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Gender Centricity of Smart Cities: What Matters Most?

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Gender Centricity of Smart Cities: What Matters Most?

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Abstract:

Purpose: The paper analyses the concept of the smart city from gender perspective, focusing on the knowledge implications for smart cities in India. The present study is a focused survey based on expert's opinion to explore the gender perspectives of "Smart Cities" in a holistic manner by focusing on all critical gender dimensions that should find a place in projects and plans. As India has also embarked upon a Smart Cities Mission, the study tries to explore which gender perspectives are more crucial and what are the constituent features of these broader gender perspectives.

Design/methodology/approach: A structured questionnaire has been adopted to survey and collect data from 99 respondents who are involved in policy making and implementing the Smart Cities Mission from 16 states of India. The study focused on five key dimensions of smart cities that is Safety, Equal Opportunity to Work, Health and Hygiene, Infrastructure and Housing and Urban Mobility with 29 constructs. The constructs in this section were measured using a five-point Likert scale ranging. In the first step Factor Analysis has been used to arrive at inferences. In the second step, the principal component analysis method was used suitably as a large number of factors were to be reduced to the most important set of components requiring immediate policy attention.

Findings and Practical implications: The findings connote that the five dimensions e.g., Safe Urban Mobility, Transportation and Infrastructure Development, Capacity Development and Community Based Solutions and Work Welfare are proved to be the most significant indicators to have gender centricity in smart cities of India. The research is an attempt to provide possible explanations to the policy makers and key functionaries involved in Smart Cities Mission for the establishing of gender perspectives in smart cities.

Originality/value: Amidst, the rising concerns of gender centricity in smart cities, the present study is an attempt to explore the gender perspectives in smart cities and related indicators or workable areas so as to achieve this gender centricity. This qualitative study provides a conceptual framework as Gender Centricity -Smart City Model(GCSCM) for policy makers and designers towards building gender inclusive smart cities. The smart city with gender security will be the best answer for the problems that urban areas are facing now.

Keywords: Gender Perspective, Smart Cities Mission, Factor analysis, Gender Centricity -Smart City Model(GCSCM)

Gender Centricity of Smart Cities: What Matters Most?

1. Introduction

The ever-growing population and struggle for sustainability have given rise to several developmental paradigms where livability conditions are being challenged every now and then. Across the world as civilization grew and developed, several imbalances were created in geographical, environmental, ecological and social spheres. These imbalances have several manifestations and dimensions.

For instance, a civilized modern settlement or organized community life is faced by a number of challenges today. To name a few, these range from waste management, preventive healthcare, air quality, traffic congestion and mobility, social safety and security, energy distribution, resource optimization, time management, ease of living and many more. Several such issues gave rise to the "Smart City" concept which stressed on how people live, plan, commute, transact and interact with social, geographical and political systems. The advent of technology has further necessitated the need to rethink how cities operate.

When urban ecosystems are being discussed it is about men and women, young and the old, able as well as disabled. Though the practical needs will be different for all the categories, but a smart city should ideally ensure livability for all. In the wake of poor developmental indicators on women, rising number of women related crimes and increasing concerns on safety, health and empowerment etc., Smart Cities require a gender lens too. When a nation's resources are committed for the development of new age urban systems, it cannot be devoid of gender centricity and the present study tries to explore this in various ways. But before looking into the intersectionalities between gender and smart city, a definitional understanding of the concept is imperative.

1.1 Smart Cities – Definitional Understanding

The word "Smart City" has been used since past several years mostly by technology-based companies. However, the broader meaning refers to revamping of urban infrastructure in terms of accessibility to services, buildings, transportation and mobility, energy & water distribution, public safety etc. (Radovan Novbreakthrootný, 2014, Albert et al. 2009, Chourabi et al. (2012).

Rather most of the contemporary research, conceptual definitions and theories related to Smart City emerged after the year 2000, when technological breakthroughs and innovations were being witnessed across the developed nations. Therefore, it may be inferred that the broader understanding of the concept was related to technological integration for improvement of urban systems through the application of science and technology transformation. Some of the most important definitions by academicians have highlighted the role of technology in Smart Cities thus focusing on "how to become a smart city?" where not much has been spoken about "what actually is a smart city?"

""Smart Cities" is the urban center of the future, made safe, secure environmentally green, and efficient because all structures - whether for power, water, transportation, etc. are designed,

constructed, and maintained making use of advanced, integrated materials, sensors, electronics, and networks which are interfaced with computerized systems comprised of databases, tracking, and decision-making algorithms."(Hall. et al 2000). "Smart Cities focus on quality of life of an urban environment by understanding the city dynamics through the data provided by ubiquitous technology." (Oliver 2011). Most of the authors put forth their propositions as to how technological developments and digital innovations can improve the quality of life in urban ecosystems (Odendaal, Nancy 2003, Bell R., Jung 2008, Komninos N. 2009, Vassilaras 2010).

The submission here is that the prevailing research on the subject falls short of understanding the components and dimensions of smart city development and seems to be overburdened by the emphasis of technology. As a common understanding, today smart cities are perceived as a technology driven urban ecosystem.

1.2 Holistic Understanding of Smart Cities

However, some studies are noteworthy highlighting the human and people related reading of the subject. Amongst them the most popular is the research published by Giffinger et al. (2007) where he attempts to drift from the common understanding of excessive tech centric perspective to a more "human -related reading of the subject." He stresses on people, mobility, economy, environment, governance and living. Similarly, other social and economic dimensions were discussed by Caragliu et al. (2009, 2011) where the focus was on participatory governance, natural resource management and investment in human and social capital. It was argued that smart city is a holistic concept and technology is only a driver but the research in this domain has been largely restricted to application of technology-based solutions with limited interdisciplinary approach where management of social, cultural, economic and political wellbeing was overshadowed (Williams and Edge, 1996). Therefore, gradually the limited understanding of the subject came to be criticized heavily and it was concluded that the strategic implementation of smart city projects will fail to give desirable results of sustainability due to its techno centric imaginations (Bai et al., 2016, Aibar and Bijker, 2008, Hommels, 2005).

1.3 Research Gap and Questions:

Despite this emergence of literature in the origin and development of smart cities, many aspects and perspectives of smart cities specially with reference to gender centricity in India remain unexplored. The research so far on the subject suggests varied understanding of the subject. What is more surprising is that most of the urban development plans and projects propose heavy investments into ICT based solutions and stress little on gender related issues. Rather many of the recent initiatives such as "smart city" are practically silent on gender related issues. In the context of sustainability, gender perspectives occupy an integral position. Most of the urban plans and projects are devoid of such perspectives. Several researchers have attempted to study the intersectionalities between gender and smart city. Government along with all stakeholders is responsible for creating better experiences for women in urban environments. Ultimately to achieve gender equality in all aspects, it is imperative that they are viewed as important

stakeholders and not just as beneficiaries. This will lead to a participatory approach where plans and actions, policy dialogues and budgetary commitments have gender perspectives incorporated within. In the context of sustainable development goals, critical aspects related to women's economic empowerment and equality, social welfare and healthcare and gender related crimes and discrimination have occupied a center stage in policy as well as planning. Therefore like other developmental programs, the "Smart City" also cannot fall short of gender dimensions.

As India has also embarked upon a Smart Cities Mission, the study tries to explore which gender perspectives are more crucial and what are the constituent features of these broader gender perspectives. Most of the smart cities projects have been conceived keeping in mind the technological innovations. They are silent on more holistic aspects like gender centricity and inclusivity. The present study has been undertaken with a view to understand what makes gender centric smart cities and which areas require policy interventions in smart city projects. Going forward, these areas can serve as performance parameters for gender appraisal of urban development projects. The authors have attempted to come up with a comprehensive list of indicators that define gender centricity of smart cities. The central objective of the study was to derive those gender centric indicators which require policy attention for development of Smart Cities.

RQ1: Can a conceptual model be developed to provide the important variables that determine gender centricity or inclusivity of smart cities in the country?

RQ2: What are the different indicators required to ensure the gender centricity of smart cities in the smart cities mission of India?

2. Theoretical Background and Model Development:

Women represent around half of the population in the world. However, there is an absence of participative efforts and collective planning from gender perspective in the development of smart cities. Academicians believe that future of smart cities should talk about peoples' experiences and how to make them better. Caitlin Kraft-Buchman discussed the dual nature of cities; she referred to popular representations of cities as "places of economic opportunity, liberation, and reinvention", but conversely also of "fear, danger, and violence for women, from dark city streets to public transport".

Academicians have suggested that gender inclusive smart city can be achieved in various ways. Technology can be used in three ways to ensure gender inclusive smart infrastructure design, firstly, it can provide platforms for city planners to engage and interact with women in city to understand their needs. Secondly, technology can help in better analyzing the problem confronted by women in cities using real time data. Smart city applications can be designed to continuously collect and monitor gender disaggregated data. Such data can be used to better understand and adequately respond to the needs of women. For example, existing evidence suggests that the mobility pattern of women, including mode of transportation, time and

frequency of journey, are quite different from that of men (Leydesdorff and Deakin, 2011; Macke et al., 2018; Sauer, 2012; Voytenko et al., 2016).

Recently most of the smart city projects have realized the importance of incorporating gender needs into the plans. For instance, in India, Niti Aayog in their paper "Re-conceptualizing Smart Cities: A Reference Framework for India" has proposed only a few gender related needs in terms of transport and safety and a strategic road map or plan of action at policy level is yet to be rolled out.

 In the context of Smart Cities, UN Women has time and again cautioned that most of the critical gender aspects are missing in urban planning approaches. "Programs generally lack critical inclusion aspects. More opportunities for livelihood do not automatically translate into inclusion, especially gender concerns (UN WOMEN, 2012)."

Recently, discussions around gender concerns and perspective in urban planning have been gaining fast pace and it has been realized that gender centric planning is a missing but important ingredient of urban planning or the more recent smart city development initiative.

For instance, "urban safety" is an important gender dimension and one of the most talked about in the context of increasing number of crimes and violence cases amongst women. "According to UN Women, a safe city for women is a city where women can enjoy public spaces and public life without fear of being assaulted, and where violence is not exercised against women in either the home or the street". The importance of women safety in urban spaces should occupy a central position in activities related to urban planning (Mahadevia, 2019 ; Leao, 2018, Ceccato, 2012, Sur, 2014, UN Women 2019). The growing gender gaps in urban infrastructure have to be addressed to foster safety and security of women in cities (KPMG, Global 2019).

The incorporation of gender perspective in urban planning and design is not only limited to safety but several other dimensions as well, like "use of public services and spaces", "mobility", "health and hygiene", "climate resilience", "equal opportunity for work", "right to housing and asset ownership" and other such aspects (World Bank, 2020; Chant, 2013). Urban infrastructure, especially housing for women has also been stressed upon as an important indicator of gender centric cities over the past two decades (Larsson, 2001; Walker, 2013; Varley, 1993; Moira, 1989; Skaburskis, 1997). Still most of the smart city projects are silent on housing and infrastructure aspects related to women.

Similarly, issues related to sanitation, health and hygiene are pressing gender issues that need to be looked into to achieve holistic urban planning. In the wake of rapid urbanization, urban health and clean environment occupies a prominent position in planning (Chaplin, 2017; Butch, 2012). In this context, it may be noted that sanitation is still a major concern. "Sanitation was established as a separate human right by the United Nations General Assembly in January 2016". The inequalities in access to urban sanitization continue to affect health of women and girls. Studies have shown that there is tremendous social, physical and emotional

pressure and stress on women due to improper access to water and sanitation (Truelove, 2011, p. 148; Phadke, Khan & Ranade 2011, p. 85, Tilley 2013). There is absolutely no dearth of literature to show that gender mainstreaming and sanitation programs has not been properly implemented, adding much to the woes of women particularly in slum areas with little access to basic sanitation facility such as community toilets. An extensive bibliometric study by Susan Chaplin in 2017, brings out such nuanced observations on several issues related to gender and sanitation in general and particular to the Indian urban context.

In the urban context, employment opportunities are more as compared to rural segments. However, equal access to such opportunities is still questionable. This is mainly due to economic inequality in the labour market and disproportionately high burden of care work and unpaid labour (Fraser, 2014; Sayer, 2005);. Yet another reason could be hostile transport systems and mobility related issues. A meticulous review of literature reveals that mainstreaming gender in urban development and planning involves several dimensions. Each dimension can be thought of as a broader construct of "Gender Well Being", comprising of various indicators or parameters that drive that overall dimension.

For instance, in her paper titled "Addressing Gender Concerns in India's Urban Renewal Mission" for the UNDP, Dr Renu Khosla (2009), discusses the multiple facets of gender in urban infrastructure development and suggests ways for mainstreaming gender and achieving good urban governance where women are not viewed as beneficiaries but active partners and stakeholders of planning and implementation. The study puts forth many differential impacts of urban development on men and women. These are in the form of "Access to Municipal Services" like water and sanitation, "Women's Rights to Urban Spaces – Land, Housing and Finances", "Access to Livelihoods and Employment", "Right to Social Services" like healthcare and education, "Safety and Security", "Urban Transport". The study further elaborates on each of these dimensions by enlisting micro level parameters that need to be addressed through proper implementation.

2.1 Measures:

Amidst, the rising concerns of gender centricity in smart cities, the present study is an attempt to explore the gender perspectives in smart cities and related indicators or workable areas so as to achieve this gender centricity. The study carefully examines the available literature on the subject and based on that identifies five major, most pressing gender related issues which are of prime importance in gender inclusivity of smart cities for the future. These are "

a) **Independent variables**: Safety, Equal Opportunity to Work, Health and Hygiene, Infrastructure and Housing and Urban Mobility are fully independent variables. The questions and scales to measure these variables are presented in Appendix II.

b) Dependent variable: Gender Centricity of Smart cities is considered as the dependent variable of the model (figure 1).

3. Methodology

The present quantitative research is conducted through a survey designed to collect responses. However, in the present study, researchers opted for empirical quantitative research methods.

3.1 Item Development

There is no dedicated and suitable questionnaire available that could be used to collect responses. Therefore the researchers developed the present study's items after robust literature review. From these, a total of 29 items were created and measured via a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree). The views of a few experts in academics are taken and during the development of questionnaire and validation was done and based on the feedback, we distributed the items into five factors: Safety (eight items), Equal Opportunity to Work (seven items), Health and Hygiene (five items), Infrastructure and Housing (four items) and Urban Mobility (five items). The complete list of all the items is presented in Appendix I.

3.2 Participants and Procedures:

The present study has been conducted from the perspective of planners and policy makers who are involved in urban development and related activities. The demographic analysis of the respondents is presented in Table 1.

A judgmental sampling approach has been applied to collect data in the electronic form from the sample consisted of officers involved in involved in the planning and implementation of Smart Cities and related projects of Urban development. The data is collected from November 2019 to February 2020 from 16 states across India. There were a total of 121 filled questionnaires collected, however, some of them were found incomplete or ambiguous and therefore were discarded for further inclusion. Finally, 99 questionnaires found to be complete and suitable for inclusion in the study.

4. Data Analysis:

The study is exploratory in nature as the literature reveals that there are a host of factors that determine gender centricity of cities. Urban planning has a wide spectrum gender dimension. lanners and researchers across countries have attributed varied importance to these dimensions. In the Indian context, it is important to explore the important variables that determine gender centricity or inclusivity of smart cities in the country. Hence, factor analysis was used.

The statistical method was found suitable as a large number of factors were to be reduced to the most important set of components requiring immediate policy attention. In terms, of gender the observed variables are highly correlated to each other and had similar response patterns. This is a

pre requisite for applying Factor Analysis as a statistical method and further the Principal Component analysis was applied(Bryant et al1995, Wood et al 1916). For instance, urban mobility is intricately linked to safety, infrastructure and opportunity to work. In order to study observed highly correlated factors, the method was employed as the most suitable technique to identify fewer gender dimensions of integral importance.

The study focuses on five key dimensions of smart cities that is "Safety", "Equal Opportunity to Work", "Health and Hygiene", "Infrastructure and Housing" and "Urban Mobility". Each of the five dimensions were explored through a structured instrument to capture those indicators which are integral to gender centricity. The sub items under each of the variable / dimensions were presented in a set of Likert scale statements. The indicators and items were derived through extensive literature review and expert judgement.

As discussed earlier, the five thematic areas so identified have been split into constituent indicators which have been represented in the form of affirmative statements on a Likert Scale Continuum ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The responses captured have been subject to Statistical Analysis in Microsoft Excel. According to the requirement of the study, statistical tools Factor Analysis has been used to arrive at inferences. The principal component analysis method was used in factor analysis.

5. Results and Discussion

The results of Principal Component Analysis have been discussed below. The KMO and Bartlett's Test(Center, I. K. (2018) is applied for testing the suitability of the data for application of factor analysis and association between variables under study. The results are presented in table no 1. Further, Principal component analysis method was executed (Wood et al1996). The results of PCA reveal that the 29 indicators spread across five variables are constituent of four major gender dimensions or components C1, C2, C3 AND C4. Only significant correlations above 0.5 have been considered for mapping of factors to components. C1 is categorized as "Safe Urban Mobility" and C2 categorized as "Transportation and Infrastructure Development" , C3 is categorized as "Capacity Development and Community Based Solutions" and C4 is categorized as "Work Welfare".

Since most of the correlations are quite significant, their contribution to factor loadings in explaining the variance is justified. Most of the indicators related to safety, security and protection of women have a high correlation with C1. This implies that safety is of utmost importance to development of smart cities. The items studies are basically a manifestation of the identified latent factor that is *"Safe Urban Mobility"*. It strengthens the argument that issues relating to safety of women and their freedom to move around from one place to other significantly impacts their ability to work.

Another important aspect is gender centric infrastructure development. Transportation, housing and hostels and healthcare is of prime importance when gender centric

infrastructure is to be developed. Good transportation systems, hostel facilities for working women, good health care services and affordable housing can significantly increase the participation of women in workforce by taking care of their basic needs. All the indicators mapped under this component are related to the latent component C2 that is *"Transportation and Infrastructure Development"*.

The next latent component C3 has been categorized *as "Capacity Development and Community Based Solutions"*. Issues related to skill development and confidence building should be addressed in order to develop sensitive and responsible community based organizations. To build gender centric cities, there is a need to strengthen social institutions through capacity development, education and sensitization. A gender neutral approach of all stakeholders is very important while crafting important policy decisions. Going forward, presence of strong social institutions like schools, NGOs, community-based models should be hallmark of a city that is capable of solving its problems through a participatory approach.

The last latent component C4 has been categorized as *"Work Welfare"*. State benefits like maternity, day care etc. act as high motivators for a number of women to join the workforce as they have major contribution towards care work in families. Therefore women require additional political, social and economic support to encourage their workforce participation. In view of this policy makers should concentrate not only on provision of basic hygiene factors like clean washrooms and safe drinking water but also take care of long term work welfare of women. This involves legal provisions related to labour laws, entrepreneurship development and promotion of women centric organizations. Thus the constituent component, "Work Welfare" has been identified as an important gender dimension of smart cities.

6. Concluding Remarks

In this study, we made an attempt to explore the gender perspectives in smart cities and related indicators or workable areas so as to achieve this gender centricity. In the light of the study's results, the authors suggest that any urban planning project should develop a performance yardstick based on these four dimensions. While a smart city should take care of day to day safe movement of women, it should also focus on developing more inclusive infrastructure and transportation systems. In order to increase participation of women in workforce and enhance their employability, policy makers should promote work welfare and undertake capacity development of all stakeholders and encourage a participatory approach towards development. More economic opportunities should be created for women in smart cities by focusing on short term and long-term needs. Important aspects are safety, availability and accessibility of work benefits, good transportation systems, people centric planning, capacity building, sensitization of stakeholders should be prioritized in smart cities planning. Important to conduct gender centric appraisal of smart cities by using these

indicators. Thus, without having a proper gender-based framework of development, a city cannot transform into a safe and smart city. The main part of the development agenda of a smart city is that, we have to concentrate on gender inclusive, fast and secure development strategy. Without considering the gender security and development the cities cannot develop in future. The smart city with gender security will be the best answer for the problems that urban areas are facing now.

7. Limitations and future research:

The results of this study must be viewed in light of some limitations. Although, the study started with a rigorous literature review on the chosen topic but still researchers don't claim its holistic state as lots of further research can happen in this area. Despite the participants for the study are from across India and accomplishing statistical support, the factor structure in the gender inclusivity of smart cities in India with the base of Gender Centricity of Smart City Model (GCSCM) should be further tested as a base framework and evaluated. Therefore, further research in this field would do well to widen the required dimensions, to ensure that the developed instrument is operational and effective for the long term with different subgroups. More research can be undertaken to develop indicators on other criterion like for "short term and long term", "economic and social". Another limitation of this work is that this work is confined to understand the gender inclusivity in smart cities from a few stakeholders' perspectives but this could also be further studied from the common citizens of smart cities.

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Figure 1   Hypothesized Conceptual Model

Figure 1: Gender Centricity _Smart City Model (GCSCM).

| Safety | Equal Opportunity to Work | Health & Hygiene | Infra & Housing | Urban mobility |

→ Gender Centricity _Smart City
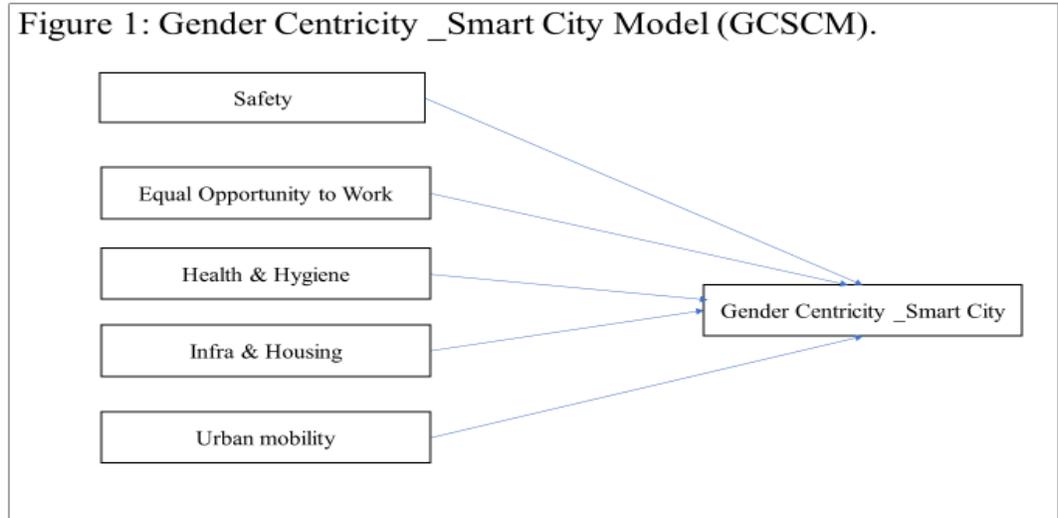
Table 1   Demographics(From data)

Item	Type	Frequency	Percent
Gender	Male	61	61.62
	Female	38	38.38
Age Group	25-35 years	12	12.12
	36-45 years	36	36.36
	46-55 years	29	29.29
	56 years and above	22	22.22

Table No 2 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.755
Bartlett's Test of Sphericity	Approx. Chi-Square	3441.184
	Df	406
	Sig.	.000

Table No 3 -A Principal Component Analysis

Communalities		
	Initial	**Extraction**
S1	1.000	.743
S2	1.000	.674
S3	1.000	.768
S4	1.000	.845
S5	1.000	.699
S6	1.000	.774
S7	1.000	.584
S8	1.000	.802
EO1	1.000	.897
EO2	1.000	.818
EO3	1.000	.922
EO4	1.000	.648
EO5	1.000	.732
EO6	1.000	.691
EO7	1.000	.691
HH1	1.000	.849
HH2	1.000	.833
HH3	1.000	.737
HH4	1.000	.898
HH5	1.000	.904
IH 1	1.000	.683
IH 2	1.000	.802
IH 3	1.000	.757
IH 4	1.000	.641
UM 1	1.000	.791
UM 2	1.000	.821
UM 3	1.000	.800
UM 4	1.000	.893
UM 5	1.000	.691
Extraction Method – Principal Component Analysis		

Table No 3- B Total Variance

Total Variance Explained								
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.862	44.353	44.35	12.8	44.353	44.353	5.76	19.865	19.86
2	3.258	11.234	55.58	3.25	11.234	55.587	5.12	17.678	37.54
3	2.963	10.217	65.80	2.96	10.217	65.804	4.84	16.712	54.25
4	2.235	7.705	73.50	2.23	7.705	73.509	4.50	15.535	69.79
5	1.068	3.682	77.19	1.06	3.682	77.192	2.14	7.402	77.19
6	.886	3.054	80.24						
7	.817	2.816	83.06						
8	.707	2.437	85.50						
9	.553	1.905	87.40						
10	.519	1.789	89.19						
11	.447	1.542	90.73						
12	.412	1.422	92.15						
13	.379	1.307	93.46						
14	.313	1.081	94.54						
15	.290	1.000	95.54						
16	.241	.830	96.3						

			7						
17	.198	.682	97.05						
18	.154	.531	97.59						
19	.135	.465	98.05						
20	.120	.414	98.46						
21	.096	.331	98.80						
22	.083	.288	99.08						
23	.068	.236	99.32						
24	.061	.209	99.53						
25	.044	.151	99.68						
26	.037	.127	99.81						
27	.023	.081	99.89						
28	.022	.077	99.96						
29	.009	.031	100.0						
Extraction Method: Principal Component Analysis.									

Table No 3-C Rotated Component Matrix

Rotated Component Matrix				
Variables	**Component**			
	1	**2**	**3**	**4**
S6	0.816			
S4	0.809			
S8	0.797			
IH 4	0.677			
S2	0.672			
S5	0.648			
S7	0.56			
S3	0.515			
EO1		0.899		
UM 1		0.849		
HH1		0.806		
IH 3		0.655		
EO6		0.647		
IH 2		0.581		
UM 5		0.546		
S1		0.546		
UM 4			0.8	
HH3			0.783	
IH 1			0.688	
EO7			0.676	
UM 3			0.627	
EO5			0.599	
EO3				0.918
EO4				0.769
UM 2				0.767
HH4				0.691
HH2				0.554

Extraction Method: Principal Component Analysis.

 Rotation Method: Varimax with Kaiser Normalization. A

a Rotation converged in 16 iterations.

Table No 3-D Rotated Component Matrix

Rotated Component Matrix				
Variables	**Component**			
	C1	**C2**	**C3**	**C4**
S6	0.816			
S4	0.809			
S8	0.797			
IH 4	0.677			
S2	0.672			
S5	0.648			
S7	0.56			
S3	0.515			
EO1		0.899		
UM 1		0.849		
HH1		0.806		
IH 3		0.655		
IH 2		0.581		
UM 5		0.546		
S1		0.546		
UM 4			0.8	
HH3			0.783	
IH 1			0.688	
EO7			0.676	
UM 3			0.627	
EO5			0.599	
EO3				0.918
EO4				0.769
UM 2				0.767
HH4				0.691
HH2				0.554

Extraction Method: Principal Component Analysis.

 Rotation Method: Varimax with Kaiser Normalization. A

a Rotation converged in 16 iterations.

Annexure- I

A brief description of items of all the five constructs/dimensions are outlined as below.

A. Safety

    i. Waiting time for public transport
    ii. Adequacy of Lighting at Community Places
    iii. ICT solutions during emergency
    iv. Capacity development on Self Defense
    v. Visibility of Police and Guards
    vi. Signage and display of helplines
    vii. Extra security at crime prone areas
    viii. Capacity building of social institutions

B. Equal Opportunity for Work

    i. Increase in working women's hostel
    ii. Entitlement to maternity benefits
    iii. Compulsory crèche and day care facility
    iv. Promotion of women-oriented organizations
    v. Skill Training Centers
    vi. Need Based Grants and scholarships
    vii. Active citizen engagement and gender confidence

C. Health and Hygiene
    i. State funded primary health care centers
    ii. Installation of drinking waters facility at community centers
    iii. Preliminary diagnostic training to NGOs and SHGs
    iv. Clean washrooms
    v. Compulsory training in schools on health and hygiene

D. Infrastructure & Housing
    i. Gender neutrality in Infrastructure Development
    ii. Affordable housing
    iii. People first, Technology Later
    iv. Gender inclusivity of Smart Infrastructure

E. Urban Mobility

    i. Frequency of public transports

ii. Exclusive transport for women
iii. Good eating facilities at reasonable rates
iv. Multipurpose community centers
v. Engendering new transportation set ups like ola, uber, etc.

Annexure-II Survey Instrument

Construct	Questions	Code Assigned
Safety	The waiting time for buses, metros, trains and other public transports should be reduced	S1
	Proper lighting and electrification of community places and markets are very important to ensure safety	S2
	Technology based ICT solutions should be promoted to ensure safety during emergency situations	S3
	Capacity development and training in areas like self-defense should be mandatory in schools and colleges	S4
	Lack of visible police or civil guards during the late hours can cause security issues for women	S5
	Proper signage and display of important phone numbers can promote safety of women	S6
	Extra security force is required at clubs and pubs which are more prone to gender crimes	S7
	Capacity building of social institutions like schools, colleges, hospitals, community centers, health centers etc., should be undertaken regularly	S8
Equal Opportunity at Work	The number of working women's hostels should be increased in the Smart City	EO1
	Entitlement to maternity benefits should be mandatory as per extant Government rules	EO2
	Compulsory crèche and day care facility should be provided as per extant Government rules	EO3
	More number of women oriented organizations should be promoted by State Governments to encourage more women into workforce	EO4
	Capacity building of small and medium sized women entrepreneurs should be done regularly through Skill Training Centers	EO5
	Need Based Grants and scholarships should be made available for up gradation of qualification and skills	EO6
	More women should be employed as drivers, conductors, petrol stations, security guards etc., to promote active citizen engagement and gender confidence	EO7
Health and Hygiene	The number of working women's hostels should be increased in the Smart City	HH1

	Entitlement to maternity benefits should be mandatory as per extant Government rules	HH2
	Compulsory crèche and day care facility should be provided as per extant Government rules	HH3
	More number of women oriented organizations should be promoted by State Governments to encourage more women into workforce	HH4
	Capacity building of small and medium sized women entrepreneurs should be done regularly through Skill Training Centers	HH5
Infrastructure and Housing	Smart Cities Mission has a largely gender-neutral approach In the context of infrastructure development.	IH 1
	Affordable housing should be on the top priority of smart cities mission.	IH 2
	Building smart cities starts with people, not technology.	IH3
	Smart infrastructure in smart city development should be gender inclusive.	IH4
Urban Mobility	Increasing the frequency of public transports can lead to gender well-being in terms of urban mobility	UM1
	Exclusive transport for women in metros, trains, buses should be available in smart cities	UM2
	Good eating facilities at reasonable rates should be should be available in smart cities	UM3
	Multipurpose community centers and clubs should be developed by Urban Local bodies to foster socialization and freedom of expression	UM4
	There is a need to engendering set ups like ola, uber, car pool set ups, transport associations etc., through campaigns	UM5

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