



An Empirical Study to Analyze Consumer Buying Behavior in Smart Cities

KEYWORDS

Consumer Buying Behavior, Smart Cities, LPG, Demography

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ABSTRACT India being a vast and voluminous landmass, has seen an enormous boost in the population especially in the post Liberalization Privatization and Globalization (LPG) era. By 2026, it is predicted that the population of India would be approximately 1.4 billion. Also, due to the unprecedented rate of migration the load on urban land is increasing. It alarms and challenges the government to formalize a strategy to mitigate the problems of accommodating massive population which would open gates for the development of new cities – Smart Cities; thereby filling the gap in the existing infrastructure and facilitating social needs. Today every citizen desires to live in a city which is equipped with modern facilities and technology. This is due to change in income, spending pattern, lifestyle, personality and preferences. No intensive research has been undertaken to analyze consumer buying behavior in Smart Cities, hence it provides a scope to figure out the key factors influencing consumer towards purchase in Smart Cities. This descriptive study is based on primary data collected through convenient sampling to analyze significant factors through ANOVA and factor analysis which vary across different demographic variables such as age, income, education, occupation and lifestyle. The findings are expected to make significant contributions in the development of Smart Cities

A1. Introduction:

On 25th June 2015, the Prime Minister of India Mr. Narendra Modi launched 3 major missions- Smart Cities Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT) and Housing for all to meet the challenges and mammoth growth of population.

India is urbanising at an unprecedented rate and statistics highlight that the present urban population in India is 31%. As a result, the Government of India has decided to set up 100 "Smart Cities" in India as observed from the budget speech of Finance Minister of India in 2014 to face the situation, because if this is not achieved right now, the existing cities would very soon become unlivable.

The term 'Smart city' originated in 1998, has become prevalent in the field of urban planning. Most countries considered this as a tool to control urbanization and problems of population explosion. Wellington E. Webb-Former Mayor of Denver, Colorado said about cities:

"The 19th century was a city of empires"
 "The 20th century was a city of nation states"
 "The 21st century will be a century of cities"

The urbanization agenda of the National Democratic Alliance (NDA) government emphasize mainly on "smart city" -100 smart cities to contour attention of the consumers and stakeholders. Though, the definition of the term smart city is still ambiguous; the various definitions of Smart Cities are:

The British Standards Institute defines it as "the effective integration of physical, digital and human systems in the built environment to deliver sustainable, prosperous and inclusive future of its citizens".

The UK department of business, innovation and skills considers smart cities as a process rather than a static out-

come, in which increased citizen engagement, hard infrastructure, social capital and digital technologies make cities more livable, resilient and better able to respond to challenges.

CISCO defines smart cities as those who adopt scalable solutions that take advantage of information and communication technology (ICT) it increases efficiencies, reduce costs and enhance the quality of life".

Deloitte defines a smart city as a city in which "investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life."

Giffinger defines smart cities as "A Smart City is a well performing city built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens. The six significant dimension for a smart city is given by (Giffinger, et al.2007) as smart economy, smart mobility, smart environment, smart people, smart living and smart governance.

The European Union has what is perhaps the most comprehensive definition, referring to smart cities as those that "provide public services to their citizens in a more convenient way, that are more responsive and citizens-centered, that provide the right information in real-time to allow for better every day and business decision-making, and that achieve all this in an economically viable way so as to improve environmental sustainability."

The NDA's government view on Smart city is "Good quality infrastructure, simple and transparent online business and public services processes that make it easy to practice one's profession or to establish an enterprise and run it efficiently without any bureaucratic hassles are essential features of a citizen centric and investor-friendly smart city".

Thus, the definition varies across country to country. The investment and preferences of consumers and stakeholders do vary towards smart city. In this scenario, the research succinctly captured the buying behavior of consumer in the current development of smart city.

2. Literature Review

Holland (2008) in his article 'Will the Real Smart City Please Stand Up' stated that any city who claim to be smart cannot be just based on the usage of Information and Communication technology (ICT) but should seriously focus on people and human capital side of the equation. IBM (2010) stated that cities can become smarter with the usage of technologies to transform their system to optimize the use of finite resource. Taewoo Nam & Theresa A. Pardo (2011) in their paper discussed the criteria as how a city can be considered as smart city and identified three main dimensions-Technology, People and Institutions.

Leonidas G. Anthopoulos and Athena Vakali (2011) studied the interrelationship between smart city and urban planning. They also found the significant dimensions of the urban planning and found environmental protection, sustainable residential development, resource capitalization and coherent regional growth support. Bhagat et al. (2014) highlights the role of policy makers, planners, executives, city departments, developers and industry.

Zhou and Lin (2012) identified social factors as significant factors. (Shen & Liu) added that considerable number of real estate buyers do not buy the house for personal use, but for investment and appreciation. Leung (2010) & Singh & Sao (2014) studied that the most important factors that affect consumer in buying house in any market is price. Zhou and Lin (2012) did a research on the willingness to buy real estate in china found that consumers buy real estate products due to social factors such as vanity which played significant role in enhancing thrust for buying real estate regardless of the price.

In the article 'Smart Buildings Make Smart Cities' by Ernst and Young stated "By 2030, the number of Indian cities with a population of more than 1 million will be 70, which is twice the number of cities in Europe with similar population today. They also stated that buildings are integral constituents of a city ecosystem. People spend 80 to 90 percent of their lives in buildings, be it homes, offices, recreation, retail transport or public service utilities. In India, a relatively younger population, rapid growth of internet and smartphone users, improvements in coverage and speed of the internet connectivity on wireless platforms, will only accelerate this trend. A majority of building's today do not have proactive measures". They also stated that the smart building for smart city would be measured on three dimensions – Green, Safe and Productive.

Consumer behavior is often defined to include acquisition and use of goods and services by ultimate consumers (Jacoby, 1975). Consumer buying behavior is influenced by various factors such as lifestyle, values, personality, brand image, features, facilities, learning, perception, distance, price, reference group, awareness etc. The initial problem recognition stage of the decision making process is the result of black box (Loudon, 1988). It has been found that for young couples, married/unmarried, factors such as housing costs and tenure are important and impact the consumer's decision on where to live (Hansen, 1959). However, it is seen that young family's sacrifice with the quality of the residential environment. In lieu of restriction due to

job accessibility (Kim et al., 2005) for a high involvement product like house, retail outlet and automobile consumer passes through different stages in making decision. According to J Scott Armstrong (1991) – these stages are Problem recognition, Information search, Evaluation of alternative, Purchase decision & Post purchase behavior.

From the literature review it is clear that no intensive work has been done to align Consumer buying behavior & smart city. This study and the outcome will certainly help the developers and the government of India to understand customer's expectations from smart cities and converge citizens' interest into reality.

2.1 Objectives of the Study: It is adequately clear from literature review that smart city concept in Indian context is in nascent stage. However, the stakeholders have much expectation from the government's upcoming smart city project which will certainly improve the quality and lifestyle of Indians. Keeping in view the practical concerns of consumers and stakeholders, the following are the objectives of the present research:

- To study the factors that enhances the consumer's willingness to invest in a smart city.
- To find out the role of various demographic factors towards investment in smart cities.
- To offer suggestions to the developers and makers of smart city.

2.2 Hypothesis: The study seeks to find out the factors that influence the consumer investment towards retail outlet/office space/house/or any - in a smart city. In pursuit of the above objectives, the following hypothesis were formulated:-

Ho1: There are no significant variations in the consumer response for willingness to invest in smart city based on respondent's age

Ho2: There are no significant variation in the consumer response for willingness to invest in smart city based on respondent's gender.

Ho3: There are no significant variation in the consumer response for willingness to invest in smart city based on respondent's education.

Ho4: There are no significant variation in the consumer response for willingness to invest in smart city based on respondent's income.

Ho5: There are no significant variation in the consumer response for willingness to invest in smart city based on respondent's lifestyle.

Ho6: There are no significant variation in the consumer response for willingness to invest in smart city based on respondent's occupation.

3. Research Methodology:

To analyze the behavior of consumer towards smart city descriptive research design was used. For this research, primary and secondary data were used. A questionnaire survey method with formal discussion was adopted to analyze the consumer expectation and buying pattern. An interview was conducted for 162 respondents from Faridabad, Raipur and Navi-Mumbai to collect primary data with no discrimination on the basis of Age, Gender,

Education or Income. The respondents opinion were being gauged by using a questionnaire containing close-ended question, which were designed to ascertain satisfaction level of the respondents using a five point Likert scale with following options: Highly Satisfied, Satisfied, Neither Satisfied nor Dissatisfied, Dissatisfied and Highly Dissatisfied. The sample broadly fulfills the purpose of cross sectional survey. The research and statistical tools employed in this study are frequency analysis, factor analysis & ANOVA (Analysis of variance). SPSS 22 was used to perform statistical analysis. The reliability of the data was carried out by using Cronbach's Alpha Value. ANOVA was employed to find the association between demography and relevant factors. The third major analysis carried out was factor analysis to reduce the clustering effects of the similar attributes. Both Bartlett's test of Sphericity and measure of sampling adequacy (MSA) were also carried out to ensure that the requirements of factor analysis were met.

4. Analysis and Interpretations:

The analysis of this data was divided into following sections:

- Demographic profile of Respondents - Table 1
- Consumer willingness to buy - Table 2
- Factor Analysis - Table 3-Table 15
- ANOVA - Table 16

5. Limitations of the study:

The study was restricted to Faridabad, Raipur and Navi-Mumbai.

The data were collected only from those respondents who intend to invest in smart city.

The findings of the study cannot be generalized for the whole country.

Table 1: Demographic profile of Respondents

Variable	Characteristics	Frequency	Percent
Age	Less than 30	36	22.22
	31- 35	46	28.39
	36-40	39	24.07
	Above 40	41	25.30
Gender	Male	98	60.49
	Female	64	39.51
Education qualification	HSC	10	6.2
	Graduate	62	38.3
	Post Graduate	67	41.4
	Professional	19	11.7
	Others	4	2.4
Occupation	Govt. Employee	28	17.3
	Private Employee	43	26.5
	Business	34	21.0
	Professional Service	23	14.2
	Agriculture	16	9.87
	Housewife/others	18	11.11
Income per annum	Less than 10 lakhs per annum	85	52.5
	10 - 20	63	38.9
	20-30	7	4.3
	Above 30 lakhs	7	4.3

Lifestyle	Self-Actualizers(non-materialistic, open, sociable)	49	30.2
	Innovators (risk takers, adapt new things)	34	21.0
	Strivers (hold traditional value, image and status conscious)	37	22.8
	Esteem seekers (symbol of success)	19	11.7
	Openness to change	23	14.2

Source: Primary data collected and compiled by authors

The demographic profile of the respondents shows that the respondents below 30 years are 22.22% and people above 30 years are more than 70%, which is in general considered to be the most independent to take decisions for investment. There are 38.3% graduate and 41.4% are Post graduate, which indicate that educated persons are showing interest in this sector. They are decently employed as 26.5 % belong to private sector, 17.3% to government sector, and 21% are businessman and have monthly income above 10 Lakhs (47.5%) which indicate that they have the buying ability and can invest for better living and for business in smart city. In the lifestyle category we found 30.2% were self-actualizers and around 35 % (innovators & Openness to change) look forward for new things & for better livelihood. This is ideal demographic profile who had shown willingness and interest in living and investing in smart city.

6. Reliability and Validity:

Reliability is the test to measure the consistency between scales which is based on the method of data collection and analysis (Saunders et al., 2007). Usually, Cronbach's alpha value is taken to analyze the reliability of the data. (Pallant, 2007). A Cronbach's alpha with score 1 indicates 100% reliability. Internal reliabilities were computed to check consistency for 47 items and was found 0.855, which indicates the reliability of the survey adhering to minimum value proposed by Nunnally's (1978) as 0.7. A reliability of 0.885 means the variability is about 88.5% with 11.5% error. Hence, for the data set research can be carried.

Table 2: Consumer Willingness to buy

Consumer willingness to buy	Frequency	Percentage (%)
House/flat/Bungalow	91	56.17
Retail outlet/ shops	55	33.95
Land/Space	36	22.22

Source: Primary data collected and compiled by authors

From the table, it is clear that 56.17% of the respondents are looking forward to buy house, 33.95% are looking to buy retail outlet or shops to do business and 22.22% intend to buy land for future purpose.

7. Factor Analysis:

To conduct out the factor analysis, the appropriateness of data was examined with the help of Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMSA) and Bartlett's Test of Sphericity (Hair et al, 2006). Overall, the set of data meets the essential requirements of factor analysis acceptably (Hair et al, 2006). In analyzing the data given, the 41 attributes were subjected to a factor analysis using the principal component method. As in common practice, a Varimax rotation with Kaiser Normalization was performed to achieve a simpler and theoretically more meaningful factor solution. The Cronbach's alphas score for all the factors were above the cutoff point (0.7) recommended by Nun-

nally's (1978). The KMO value for the selected 41 attributes is 0.845 (sig: 0.000) which is quite above the standard value. Applying SPSS, the principal component analysis was carried out to explore the underlying factors associated with 41 items. A total of thirteen principal components (factors) were evolved. Results are tabulated in table 3 to 15. These thirteen factors explained 84.5% of variance. Varimax rotation was used for better understanding of results.

8. Discussion of extracted factors:

Table 3: Factor 1- Transportation

Statements	Factor Loading	%variance Explained
Intercity rail/metro network	0.515	9.75%
Reduced Travel Time	0.606	
Connectivity with other city	0.607	
Intercity road network	0.725	

Source: Primary data collected and compiled by authors

The above table3 contains four statements with positive loading which accounts that this variables segment most of their variances between them and thereby co-vary with each other. The factor identified is 'Transportation' with 9.75% variance which means that the consumers seeks for better mobility for access to jobs and services and also it boost economies. (Giffinger, R et. al. 2007) in his paper also concluded that smart mobility with transport and infrastructure would robust the growth of the city.

Table 4: Factor 2 - Electricity and Services

Statements	Factor Loading	%variance Explained
Electricity (24 x 7)	0.605	9.7%
Power Backup	0.819	
Smart electric meters	0.825	

Source: Primary data collected and compiled by authors

This factor2 combines three attributes which integrate to form second factor named as 'electricity' with 9.7% variance explained by electricity (24 x 7), power back up & smart electric meters. The consumer todays look mainly that the electricity should be uninterrupted but at the same time they even feel that the automated smart meters should be established to avoid unmethodical bills.

Table 5: Factor 3 - Water Management

Statements	Factor Loading	%variance Explained
Water Supply (24 x7)	0.813	8.75%
Water Quality Monitoring	0.718	
Rain Water Harvesting	0.816	

Source: Primary data collected and compiled by authors

Table 6: Factor 5 - Education Facility

Statements	Factor Loading	%variance Explained
Quality of Education	0.77	7.20%
Higher education	0.70	
Smart Education	0.55	

Source: Primary data collected and compiled by authors

The factors Water Management with 8.75% variance and Education Facility with 7.20% variance try to signify the basic requirements of any individual. Water being the natural resource has become a big concern as it is not just finite but is tending to be a diminishing resource and is becoming costlier with respect to the passage of time. Hence, the respondents have shown concern to save water. Education has always been the significant priority and if Smart Education can be provided the customers would be delighted for their personal growth and development.

Table 7: Factor 4 - Amenities Center

Statements	Factor Loading	%variance Explained
Sports and recreation center	0.66	7.5%
Trade & Commerce facilitation center(super market, veg-market)	0.63	
Skill development Centre	0.58	

Source: Primary data collected and compiled by authors

The above factor is named as Amenities center describing 7.5 % of the total common variance and there are three positive variables in this factor. Here the respondents are more concerned about their personal development in the form of recreation and sports which is highly important in today's busy lifestyle.

Table 8: Factor 6 - Safety and Security

Statements	Factor Loading	%variance Explained
Video Crime monitoring facility	0.66	7.15%
Security in city with patrolling	0.59	
Intelligent traffic to avoid accident	0.65	

Source: Primary data collected and compiled by authors

Table 9: Factor 8 - Health and Hygiene

Statements	Factor Loading	%variance Explained
City's hygiene condition	0.55	6.95%
Quality and quantity of green area	0.59	
Health care hospitals	0.65	
Tele-medicine facility	0.5	

Source: Primary data collected and compiled by authors

Table 10: Factor 11 - e-Facility

Statements	Factor Loading	%variance Explained
Online bill payments	0.651	4.50%
Online taxation facility	0.73	
Free Wi-Fi/ICT service.	0.652	

Source: Primary data collected and compiled by authors

The above factors namely Safety and Security, Health and Hygiene and e-Facility explains 7.15% variance, 6.95% variance and 4.50% variance. This signifies that the consumer today perceive that safety, health and individual productivity with the usage of Information and Communication Technology (ICT) is very significant. The same is reflected in the report by Honeywell and Ernst and Young LLP who gave insights about the concept of Green, Safe and Productive.

Table 11: Factor 13 - Sustainable resources

Statements	Factor Loading	%variance Explained
Green Building to save energy	0.55	2.75%
Use of Renewable source of energy	0.57	
Policy to use Hybrid vehicles only	0.498	

Source: Primary data collected and compiled by authors

Table 12: Factor 9 - Waste Management

Statements	Factor Loading	%variance Explained
Solid waste management	0.695	4.85%
Convert waste to energy	0.573	
sewage waste management	0.497	
Waste water treatment	0.512	

Source: Primary data collected and compiled by authors

The above tables talk about Waste Management and Sustainable Resources in which the consumers are highly concerned for the environment. They feel that the management of waste is the prime responsibility of the government and if advanced technology can be used like (Incineration in Japan) can help generating energy from waste and in sustaining resources. They also feel that usage of renewable source of energy will help next generation to sustain. The same is reflected in the findings of Giffinger, R et al, (2007) as one of the significant dimension for a smart city.

Table 13: Factor 7 – Govt-Accessibility

Statements	Factor Loading	%variance Explained
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9. ANOVA Analysis:

Table 16: Computation of ANOVA

Anova Table	Age		Gender		Income		Education		Occupation		Lifestyle	
Factor	F	SIG	F	SIG	F	SIG	F	SIG	F	SIG	F	SIG
Transportation	1.824	0.145	2.467	0.088	2.036	0.111	0.908	0.477	4.3	0.001	1.19	0.317
Electricity	0.712	0.546	0.135	0.874	0.775	0.509	1.45	0.21	1.239	0.289	1.051	0.383
Water	1.237	0.298	0.205	0.815	0.369	0.775	0.714	0.614	0.657	0.684	3.837	0.005
Facilitation Center	1.679	0.174	3.043	0.059	2.158	0.095	1.048	0.392	2.207	0.045	1.62	0.172
Education Center	3.341	0.021	0.612	0.543	2.275	0.082	2.668	0.024	2.821	0.012	2.793	0.028
Safety And Security	1.571	0.199	0.632	0.533	2.706	0.047	3.219	0.009	0.808	0.565	0.16	0.958
Govt. Facilitation	2.629	0.052	0.98	0.378	3.787	0.012	2.095	0.069	2.398	0.03	0.396	0.812
Health And Hygiene	2.699	0.048	0.636	0.531	0.104	0.958	0.529	0.754	0.717	0.637	2.045	0.091
Citizen Engagement	4.479	0.005	0.846	0.431	2.135	0.098	3.604	0.004	2.04	0.064	3.91	0.005
E-Facility	3.53	0.016	2.498	0.085	1.415	0.24	1.583	0.168	1.23	0.294	1.092	0.363
Smart Facility	1.063	0.366	1.498	0.227	1.93	0.127	2.923	0.015	2.25	0.041	1.076	0.37
Sustainable Resources	0.238	0.87	0.866	0.423	0.593	0.62	1.417	0.221	1.788	0.105	0.731	0.572
Waste Management	3.22	0.024	0.708	0.494	1.64	0.182	1.115	0.355	0.328	0.921	2.105	0.083

Easy Approach to Govt. Depts	0.595	6.95%
Easy Approach to Govt. policy	0.568	
Fast track grievance Redressal	0.565	
Public Information center	0.500	

Source: Primary data collected and compiled by authors

Table 14: Factor 10 - Citizen Engagement

Statements	Factor Loading	%variance Explained
Taking Public Opinion in city dvpt.	0.60	4.75%
Society feedback and interaction	0.55	

Source: Primary data collected and compiled by authors

The above factors namely Government Accessibility and Citizen Engagement with a percentage variance of 6.95 and 4.75 respectively tries to explain citizen participation and empowerment in terms of accessing information, policies and city development. This will empower human capital. The same is being identified by Giffinger, R et al, 2007 as Smart Governance.

Table 15: Factor 12 - Smart facility

Statements	Factor Loading	%variance Explained
Smart parking facility	0.572	3.20%
Smart walking/cycling track	0.56	

Source: Primary data collected and compiled by authors

This factor describes 3.20% of total variance and there are two Statements in this factor and all are positive and have loadings in the range of 0.572 and 0.560. With change in time, the needs and requirements of consumers are changing. They look forward for ease. They believe that the concept of Smart will resolve their mundane problems in the form of smart parking, smart walking and smart cycling track.

10. Hypothesis testing:

In order to find whether is there any significant variation in willingness to invest by respondents in smart city we carried out ANOVA on the demographic factor to test the first six hypothesis. Result of ANOVA are given in the table 15. Based on significance criteria (0.05), the hypothesis will be accepted or rejected. The analysis of variance based on age signifies that the factors such as education, health and hygiene, citizen engagement & e-facility have significant value less than 0.05. Hence, we reject H01.

The ANOVA based on respondent's gender group indicate that the significance value for all the factors is greater than 0.05. Hence, we accept H02 and conclude that there are no significant difference between male and female when it comes to the expectation or willingness to invest in smart city. Both gender seeks similar requirements and facility in a smart city.

The analysis of variance based on income level shows that the significance level less than 0.05 in the factors 'Safety & Security' and 'government facilitation', hence we reject H03 and conclude that there is significant variations in the respondents response for investing in a smart city. Respondents have different expectation when it comes to these factors. For H04, H05 and H06 there are many factors such as Education center, safety and security, citizen engagement, transportation, water, education center and citizen engagement which have significant value less than 0.5 and hence we reject H04, H05 & H06. This indicates that the consumer willingness to buy/invest in a smart city depends and varies on multiple factors offered.

11. Conclusions & Suggestions:

The empirical study based on Anova suggest that there are no significant variation in the willingness to invest in smart city based on Gender. This indicates that the customer irrespective of their gender have similar requirements in a smart city. However, this study also reveals the fact that there are significant differences on the basis of age, occupation, lifestyle, education and income when it comes to buying space, house or retail outlet in a smart city. This study brings out the significant characteristics and features of Smart City. Factor analysis, have brought 13 factors representing different elements affecting consumer buying behavior. These factors are transportation, electricity, water, facilitation center, education center, govt. facilitation, health and hygiene, citizen engagement, e-facility, smart facility, sustainable resources and waste management. The data reveals the fact that majority of respondents intend to buy house and have income less than 10 lakhs per annum. We suggest the government should promote affordable housing with lower interest rates for the growth and upliftment of the society.

In India, the major problems faced by people are very fundamental, like unplanned city, inevitable growth of population, growth of unorganized sector, lack of basic facilities-air, food, water, electricity, traffic, governance, security, pollution leading to environmental degradation and climate change. Thus the government and stakeholders should plan systematically and build smart cities to improve the quality and lifestyle of citizens. Further the consumer's basic fundamental requirement is in the form of BIPASA, i.e. *bijli*, *pani* & *sadak* – which is needed to be changed to *smart bijli*, *smart ict* (information & communication technology) & *infrastructure*, *smart pani* and *production*, *smart administration*, *smart sadak* and *safety*, *smart amenities*.

Consumer Perspective model –Smart City: On the basis of study and formal discussion with the respondents, we propose a consumer perspective model.

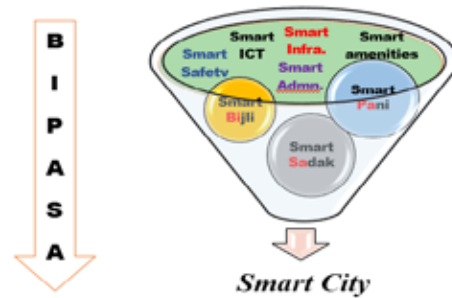


Figure: A Consumer Perspective Model - Smart City

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