achieved
	Water bodies	4.01	0.86	4.06	0.86	-	-	Achieved
	Balance ratio between green spaces and built-up areas	4.56	0.59	4.72	0.56	-	-	Achieved
	Conservation of agriculture land	-	-	4.74	0.55	4.71	0.6	Achieved
Water	Water conservation	4.77	0.53	4.83	0.42			Achieved
	Onsite wastewater recycling	4.32	0.71	4.58	0.66			Achieved
	Provide onsite water quality	4.67	0.6	4.75	0.47			Achieved
	Diversity of water resources onsite	4.07	0.8	4.21	0.83			Achieved
	Efficiency water system	-	-	4.6	0.62	4.8	0.44	Achieved
Energy	Minimise energy consumption	4.52	0.69	4.58	0.63			Achieved
	Use of insulation	4.4	0.73	4.58	0.63			Achieved
	Use alternative renewable energy	4.44	0.7	4.7	0.6			Achieved
	Smart energy management	4.19	0.79	4.31	0.89			Achieved
	Smart and safe energy distributed system	-	-	4.06	0.75	4.34	0.64	Achieved
	Smart solar heating water	-	-	4.22	0.83	4.24	0.8	Achieved
	Solar energy							Achieved
	Use the PV on top of the building	4.33	0.77	4.35	0.77	-	-	Achieved
Transportation	Promote of public transport	4.75	0.45	4.89	0.37	-	-	Achieved
	Walking as a mean of mobility particularly nearby distance	4.34	0.7	4.89	0.37	-	-	Achieved
	Use of private car	3.08	0.94	2.7	0.81	-	-	Achieved
	Mitigate traffic congestion	4.7	0.56	4.83	0.42	-	-	Achieved
	Provide bicycle streets networks	3.91	0.9	4	1.05	3.96	0.98	Achieved
	Safe streets network onsite	4.27	0.74	4.43	0.77	-	-	Achieved
	Diversity transport modes	4.67	0.63	4.83	0.42	-	-	Achieved
	Public car parking availability	4.38	0.77	4.45	0.72	-	-	Achieved
Public services and infrastructure	Provide activities areas for the elderly and disabled	4.2	0.81	4.45	0.72	-	-	Achieved
	Designated activities areas for children's play areas	4.49	0.64	4.77	0.46	-	-	Achieved
	Provide recreational facilities	4.36	0.72	4.6	0.53	-	-	Achieved
	Promote cultural activities	4.04	0.85	4.21	0.81	-	-	Achieved
	Develop health care centres	4.24	0.61	4.66	0.55	-	-	Achieved
	Emergency paths network	-	-	4.42	0.71	4.4	0.6	Achieved
	Use of camera security system in motorways	-	-	4.55	0.69	4.62	0.6	Achieved
Social and cultural	Preservation of traditional building	4.55	0.72	4.6	0.65	-	-	Achieved
	Promote traditional design for the new buildings	3.98	0.84	4	0.87	-	-	Achieved
	Provide the hierarchy in public and residential places	4.07	0.82	4.19	0.75	-	-	Achieved
	Promote use of natural lighting and for diversity buildings	4.41	0.68	4.43	0.66	-	-	Achieved
	Promote intensive social programs	4.57	0.62	4.57	0.6	-	-	Achieved
	Provide social awareness programs through educational curriculum	4.55	0.59	4.53	0.6	-	-	Achieved
	Stakeholders' participation in decision-making	4.53	0.64	4.51	0.6	-	-	Achieved
	Skills improvements programs, women involvement	-	-	4.18	0.71	4.23	0.73	Achieved
	Fines for violators	-	-	4.7	0.57	4.64	0.56	Achieved
Innovation factors	Smart shading devices	3.91	0.8	3.91	0.78	-	-	Achieved
	Use travel time management system	4.21	0.7	4.32	0.61	-	-	Achieved
	Use smart traffic system	4.38	0.75	4.36	0.65	-	-	Achieved
	Provide smart guidelines in the buildings	4.04	0.85	4.26	0.76	-	-	Achieved
	Adopt Building Information Modelling (BIM)	-	-	4.17	0.77	4.14	0.8	Achieved
	Ensure safety construction	4.65	0.56	4.17	0.77	-	-	Achieved
	Provide smart existing doors	4.38	0.75	4.6	0.65	-	-	Achieved

Indicator	Sub-indicators	Round 1		Round 2		Round 3		Status
		Mean	SD	Mean	SD	Mean	SD	
	Fire alarm system	4.6	0.6	4.72	0.56	-	-	Achieved
	Provide camera security onsite	4.4	0.72	4.72	0.65	-	-	Achieved
Economic factors	Promote investment	4.63	0.58	4.62	0.58	-	-	Achieved
	Develop the tourism sector	4.45	0.66	4.55	0.69	-	-	Achieved
	Employment	4.74	0.5	4.75	0.51	-	-	Achieved
	Foreign experience	4.11	0.8	3.81	0.83	-	-	Achieved
	Promote use of local materials	4.56	0.64	4.7	0.5	-	-	Achieved
	Diversity of economic activities instead of single economy (oil)	-	-	4.87	0.44	4.92	0.27	Achieved
	Cooperating between public and private sector	-	-	4.58	0.6	4.64	0.55	Achieved
	Commercial awareness's programs onsite	-	-	3.87	0.91	4	0.69	Achieved
Management factors	Reduce Life Cycle Assessment (LCA) cost	4.24	0.7	4.47	0.66	-	-	Achieved
	Ensure a long- term maintenance and management	4.59	0.55	4.72	0.56	-	-	Achieved
	Use an electronic governance system	4.57	0.62	4.64	0.68	-	-	Achieved
	Establish postal code system	4.21	0.72	4.3	0.86	-	-	Achieved
	Create various opportunities for local people to participate in multiple activities	4.39	0.77	4.3	0.77	-	-	Achieved
	Comprehensive updates schemes	-	-	4.4	0.76	4.62	0.56	Achieved

To explore the common factors of the relationships between the viewpoints of experts and the public the following statistical tools have been used;

First, internal consistency and reliability were identified via Cronbach's alpha coefficient (α) [6]. This coefficient α provides a single value to assess internal consistency or average correlation of survey factors to measure reliability [3] [7]. Many studies have claimed that α = 0.70 and higher is an acceptable level of reliability [4], [8].

Second, factor analysis attempts to identify underlying variables that explain the pattern of correlations within a set of observed variables. This is often used in data reduction to identify a small number of factors that explain most of the variance that is observed in a much larger number of manifest variables. The factor analysis model specifies that variables are determined by common factors (estimated by the model) and unique factors (which do not overlap between observed variables).

The purpose of factor analysis is to uncover the latent structure of multiple variables; that is to reveal any latent variables that explain the correlations among the variables, called dimensions. Therefore, factor analysis is based on the assumption that all variables are correlated to some degree.

There are many methods to extract factor analysis results, PCA (Principal Component Analysis), which is available in many statistical software packages, including SPSS, is an easiest method for creating new structures called principal components. PCA is an important statistical tool to identify the underlying structure by characterising/classifying a group of correlated variables. The significant of a component is evaluated by examining scree plots and the contribution of each individual component to the total of variance more than 5%. Variance Maximization (varimax), as an orthogonal rotational strategy, is used as the result of the PCA. Rotation generally reduces the number of factors, where the variables under investigation/processing have high loadings, resulting in the easier interpretation of the analysis [2], [3], [5]. These structures are considered linear composites of the original variables and are uncorrelated. The first principal component presents for as much of the variance as possible, while the second principal component accounts for the remaining variance [11]. This approach is applied then successively for the rest of the principal components.

The Principle Component Analysis (PCA) usually deals with factors equal to the total number of variables, in order to reduce the number of factors to only the significant factors. This study uses the criterion that the eigenvalues exceed 1, where eigenvalues > 1 are less than the total number of factors and usually they are less than half the number. This, at the end normally reduces the dimensions of the factors. This means the number of vectors is equal to the number of variables (r) [10].

Eigenvalues are a special set of scalars associated with a linear system of a correlate matrix. They are used to reduce dimension space in such a way that instead of analysing r factor (r = 19 in this study), it is meaningful to select a few of them much less than r. The rule of determining the number of factors is simply restricted to the number of Eigenvalues that their values exceed 1.

$$\frac{E_1 \geq E_2 \geq \cdots \geq E_K}{No.of\ selected\ factors} \geq \frac{E \leq 1.0 \geq \cdots \geq E_{19}}{factors\ ignored}$$

The extracted PCA factors are usually followed by a rotation process to reduce the number of items on which the different variables have high loadings (usually < 0.4), which makes interpretation of the analysis easier [8], [9]. Variance Maximization (Varimax) was applied using the initial findings of the PCA.

Third; Bartlett's test of sphericity is used to identify significant correlations between items. Sampling adequacy is assessed using Kaiser-Meyer-Olkin (K-M-O). If the value of K-M-O is more than 0.8, then it can be considered good and indicates that PCA is a useful way to interpret these variables [4] [12].

The t-test method can measure and investigate the size of the difference of two means relative to the variation in the

sample data. The t-value is simply estimated as:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_{1-1}} + \frac{s_2^2}{n_{2-1}}}}$$

where x1 and x2 are the expected means; s_1^2 and s_2^2 are the corresponding variances; and n1 and n2 are the sample sizes. The calculated value is compared with t - standard table, under n1 + n2 - 2 degrees of freedom [12]. The comparison result gives the evidence of the significant difference if tc > tt.

V. Results

Fitness of data is an important value to show in this study, there are two datasets used, as shown in Tables II and III. The first dataset is the experts, with a matrix of 53 observations and 19 variables as a part of urban sustainable development factors. The second dataset is used for the public, with a matrix of 750 observations and 19 variables.

The variables of the two sets are quantitative, and the data for which Pearson correlation coefficients can sensibly be calculated are suitable for factor analysis. Cronbach's alpha (x) test has been used to test the assumption of reliability (internal consistency) (i.e. how closely related a set of items are a group), where: $\alpha \geq 0.9$ shows an excellent internal consistency; $0.8 \leq \alpha \leq 0.9$ shows a good internal consistency; and $0.7 \leq \alpha \leq 0.8$ shows an acceptable internal consistency. The results of Cronbach's test have shown that: (a) the public's data are of excellent internal consistency, where $\alpha = 0.934$; and, (b) the experts' data set is of good internal consistency, where $\alpha = 0.830$.

The K-M-O test measures how suited the data are for factor analysis. The results of the K-M-O test show that: (a) the level of public sampling is good. K-M-O = 0.956, where the sample size of the public survey is n = 750; and, (b) the level of experts sampling adequacy is less than public sampling adequacy (K-M-O = 0.599), which is considered a mediocre level because the sampling size is less than the public respondents. The factor analysis model is extracted (by using PCA) for each of the two sets to investigate the number of underlying factors. The extracted factors have been rotated by the varimax method. The next sub-sections will present the findings of the PCA, in terms of the public's views and the experts' consultation, then the results of the t-test for the same 19 common items in order to show the differences among the categories as shown in Tables II-IV.

A. Results of the Expert Views Analysis

The main results of PCA will be analysed the experts' views (see Table II). There are 19 variables listed in the first column, followed by the Rotated Component Matrix, which contains six factors. The last two columns of Table II represent the explained variance (communalities) and the unexplained variance, which means (1- explained variance). At the end of the table, there are three rows, one of the eigenvalues (E.V), followed by total variance explained % and the Cumulative %. Six Eigenvalues are < 1; e.v1 = 4.133, e.v2 = 1.99 … e.v6 = 1.228, and hence the rotated component Matrix has six factors. These factors explained 66.6% of the total variance. The first factor explained the maximum variance of 27% and the second explained 10.5%. The other four successive components explain progressively smaller portions of the variance, as shown in the lower part of Table II. The first factor includes significant loadings (< 0.4) of the walking or bike as a mean of transport, improve social activities, and social awareness programs variables, with 0.78, 0.68, 0.68 respectively, and with less loading value (0.47) of promotion of public transport. This reflects the "impact of social consideration as a most important pillar" of the proposed local comprehensive sustainability framework for Baghdad.

The second factor includes four significant loadings of renewable energy sources, reduce pollution, parks and green areas, and mitigate traffic congestion variables, with 0.74, 0.71, 0.60, 0.57 respectively. It is obvious that the second-factor structure reflects an "energy and environment pillar".

The third factor, which explains 8.8% of the total variance, includes the promote investment (0.86); employment (0.71) and with less loading value of minimum energy consumption variables. This factor reflects the impacts of "creating jobs".

The fourth factor, with less variance explained (7%), refers to the impact of basic service basic needs. The highest loadings of this factor are shown with (promote cultural activities and improve educational and health services) with 0.75 and 0.59, respectively.

The fifth factor explains about 66% of the total variance and reflects the impact of "smart energy and management", including alternative materials (0.74); waste recycling and separation (0.73); use of insulation (0.63).

The last factor explains 6.5% of the total variance only, which is the least importance of the six factors, high loadings of promotion of public transport (0.6) and wastewater recycling (0.59) towards a negative high loading of -0.71 reflects the unstable vision of the respondents.

Communality can now be defined as an individual variable that represents the total variance of the variable, this means that the variable is considered related highly with other variables, and vice versa. The communalities in Table II indicate the common variance shared by factors with given variables. Higher communality indicates that a larger amount of the variance in the variable has been extracted by the factor solution. To achieve better measurement of factor analysis, commonalities should be 0.4 or greater.

To show the relative importance of each of the 19 variables of the sustainability approach, the common variance, shared by the main six factors has been used. The main pillars of the expert consensus have shown that the 19 variables are being listed from the high level of common variance extracted from the factor model to the lower level as follows: 17, 12, 6, 1, 7, 10, 13, 3, 4, 2, 16, 19, 11, 5, 18, 8, 9, 14, and 15. It is obvious to indicate that the relative importance of each variable decreases as the value of its communality decreases.

TABLE II
FACTOR ANALYSIS OF EXPERTS' VARIABLES

Variables	Rotated Component Matrix-Experts						Communalities (explained variance)	Unexplained variance (1-explained)
	Factors							
	1	2	3	4	5	6		
1. Walking or bike as a mean transport	0.781						0.732	0.268
2. Improve social activities	0.680			0.354			0.697	0.303
3. Social awareness programs	0.676	0.331					0.702	0.298
4. Renewable energy sources		0.736					0.700	0.3
5. Reduce pollution		0.711					0.627	0.373
6. Parks and green areas		0.598	0.339				0.752	0.248
7. Mitigate traffic congestion		0.565		0.516			0.712	0.288
8. Promote investment			0.863				0.603	0.397
9. Employment			0.711				0.594	0.406
10. Minimise energy consumption	0.336		0.530	0.469			0.710	0.29
11. Promote cultural activities				0.746			0.632	0.368
12. Improve educational and health services			0.433	0.586			0.754	0.246
13. Smart energy management	0.351	0.393		0.561	0.349		0.706	0.294
14. Alternative materials					0.735		0.565	0.435
15. Waste recycling and separation					0.726		0.499	0.501
16. Use of insulation					0.632		0.655	0.345
17. The importance of establishing sustainable cities in Iraq	0.425					-0.708	0.771	0.229
18. Promotion of public transport	0.473					0.606	0.606	0.394
19. Wastewater recycling						0.587	0.634	0.366
Eigenvalues (E.V)	5.133	1.990	1.671	1.361	1.269	1.228		
Total variance explained %	27.015	10.473	8.795	7.164	6.676	6.465		
Cumulative %	13.500	25.970	37.611	48.459	58.980	66.587		

B. Analysing the Public's Views

The main findings of the public factor analysis are shown in Table III. In this table, the same 19 variables shown in the first column such as improve social activities, increase educational and healthcare services, mitigate traffic congestion, promote cultural activities etc. are followed by the Rotated Component Matrix, involving two factors while the last two columns represent the explained variance (communalities) and unexplained variance, considering (1- explained variance). At the end of the table there are three rows same as shown in Table III, while the Eigenvalues (E.V) in Table III have two factors of the Rotated Component Matrix from the highest value (E.V) = 10.156 of the first, while the lowest value (E.V) = 1.670 of the second factor.

Two common rotated factors are extracted with a total variance explained of 62.2%. The first factor explained more than half a total variance (53.5%) and hence is considered as the main pillar of public vision on local comprehensive sustainability frame for Baghdad. The structure of this factor shows a very interesting conclusion: 12 variables out of the 19 variables are of significant factor loadings values (each ≥ 0.4).

Unlike the expert's vision, with six deterministic pillars on the local comprehensive sustainability frame for Baghdad, the first factor of public vision shows clear consensus. These variables are described as traditional indicators of socio-economic characteristics. Therefore, factor one is considered as a "traditional socio-economic pillar."

The second factor explains only 8.8% of the total variance. This factor consists of significant factor loadings of the rest six variables; waste recycling and separation; smart energy management; alternative materials; wastewater recycling; renewable energy sources; walking or bike as a mean of transport; and concern about future sustainable cities. This means that the new approach of management and materials comes as a secondary interest from a public point of view. Therefore, the second factor could be defined as a "little knowledge of urban sustainable development approach" reflecting on the application/adoption of the new local comprehensive sustainability framework for Baghdad.

The total variance of each variable explained by the two common factors is shown in Table III. Except two variables (improve of social activities and increase of educational and health services), which show high unexplained variance (0.69, and 0.62 respectively), all the other variables are considered to have significant common variances. The relative importance of the seventeen common variables in terms of their communality value is as follows: 5, 4, 7, 8, 3, 15, 6, 9, 13, 17, 10, 14, 19, 12, 11, 18, and 16.

The most important variable is 'employment' with communality, 78%, which could be reflected the ambition of the public towards job opportunities to enhance their economic aspect and improve the quality of life. Followed by the second important variable, which is 'promote cultural activities' about 77%, then 'promote public transport' ranked as the third important variable by 76%. While the lowest communality is 'Improve social activities' rated by 31%.

VI. DISCUSSION

In this study, there is a need to understand the differences between the responses of both the public and the experts. This

study aims to recognize the level of understanding of the differences between both the public and the experts' views towards urban sustainable development goals. It is believed that the level of awareness, experience, and cultural background of the public and experts have their effects on the responses of each of the two groups in terms of the nineteen indicators of the local comprehensive sustainability frame of Baghdad. T-test has been used to identify the evidence of significant differences. Table IV shows the final calculations of the t-test. Therefore, this study has used a t-test approach to identify the evidence of a significant difference between two means ranks for both the public survey and the experts' questionnaire, reflecting their awareness, experience, and cultural background.

TABLE III
FACTOR ANALYSIS OF PUBLIC VARIABLES

Variables	Rotated Component Matrix		Communalities (explained variance)	Unexplained variance (1-explained)
	Factors			
	1	2		
1. Improve social activities	0.840		0.313	0.687
2. Increase educational and health services	0.833		0.381	0.619
3. Mitigate traffic congestion	0.816	0.334	0.719	0.281
4. Promote cultural activities	0.773	0.324	0.778	0.222
5. Employment	0.733		0.780	0.220
6. Reduce pollution	0.772	0.350	0.703	0.297
7. Promotion of public transport	0.765	0.333	0.766	0.234
8. Maximise the use of insulation	0.701		0.734	0.266
9. Minimise energy consumption	0.506	0.354	0.696	0.304
10. Waste recycling and separation		0.782	0.655	0.345
11. Smart energy management	0.336	0.755	0.577	0.423
12. Alternative materials		0.732	0.593	0.407
13. Wastewater recycling		0.716	0.684	0.316
14. Renewable energy sources		0.707	0.628	0.372
15. Walking or bike as a mean transport		0.657	0.708	0.292
16.Social awareness programs	0.443	0.652	0.520	0.48
17. Promote investment	0.359	0.642	0.663	0.337
18. Parks and green parks	0.534	0.615	0.541	0.459
19. Concern about future sustainable cities		0.489	0.622	0.378
Eigenvalues (E.V)	10.156	1.670		
Total variance explained %	53.451	8.790		
Cumulative %	53.451	62.241		

TABLE IV
T-TEST SUMMARY OF THE DIFFERENCES BETWEEN PUBLIC-EXPERT MEAN RESPONSES

Indicator	Mean Response		t-value	Conclusion
	Public	Experts		
1.The importance of establishing sustainable cities in Iraq	4.47	4.34	-1.36	No difference
2. Minimise energy consumption	4.48	4.85	9.96	High significant difference
3. Reduce pollution	4.55	4.77	3.87	High significant difference
4. Mitigate traffic congestion	4.32	4.34	0.26	No difference
5. Improve social activities	4.68	4.79	1.98	Significant difference
6. Increase cultural activities	4.14	4.58	5.41	Very high significant difference
7. Increase educational activities	3.92	4.58	8.41	Very high significant difference
8. Promote the use of public transport	4.2	4.58	4.83	Very high significant difference
9. Providing job opportunities	4.46	4.70	3.09	Very high significant difference
10. Maximise the use of insulation	4.46	4.13	-2.74	High significant difference
11. Renewable energy sources	4.53	4.83	7.11	Very high significant difference
12. Smart energy management	4.35	4.89	13.75	Very high significant difference
13. Use of alternative materials	4.27	4.49	2.24	Significant difference
14. Waste recycling and separating	4.46	4.45	-0.09	No difference
15. Use wastewater recycling	4.27	4.21	-0.55	No difference
16. Walking and bike as a mean transport	4.41	4.66	3.63	Very high significant difference
17. Parks and green spaces	4.5	4.62	1.56	No difference
18. Promote investment	4.48	4.57	1.17	No difference
19. Social awareness programs	4.36	4.75	6.17	Very high significant difference

* Compared to t- tabulated value with n1 +n2 -2 degree of freedom
t (801, 10%) = 1.65 t(801,5%) = 1.96 t(801,0.01) = 2.58, t = (801, 0.001) = 3.29

Table IV shows the final calculations of t-test: 13 of the differences between the public-expert mean responses are significant. This has shown the vision and attitudes of the public and the experts are different in most of the variables. The mean response of six variables are similar, those variables are 1, 4, 14, 15, 17, and 18, as shown in Table IV. This indicates that the effect of the specialist and high education levels is not significant in terms of these variables, which could be because of most of the public respondents and the experts expressed their opinions according to their daily experience and the assessment of the existing city's applications, as well as their hope to raise and improve the quality of life for the current and coming years.

The impact of using statistical analysis for r variables is to validate the findings of this study to show the significance and differences in the respondents' attitude between public views and the experts' views. These statistical methods can be used for further studies of the public's views or experts' consultation to validate the results. The PCA method and t-test are the most common methods to identify the differences and significant values between the two groups. The findings of the statistical analysis revealed that there are considerable differences between both the general public's perceptions and the experts' views, due to practical experience, cultural background, and awareness towards urban sustainable development issues, reflecting their priorities and daily experience. Consequently, further studies can be adopted for any relevant work need to validate and concrete the results. This conclusion reflects the effect of awareness, experience, and cultural background of experts on their different views in terms of the thirteen variables compared to public views.

VII. Conclusion

This paper has highlighted the differences between the viewpoints and the general public that have been elicited in the construction of this framework based on the statistical analysis.

The PCA results for both public and experts attitudes showed wide difference between them, due to the wide knowledge and experience between the public and the experts, while the public findings, reflecting their daily experiences and ambition towards the current and future city's applications to enhance their standard of living and quality of life.

The results of the statistical analysis have answered the RQ: How do the views of the public differ from the generally accepted view of experts in the context of sustainable urban development in Iraq? The key findings of the statistical analysis revealed that most of the common items showed differences views between the public and the experts, except the mean response of six variables are similar that mean there are no differences among them. Those variables are 1 (The importance of establishing sustainable cities in Iraq), 4 (Mitigate traffic congestion), 14 (Waste recycling and separating), 15 (Use wastewater recycling), 17 (Parks and green spaces), and 18 (Promote investment), as shown in Table IV. This indicates that the effect of the specialist and high education levels is not significant in terms of these variables 6 variables, which might be because of most of the general public and the experts expressed their views based on their daily experience and the assessment of the current public services and utilities.

The expert viewpoint impacted significantly in areas where it differed greatly from the public viewpoint. For example the following variables; 'Minimise energy consumption, 'Reduce pollution', 'Increase educational activities', 'Promote the use of public transport', 'Renewable energy sources', 'Smart energy management', 'Walking and bike as a mean transport', and 'Social awareness programs'. These variables showed 'very high significant differences' as shown in Table IV. This indicates that to avoid negative impacts of the implementation of sustainable development the local community needs to raise the level of awareness and influence cultural views towards sustainability issues, especially for those factors that highlighted highly significant differences from the experts' views. If these issues are not overcome then deployment of a sustainable development framework will face significant obstacles.

Acknowledgment

This work was supported by BRE Centre for Sustainable Engineering, School of Engineering, Cardiff University, thE Ministry of Planning, CSO, Iraq, by providing and developing real data for this project. The authors would like to thank all of partners for their indirect support.

References

[1] Ameen, R.F.M. and Mourshed, M. 2017. Urban environmental challenges in developing countries—A stakeholder perspective. *Habitat International* 64(April), pp. 1–10.

[2] Grant, R. 2015. Sustainable African Urban Futures: Stocktaking and Critical Reflection on Proposed Urban Projects. *American Behavioral Scientist* 59(3), pp. 294–310.

[3] Lange, J. et al. 2012. Potentials and limits of urban rainwater harvesting in the Middle East. *Hydrology and Earth System Sciences* 16(3), pp. 715–724.

[4] Omer, A.M. 2008. Energy, environment and sustainable development. *Renewable and Sustainable Energy Reviews* 12(9), pp. 2265–2300.

[5] UN-Habitat 2014. National Report of the Republic of Iraq for Habitat III 2016. (July 2014). Available at: http://www.hlrn.org/img/documents/Iraq_National_Report.pdf.

[6] Al-Salihi, A.M. et al. 2010. Estimation of Global solar radiation on Horizontal Surface from Routine Meteorological Measurements For Different Cities in Iraq. *Journal of College of Education, Al-Mustansiriyah University* (in press)(April 2010), pp. 1–11.

[7] Aldossary, N.A. et al. 2014a. Domestic energy consumption patterns in a hot and arid climate: Amultiple-case study analysis. *Renewable Energy* 62, pp. 369–378.

[8] Ameen, R.F.M. and Mourshed, M. 2017b. Urban environmental challenges in developing countries: A stakeholder perspective. *Habitat International* 64(April), pp. 1–10.

[9] Assefa, G. and Frostell, B. 2007. Social sustainability and social acceptance in technology assessment: A case study of energy technologies. *Technology in Society* 29(1), pp. 63–78.

[10] Giannarou, L. and Zervas, E. 2014. Using Delphi technique to build consensus in practice. *International Journal of Business Science and Applied Management* 9(2), pp. 65–82.

[11] Grant, R. 2015. Sustainable African Urban Futures: Stocktaking and Critical Reflection on Proposed Urban Projects. *American Behavioral Scientist* 59(3), pp. 294–310.

[12] Habibi, A. et al. 2014. Delphi Technique Theoretical Framework in Qualitative Research. *The International Journal of Engineering and Science* 3(4), pp. 2319–1813.