EUROPEAN Geographical Studies

Has been issued since 2014.
ISSN 2312-0029, E-ISSN 2413-7197
2017. 4(2). Issued 2 times a year

Journal is indexed by: **CiteFactor** (USA), **CrossRef** (UK), **EBSCOhost Electronic Journals Service** (USA), **Electronic scientific library** (Russia), **Open Academic Journals Index** (Russia), **Sherpa Romeo** (Spain), **Universal Impact Factor** (Australia).

All manuscripts are peer reviewed by experts in the respective field. Authors of the manuscripts bear responsibility for their content, credibility and reliability.

Editorial board doesn't expect the manuscripts' authors to always agree with its opinion.

Postal Address: 1367/4, Stara Vajnorska str., Bratislava, Slovakia, Nove Mesto, 831 04

Website: http://ejournal9.com/en/index.html
E-mail: evr2010@rambler.ru

Founder and Editor: Academic Publishing House Researcher s.r.o.

Release date 15.09.17.
Format 21 × 29,7/4.

Headset Georgia.

Order № 114.

European Geographical Studies

2017

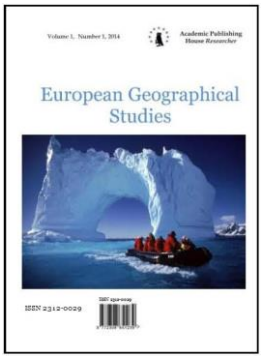
Is. 2

C O N T E N T S

Articles and Statements

Published in the Slovak Republic
European Geographical Studies
Has been issued since 2014.
ISSN: 2312-0029
E-ISSN: 2413-7197
2017, 4(2): 61-69

DOI: 10.13187/egs.2017.2.61
www.ejournal9.com



Articles and Statements

Exploring the Relationship between Energy Consumption and Socio-Economic Criteria based on Sensitivity Analysis

Soufiane Boukarta [a, b, *]

[a] Institut d'architecture et d'urbanisme, université de Blida 1, Algeria
[b] Laboratoire Ville, Urbanisme et Développement Durable (VUDD), Ecole Polytechnique d'Architecture et d'Urbanisme (EPAU), Algeria

Abstract

This paper aims to give more understanding reasons of the energy implication of the socio-economic criteria in an arid and semi-arid climate zone based on a statistical approach. The paper considers the yearly Gas and electricity energy consumption (2013) of the municipalities of the department of Djelfa. The method is organised in three steps; (a) A multiple linear regression is used to perform two estimative models of Gas and Electricity. The models performed have more than 99 % of accuracy for both models. (b) Estimating Gas and energy consumption for 2008 according to the developed models. (c) Organisation of the census Data of 2008 in six dimensions: The structural dimension of the municipal territory, population characteristics and activities, dwelling typology and occupancy and finally the households' appliance possession. (d) A set of sensitivity analysis is performed based on Principal Component Analysis (PCAs) and Pearson's bi-variate correlation. The results show globally that the socio-economic criteria are reducing the energy consumption by – 11.3 % the Gas consumption while it increases the Electricity consumption by 2.7 %. The most important factors reducing Electricity consumption are population activities and dwelling occupancy while all the six socio-economic dimensions are reducing gas consumption.

Keywords: energy consumption, Statistical approach, sensitivity analysis, socio-economic criteria, energy potential saving.

1. Introduction

The energy consumption in the world has, as never, been a crucial problematic. The population around the world is increasing and the energy demand and consumption are increasing as well. The priority of the entire world summits is given to the energy saving by implementing a several policies to reduce the energy consumption and carbon footprint emissions.

Algeria since 1985 has founded the APRUE to elaborate methods and tools to rationalise the energy demand and consumption in all the sectors. APRUE (Aprue, 2012) shows that the residential

* Corresponding author
E-mail addresses: sofiansasse@gmail.com (S. Boukarta)

building is the most consumer sector in Algeria with a consumption of 41 %. The Algerian energy policy (Bouamama, 2013) is made within several strategies. We can enumerate 4:

The first strategy aims to prepare architects and engineers to be able to assess the energy demand by introducing a set of formation in universities, schools and institutes as well. Also, APRUE and GIZ have developed a project interpreted in two ways; (a) a guide-book (GIZ, 2015) containing the different strategies aiming to reduce the energy consumption in building according to their climate zone. The guide is distributed for free by APRUE. The guide book is how ever very ambitious because it proposes for example a U value of 0.25 to 0.5 w/m².k for walls. These values are considered in the industrial countries. The guide book has no power to constrain architects or engineer to respect its orientations. (b) The second way is to make online the actual thermal regulation of Algeria. The web-site is reta.cder.de (Reta, 2015) and it contains an easy method to assess the building energy efficiency based on the quality of the envelope within a static method.

The second strategy is interpreted by pilot project in different climate zone. The main orientation is to improve insulation level of the considered buildings. Some conclusions show a gap between the studied project and the realisation. This conclusion highlights the crucial role of monitoring in this kind of project.

The third strategy aims to communicate the rationalisation of the energy consumption beside consumers. A several media spots are broadcasted on Radio and television. This spots aims to give some orientation on how to use rationally the heater or the air conditioner.

The fourth strategy is based on supporting the use of renewable energy by the consumers. The government supports 50 % of the use of the natural Gas in cars, and 45 % is also supported by the government to acquire solar water heater. From 2016, the government helps also households to improve the insulation of their housing. An ambition of 100 000 housing per year to insulate is fixed by the government. Which is noticeable here is the weak spreading of this program and it is due to the weak supporting media.

The strategies supported by the government don't take into account the importance of the urban realm implication in the energy demand and consumption. We (Boukarta, 2016, Boukarta et Berezowska, 2017, Boukarta et Berezoska-Azzag, 2017) have shown within the case of Algiers the implication of the density in both electricity and gas consumption. The density explains – 56 and – 65 % respectively the gas and electricity consumption.

In this paper, we aim to highlight within a holistic approach the socio-economic criteria implication in the Gas and electricity consumption in the residential buildings.

2. Materials and methods

To be able to assess the socio-criteria implication in the energy demand in arid and semi-arid climate zone, we have adopted a statistical-based approach. The energy consumption has been acquired from Sonelgaz (ONS, 2013), the firm in charge to invoice the energy consumption in Algeria. We have got the energy consumption of all the municipalities of Djelfa, for Gas and Electricity for the year of 2013. Based on this data of 2013, we can't use the census Data of 2008 (ONS, 2008). To overpass this gap we have performed two estimative models to be able to estimate the energy consumption of both electricity and Gas for the year of 2008. The models are performed based on a multivariate linear regression. For the Gas consumption, the model considers the number of subscribers linked to the gas and electricity network, the number of the population living in secondary agglomeration and the density. The model is performed with an R^2 of 99.7 %.

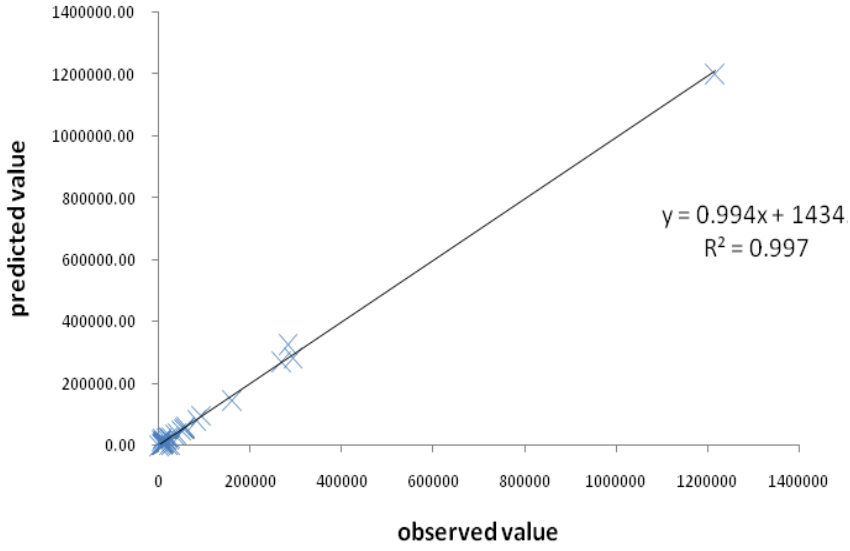


Fig. 1. Accuracy of the gas model

Table 1. Gas model summary

Model	Unstandardized Coefficients		Standardized Coefficients	Sig.
	B	Std. Error	Beta	
(Constant)	10968,596	4465,951		,020
subs_gas_13	63,596	5,803	2,276	,000
subs_ele_13	-31,895	5,136	-1,246	,000
density_2013	-106,610	27,930	-,076	,001
Sec_agglo_2013	3,315	1,379	,037	,022

The electricity model is also performed with an accuracy of 99.2 %. The model considers only the number of subscribers of both, Gas and Electricity (see the figure and table below).

Based on these two models, we have estimated the energy consumption for the year of 2008 by introducing in the models the number of subscribers of Gas, Electricity of 2008, the density and the number of the population living in secondary agglomeration of 2008.

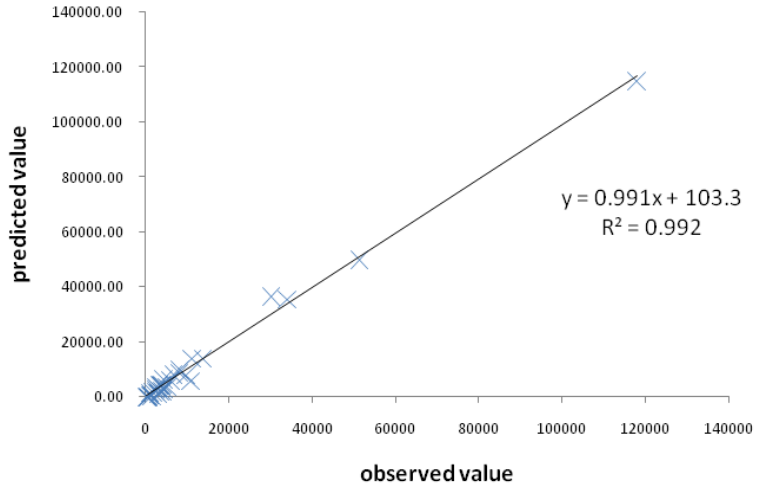


Fig. 2. Accuracy of the Electricity model

Table 2. Gas model summary

Model	Unstandardized Coefficients		Standardized Coefficients	Sig.
	B	Std. Error	Beta	
(Constant)	-1086,976	494,001		,035
subs_ele_13	4,395	,627	1,697	,000
subs_gas_13	-1,988	,684	-,704	,007

2.1 Managing census Data:

In Algeria, "The General Census of Population and Housing" is carried out by the government every ten years to collect information about population and their housing. Getting the energy consumption for the Gas and Electricity allows us to get more understanding reasons from the socio-economic parameters obtained from the 2008 census Data, which presents a large panel of potential determinants able to decrease or increase the energy demand.

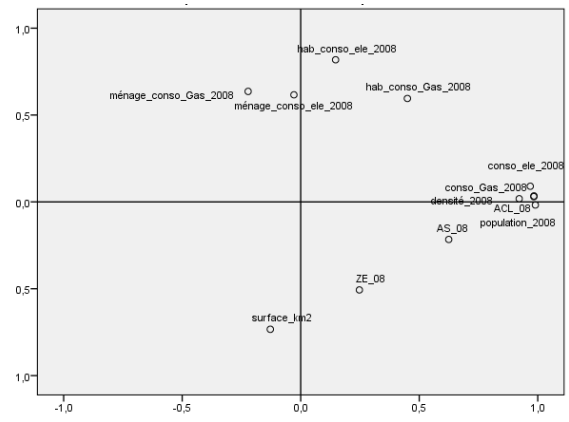
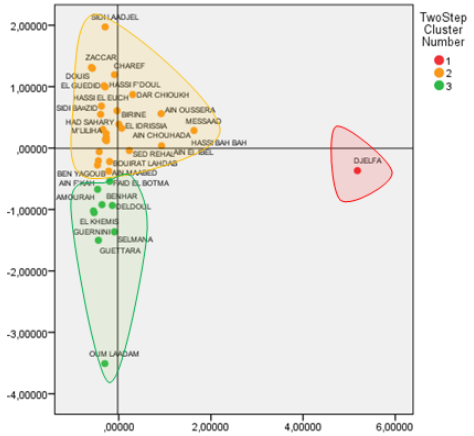
We have organized the data in six dimensions. (i) structural dimension of the municipal territory which contains the municipalities' area, the density of population, the number of population, the number of population in the chief-department, the number of population living in secondary agglomeration and scattered zone. (ii) Population characteristics, with Civil status (single rate, married rate, divorced rate and widowed rate), Gender (feminine and masculine rate), mean age per municipality and Instruction level. (iii) Population activity: with Active population, Housewives rate, Children going to school rate and Retired person's rate. (iv) Dwelling occupancy with Household size and Room occupancy rate.(v) Dwelling typology, with typology of housing rate per city (number of Dwelling, secondary residence, collective housing, individual and traditional housing), the average value of rooms per housing per municipality and the average area of housings. (vi) Household appliance, which contains the appliance rate TV, cooker, refrigerator, washing machine, air conditioner, computer and internet access rate per municipality.

3. Results

3.1. Sensitivity Analysis of the census data with energy consumption Based on PCAs:

The sensitivity analysis is based on a panel of six PCAs for each dimension to identify the criteria reducing the energy consumption and to cluster municipalities according to the dimension studied.

Table 3. PCAs maps combining energy consumption and the census data of 2008

D	Factorial analysis with each dimension considered as discriminant	Clustering municipalities according to each dimension.
1		
	Factorial analysis with territory structuring as discriminant. Quality of representation : 67.5%	

2

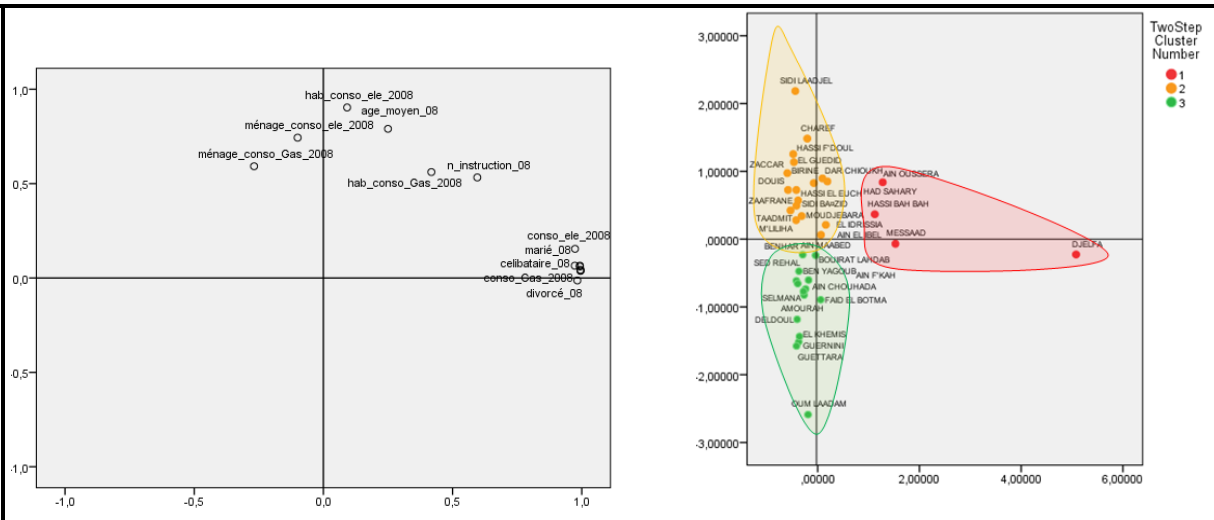
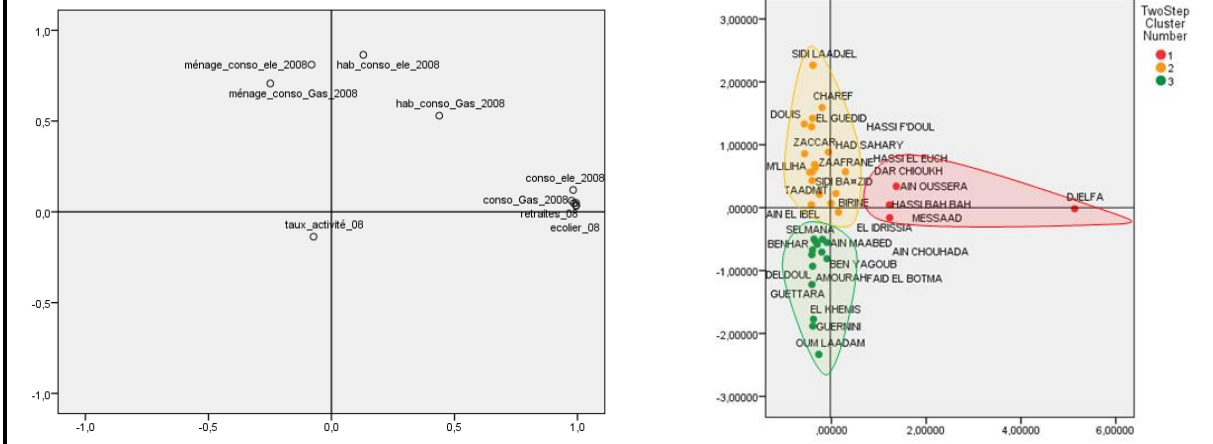


Fig. 1 :

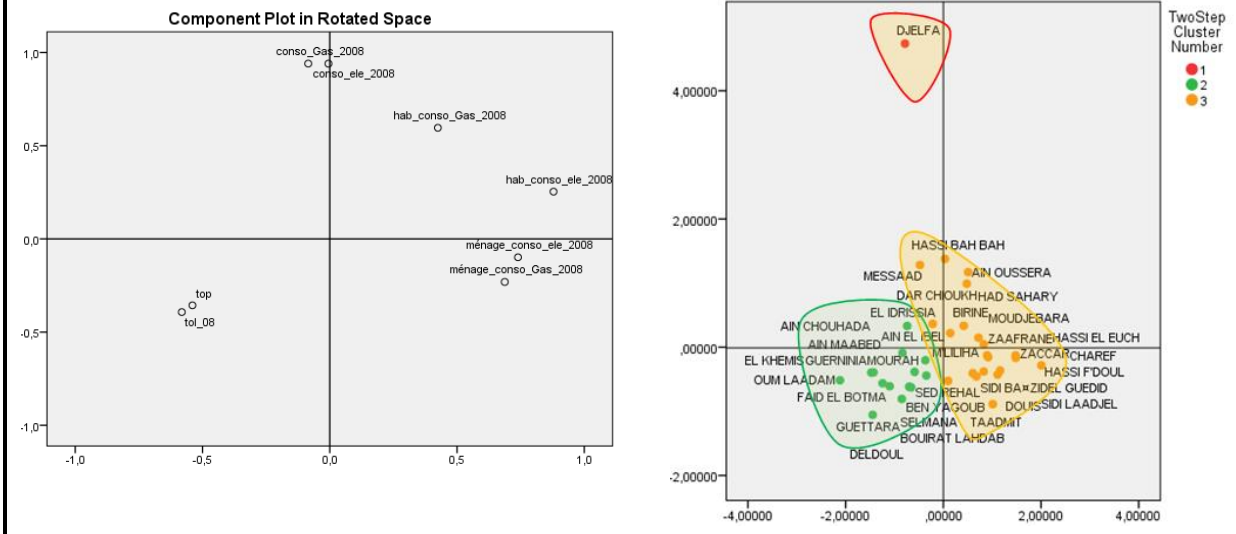
Factorial analysis with Population characteristics as discriminant. Quality of representation : 81.9%

3

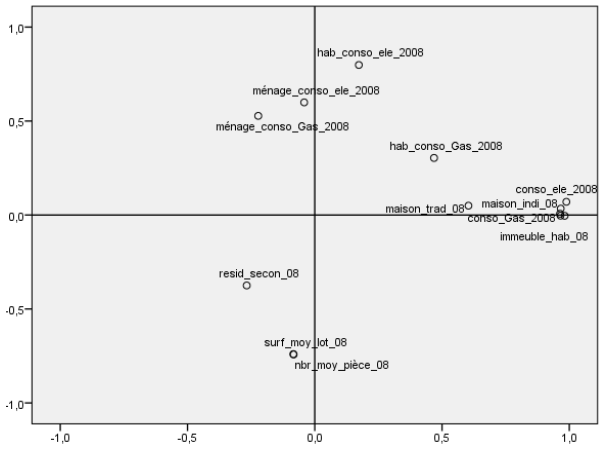
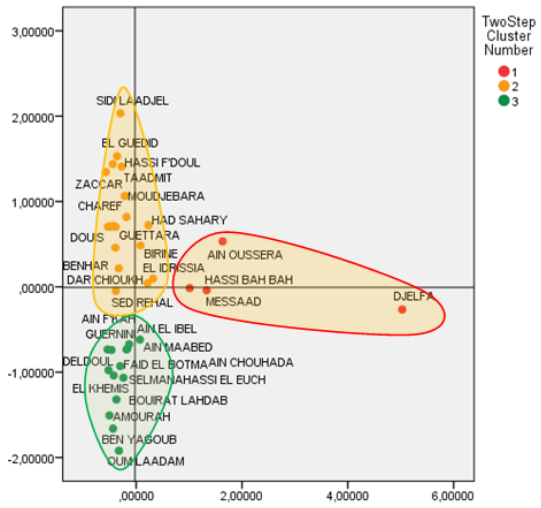
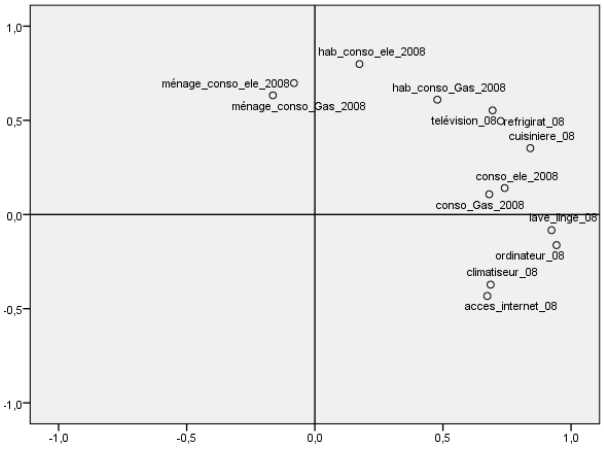
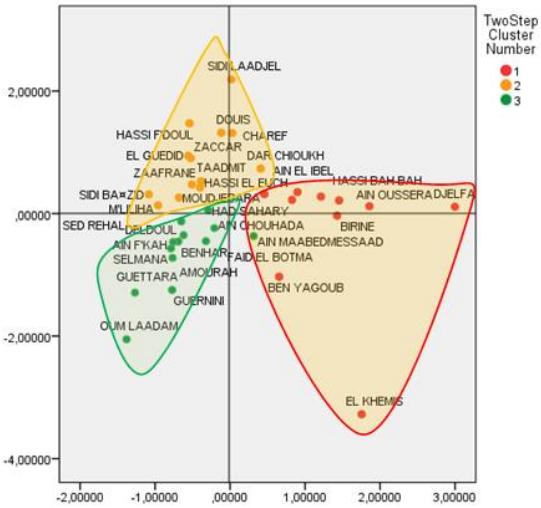


Factorial analysis with Population activities as discriminant: Quality of representation 76.03%

4



Factorial analysis with Dwelling occupancy as discriminant. Quality of representation 64.26%

5		
	Factorial analysis with dwelling typology as discriminant. Quality of representation : 62.30 %	
6		
	Factorial analysis with household appliance as discriminant. Quality of representation : 66.17%	

Based on the organization of the census data as shown above, we clustered the municipalities in three profiles according to their six dimensions of the socio-economic criteria, their energy consumption per municipality, per households and per inhabitant. (a) The wasteful municipalities (red colour) which consumes more energy per municipality and an average consumption by household. (b) The standard or intermediate profile, represented by the orange colour. This class consumes more energy per households and average consumption per municipality. (c) And the thrifty profile which consumes less energy per household and per municipality.

The structural dimension of the municipal territory shows that the energy consumption has two behaviours based on the observation's level, household, inhabitant or municipality level. The energy consumption by municipality is projected at the right of the map with the density, the population number, the Chief-place agglomeration, the Secondary agglomeration and the scattered one. The correlation is positive, the energy consumption increases with the population number. But, the energy consumption per household and inhabitant is projected in the opposite way than the municipalities' area, scattered zone, and the secondary agglomeration. This means that households consume less energy in bigger municipalities than in smaller and most populated ones. The biggest and less populated municipalities are not as rich as the smallest ones. This is why we think that the consumption is here constrained by the income. Our assumption is confirmed by the sixth PCA presenting the appliance possession rate per municipality where smaller and most

populated municipalities have higher appliance possession rate. It is logically recognized that households with higher income have higher appliance possession rate as well.

The characteristics of population have also an impact on the energy consumption. The average age and the instruction level are positively correlated to energy consumption which means that older and more instructed municipalities consume more energy. Oum Laadam has the less level of instruction and the higher average age, and remains the less energy consumer per municipality and household

Within population activities, the map above shows that the most active households consume less energy. Also, having more retired and children going to school rate par municipality indicate less energy consumption.

Within Housing occupancy as discriminant, the rate of occupancy per room and housing is projected oppositely with energy consumption for both households and municipalities which interprets a negative correlation. The more important is the rate of dwelling and room's occupancy, the less important is the energy consumption considered at the municipality and dwelling scale.

Within dwelling typology, the energy consumption is negatively correlated to the rate of secondary residence, average area and number of rooms per housing.

The household's PCA above shows that the rate of computers, air conditioner, internet access and washing machine reduces the households' energy consumption while the rate of cookers and refrigerator increase for housings.

3.2. Pearson's Bi-variate correlation:

To complete the overview of the most important socio-economic parameters, we have performed a bivariate correlation between the energy consumption of Gas and Electricity household level. The correlation analysis evaluates the degree of standardized covariance between the variables. The results are shown in figure below. The Pearson's correlation coefficient (r) is a measure of the strength of linear dependence between two variables with a value between −1 and +1. The proportion of shared variance (R2) can be calculated by squaring the Pearson's r. In other words, R2 represents the proportion of variability in one variable that is accounted for by another variable. The values range from 0 to 1, where 1 indicates a perfect fit (Field, 2010).

The figure below is a synthetic view of the Pearson's bivariate correlation at the housing level.

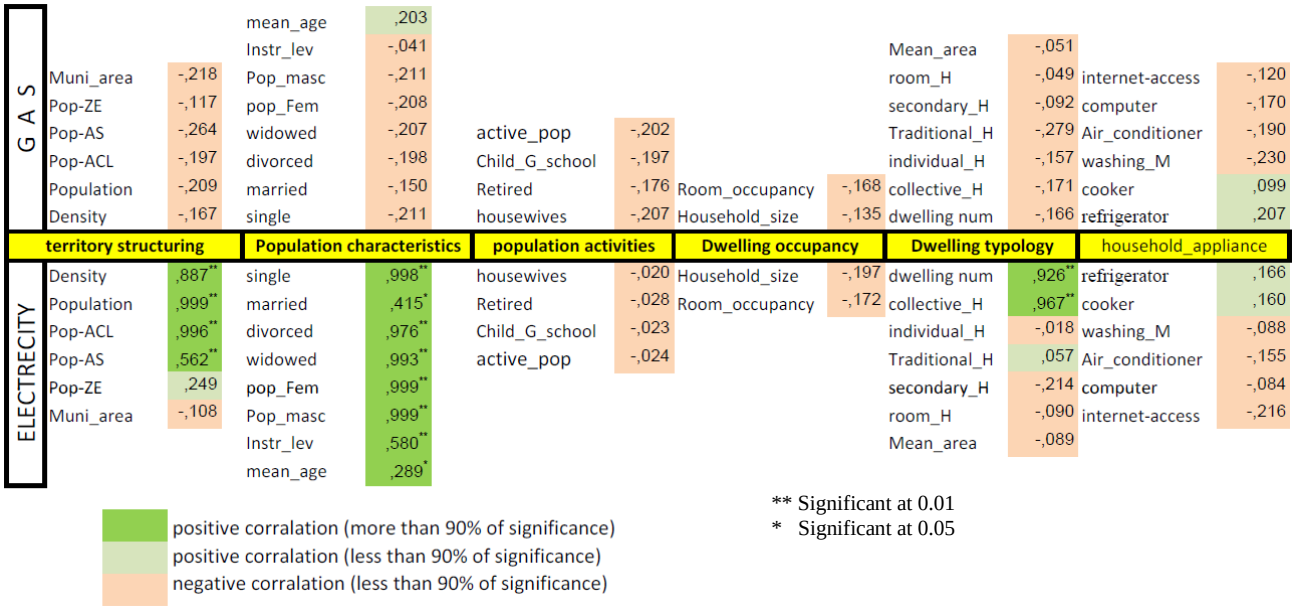


Fig. 3. Pearson's bivariate correlation

The most important factors increasing the electricity consumption are observed with population characteristics where the significance of the entire parameters is above 90 %. While the

most important factors reducing the electricity consumption are population activity and dwelling occupancy where all the parameters are negatively correlated to the electricity consumption. In the other hand, the most important factors reducing Gas consumption are observed with all the dimensions. The most important value is observed with retired person's rate per municipality (-28 %). Followed by traditional housings (-27.9 %) and this could be interpreted by the materials used in the traditional housing, where the stone and adobe walls are frequently used in the traditional housing. These materials have a weak U values comparing with hollow bricks.

Also the average age per housing and per municipality is posotovely correlated to the energy consumption for both Gas and Electricity. One way to explain this relationship between age and energy is to look at the thermal comfort perception. older people have a lower thermal comfort perception (Chen et al., 2013).

To get more understanding reasons, we have aggregated, as shown in the figure below the negative and positive correlations per dimension to be able to assess the impact of each dimension on the energy consumption. A total impact of the socio-economic criteria of the department of Djelfa is presented also as an aggregated value (see the figure below).

GAS	housi	positive	,000	positive	,203	positive	,000	positive	,000	positive	,000	positive	,153	,059
		négative	-,195	négative	-,175	négative	-,195	négative	-,151	négative	-,138	négative	-,177	-,172
		territory structuring		Population characteristics		population activities		Dwelling occupancy		Dwelling typology		household_applianc		total	
ELECTRECI	housi	négative	-,108	négative	,000	négative	-,024	négative	-,185	négative	-,103	négative	-,123	-,136
		positive	,739	positive	,781	positive	,000	positive	,000	positive	,650	positive	,180	,163

Fig. 4. Impact of the socio-economic criteria based on pearson's correlation

The figure above considering the Gas and Electricity consumption and the socio-economic criteria at the housing scale shows globally that the socio-economic criteria are reducing the Gas energy consumption by up to – 11.3 % and increasing the electricity consumption by up to 2.7 %. the most important dimension reducing the Gas consumption are, the structuring territory, population activities, Dwelling occupancy and typology. The most important dimension increasing the electricity consumption are the territory structuring with an average value of 73.9 %, population characteristics (78.1 %) and dwelling typology with 65 %.

4. Conclusion

In this paper we have performed a set of sensitivity analysis to assess the energy impact of socio-economic criteria based on PCAs and a bi-variate Pearson correlations. The results show a clear correlation between socio-economic criteria and the energy consumption. The structuring territory, population activities, Dwelling typology and occupancy are the most important criteria reducing the energy consumption. This paper highlights the importance and potential energy saving of the socio-economic criteria which could help politics to focus on the structuring territory, population characteristics and dwelling typology to understand how these parameters could reduce the energy consumption in particular the electricity consumption instead of increasing it.

References

Aprue, 2012 – Aprue (2012). Site web of national agency for the promotion and energy use rationalization. [Electronic resource]. URL: http://www.Aprue.org.dz/

Bouamama, 2013 – *Bouamama Wahiba* (2013). "Au Sujet De La Politique D'efficacité Energétique En Algérie: Approche Systémique Pour Un Développement Durable.Cas De: Programme Eco-Bat Cnerib", magister thesis, university of tlemcen, Algeria.

Boukarta, 2016 – *Boukarta S.* (2016). Densité, énergie et changements climatiques, quelle résilience? In le climat dans tous ses états, newsletter, n°02.

GIZ, 2015 – Giz (2015). Guide Pour Une Construction Eco-Energétique En Algérie.

ONS, 2008 – ONS (2008). Office national de statistiques, Census data.

ONS, 2013 – ONS (2013). Office national de statistiques, population Data.

Reta, 2015 – RETA (2015). Website of the thermal regulation in Algeria. [Electronic resource]. URL: www.reta.cder.de

Field, 2010 – *Field A.* (2010). Discovering Statistics using SPSS, third ed., Sage Publications, London.

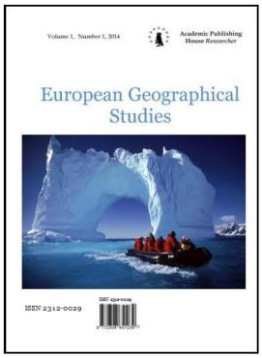
Chen et al., 2013 – *Jun Chen, Xiaohong Wang, Koen Steemers* (2013). A statistical analysis of a residential energy consumption survey study in Hangzhou, China, *Energy and Buildings,* 66, pp. 193–202.

Boukarta et Berezowska, 2017 – *Boukarta, S., Berezowska, E.* (2017). Exploring the Energy Implication of Urban Density in Residential Buildings. *Journal of Applied Engineering Sciences*, 7(1), pp. 7-14. Retrieved 28 Aug. 2017, doi: 10.1515/jaes-2017-0001

Boukarta, Berezoska-Azzag, 2017 – *Boukarta, Soufiane, Berezowska-Azzag, Ewa*. "Urban island" as an energy assessment tool. The case of Mouzaia, Algeria, *Journal of applied engineering science,* 15 (2017) 2, 128-139. doi: 10.5937/jaes15-12951.

Published in the Slovak Republic
European Geographical Studies
Has been issued since 2014.
ISSN: 2312-0029
E-ISSN: 2413-7197
2017, 4(2): 70-79

DOI: 10.13187/egs.2017.2.70
www.ejournal9.com



Traditional Food Producers and Possibilities of Their Tourist Affirmations the Territory of Bačka (Serbia)

Tamara Lukić [a, *], Bojana Kalenjuk [a], Bojan Đerčan [a], Milka Bubalo-Živković [a], Milica Solarević [a]

[a] University of Novi Sad, Novi Sad, Serbia

Abstract

The aim of the paper was to indicate the possibilities offered by the inclusion of traditional food products in the tourist offer of Bačka, a region bordered by the rivers Danube and Tisa in the northwestern part of Serbia. The purpose of the research was to identify who are the producers of traditional food products that are the main actors of the realization and confirmation of the conceptual plan. The communication was conducted in the form of questionnaires and interviews. The results obtained showed that the tourist affirmation of traditional food products would enhance the existing tourist offer. The emphasis on these products has been made so far once a year, when the manifestations bearing their names were organized. Their place, which until now was in the shadow of some other type of touristic movements, can be improved by organizing various tours, routes, to familiarize with the production process, tasting and selling these products. Other tourist attractions would be viewed as complementary. With the financial and political support of the government, quality control would be established, the volume of production of healthy eco-products and export potential would be increased. This would improve the material situation of producers. If this action would be successful, this could be the key to further development of rural areas in this part of the southeastern part of the Pannonian Basin. Development implies the improvement of the material situation of the producers and the creation of new employment opportunities that would keep or even bring back the population to the countryside.

Keywords: food, gastronomy, Bačka, traditional food producers, routes.

1. Introduction

The population of Bačka, in the northwestern part of the Republic of Serbia, traditionally makes food products for its own needs. This process is time-consuming and specific, and is not possible under industrial production conditions. Achieving a specific taste makes it original and unrepeatable. Because of this specialty it is attractive to both domestic and foreign visitors. This paper is inspired by the work of Bessiere and Tibere (2013), which states that tourist interest in different food cultures is a factor for local development in the fields of agro-food and crafts, whilst also contributing to the enhancement of food culture and heritage. The research shows the characteristics of the producers of traditional food products in Bačka and how much they are

* Corresponding author
E-mail addresses: snstamara@yahoo.com (T. Lukić), bojanakalenjuk@yahoo.com (B. Kalenjuk), bojandjercan@yahoo.co.uk (B. Đerčan), miladin32dus@yahoo.com (M. Bubalo-Živković), milica.solarevic@gmail.com (M. Solarević)

interested in affirmation in tourism. The importance of the paper is because of drawing attention to the existing forms of tourism trends that are influenced by traditional food products, but also to potential types of tourism activities. The enhancement of tourism offer could provide additional incomes to raise the standard of living in the countryside, which would only be able to stop the emigration process and depopulation.

2. Research Area

Bačka is located in the northwestern part of Serbia (Figure 2). It is bounded by the Danube in the west and south, while its tributary Tisa makes the eastern natural border of Bačka. The northern border of Bačka is pulled down by the southern part of the sandy terrain, which extends almost to Budapest northwards. Bačka extends in the southeastern part of the Pannonian Plain, at altitude of 70 to 140 meters. Its relief consists of inundational plaines, alluvial terraces, pleistocene terraces, loess plateaus, and sand terrain. The largest areas of Bačka are under pleistocene terraces and loess plateaus, which are both in relief and soil quality excellent for cultivating any culture of moderate width. The plain of Bačka in conditions of moderate continental climate, rich in underground and surface waters, and above all black soil, has a good pedological cover in a relatively healthy environment with all the necessary prerequisites for the production of quality and healthy food. Located in the central European and Oriental gastronomic influences, for centuries it fosters the most rewarding recipes. Janjetović (2009) and Hadži-Zarić (2010) speak about the influences of Hungarian, Romanian, Slovak, Turkish and other surrounding cuisines.

3. Methods

Bačka was selected because it stands out in the region of Vojvodina by the number of registered craftsmen, which in return stands out in relation to other regions of Serbia (Stojanović, 2017). In the territory of Bačka, 94 traditional food producers were found which were willing for conversation. That means there are many more than that number.

The work was created by analyzing literature and interpreting the results obtained by statistical processing of data collected in the survey, as well as by interviewing traditional food producers. The interview was based on the questions that Fabeil (2013) used in her studies of traditional craftsmen in Malaysia.

Theoretical Approach

In Bačka, traditional food products are made for personal needs, but there are those who make them for sale. There are meat producers, milk processors and honey producers. However, there are others who are in the minority, and therefore are rarely mentioned, such as candy producers, halva producers, soda producers, traditional cake producers, etc. They belong to people who perform old crafts. In literature, the terms of gastronomy and craftsmanship usually stand side by side (Lee et al, 2009). Xie and Wall (2008) classify them into cultural elements and authentic ethnic tourist attractions.

According to Hung et al (2016), traditional crafts and handicrafts and gastronomy, in addition to cooking courses, porcelain painting, drawing and sculpture are considered creative activities in tourism. Ali et al. (2016) believe that creative tourists' experience is a good predictor of their memories, satisfaction, and behavioral intentions which makes a motivation for return, a good recommendation to friends, or a search for a similar place. Results of de Molina et al (2016) showed a definition of gastronomy as an intangible world heritage would be required. Looking at the production of food, as a kind of craft, is present in the paper. For Cobos et al. (2015) the kitchen, like the foundation of agro-food crafts, is a factor of national identity that goes beyond the mere fact of satisfying human needs. Bessiere and Tibere (2013) state that tourist interest in different food crops is a factor for local development in the fields of agro-food and crafts, while also contributing to the enhancement of food culture and heritage. Vaugeois and Predyk (2016) find that food artisans play critical role in providing destinations with authentic food products visitors and in growing the food tourism industry. According to Smith and Costello (2008), the wish to travel and taste unique and authentic foods is an emerging phenomenon in the tourism industry. It is a fact that food is increasingly appreciated as a significant part of the cultural tourism market and a key area of interest for rural areas.

Pallarès-Blanch et al (2015) emphasize that the lack of employment and in the process of restructuring in rural areas, women play a central role in new economic activities, especially those related to food crafts. Edima et al. (2014) and Cobos et al. (2015) point to the development of urban food crafts, which constitute, through street foods, both one of the main feeding sources of people and source of income. According to Tregear (2005), two strands of literature offer different conceptualizations of artisans, the first inferring proclivity towards co-operation and community involvement, the second assuming the prioritization of lifestyle goals over growth. Each conceptualization presents alternative implications for regional development. Review of the literature from the Bačka area leads to works on rural tourism (Petrović et al, 2016; Jegdić et al, 2017; Vujko et al, 2017), wine (Sekulic et al, 2016; Radovanovic et al, 2017) or manifestation tourism (Bjeljac et al, 2014; Blešić et al, 2014; Bjeljac, Ćurčić, 2016). Gastronomic tourism (Banjac et al, 2016; Vuksanović et al, 2017) and the forms of its manifestation in the area of Bačka have begun to be paid attention in recent years.

4. Results

The results of the research are related to the socio-demographic and other characteristics of the producers of traditional food products, and what are the characteristics of their job? How much are they willing to affirm themselves in touristic sense? And in what form could this tourist affirmation take?

Who are the guards of the gastronomic tradition of Bačka?

Respondents were located in each settlement of Bačka, but only 94 were willing to fill in the questionnaire and conduct verbal communication. Guards of gastronomic tradition are women. According to age categories, the relative majority of respondents are in the cohort of 50-59 years. According to the ethnic structure, most of the respondents were Serbs, but more than a third of traditional food producers were part of some of the smaller ethnic groups. Among them are mostly Hungarians and Slovaks (Table 1). Only a third of respondents come from other settlements, while most are from urban areas. According to education, most of them are highly educated, almost every fifth has completed secondary school, and almost every fourth has completed only primary school. The production of traditional food products is the only job for most of the respondents.

Respondents are owners of their craft business. Only every twentieth person started their business in a partnership. Half of the respondents have a registered business, while others state that the registration of business would jeopardize their economic viability. Nearly every fourth respondent owns a special space, workshop (Table 2). Most of the respondents work at home, while on average every tenth respondent does not want to say about the space in which they produce. Visibility on the tourist map must be condition the transparency of the production space, in order to be available in the quality control process.

Table 1 Socio-demographic characteristics of producers of traditional food products

		Number	%			Number	%
Gender	Male	45	47.9	Settlement	Town	59	62.8
	Female	49	52.1		Other	35	37.2
Age	20-29	3	3.2	Education	No school	1	1.1
	30-39	14	14.9		Primary school	22	23.4
	40-49	20	21.3		High school	18	19.1
	50-59	25	26.6		Faculty	53	56.4
	60 -69	24	25.5	Employment			
	70 i više	8	8.5		The only job	51	54.3
					Additional job	43	45.7

Ethnic groups	Serbs	61	64.9
	Hungarians	14	14.9
	Slovaks	11	11.7
	Croats	6	6.4
	Others	2	2.1

Source: Survey

Table 2 Other characteristics of producers of traditional food products

Questions	Answers	Number	%
Owner	The only one	89	94.7
	Partnership	5	5.3
A registered shop	Yes	47	50.0
	No	47	50.0
Place of production	Home	59	62.8
	In a workshop	22	23.4
	Somewhere else	13	13.8
Received help	Yes	31	33.0
	No	63	67.0
Market	International sale	6	6.4
	Outside of Bačka	27	28.7
	In Bačka	32	34.0
	Local	23	24.5
	Random	6	6.4

Source: Survey

Research on the basic characteristics of the job of the producers of traditional food products

Based on the communication with traditional producers, the following findings have been made. They generally have an easy access to raw materials, equipment and sales opportunities. Regarding the market, some producers have shown that it exists also beyond the borders of the Republic of Serbia. The relative majority, which is one third of the respondents, sell their products in the region, in the area of Bačka. As they say, big cities, such as Novi Sad, Subotica and Sombor, 'eat' it all quickly. Almost a quarter of respondents sell their products to the local community because their production volume is modest or their quality is proven and verified. Some of them state that they are more likely to work by order than that 'their goods wait for the buyer'. These results show that the production of traditional products is currently economically viable.

Respondents agree that they prefer to do the job independently, as well as they fully believe in their skills. Respondents consider they have the skills to perform craftsmanship and manage equipment. They agreed also that they have the ability to connect with other people in order to create new ideas, solve problems and develop new jobs. Most of them say they are constantly working to improve the organization and planning of production and sales. They fully agreed that they constantly plan new and better ways of doing things to improve performance.

One of the positions with which they agreed most is that their crafts allow them to be independent. Most say their craft is a passion, but also a great way to earn money. Respondents agree that they have flexible working hours and are usually refer it as a great advantage of this job. Respondents feel the support of friends and family and agree that they listen to their advices.

The opinions of the respondents were divided as to how the external factors can influence the performance of the craft activity they perform. Thus, according to the mean value and the value of

standard deviation, respondents cannot say that they thing that unexpected obstacles really prevent them from achieving what they want.

However, the research has shown that there are some difficulties and problems. Traditional food producers say they find it hard to find workers. The production process is long, requires patience, knowledge, tidiness. They consider that young people prefer jobs for which they do not have to invest much effort and which bring them a quick profit.

It is hard for them to get additional funding sources and do not consider to have support from government agencies. But standard deviation also shows high levels of their mutual disagreement on these issues. This means that things vary from one individual to another. Lukić et al. (2015) talk about the existence of some forms of state aid in crafts on the territory of Bačka. In the survey, almost a third of respondents said they had received some form of support from the government sector (Table 2). Respondents who felt political or financial support commented that they knew people from the profession who never asked for help, and they explain that this could be the reason they could not get it.

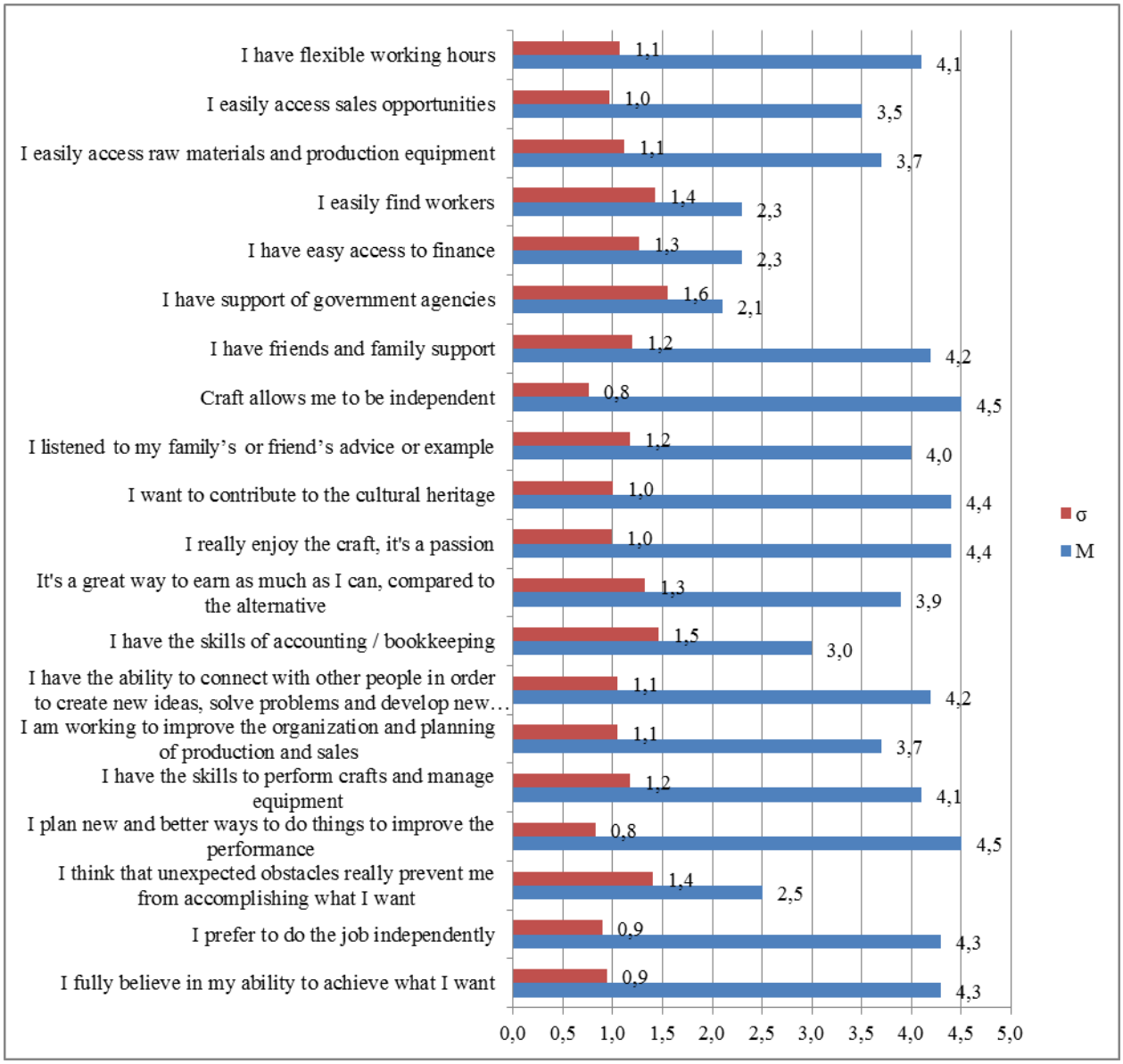


Fig. 1. Results of descriptive statistics based on the questions in the survey
Source: Survey

Based on the answers received, it can be clearly seen that the respondents are indecisive about the possession of skills in accounting or bookkeeping. This means that some have problems with it. The high value of standard deviation indicates that there is a great deal of disagreement among them. The differences that have arisen are a consequence of the financial situation. Those who have good earnings can run the business legally and finance accounting and bookkeeping services. In the worst position are the producers of traditional food products that want to work legally, but earnings do not allow them to pay for auxiliary workforce, such as accountants, and they themselves 'cope with paperwork'.

The most important attitude about which all respondents were very united and clear is that there is a desire to contribute to their cultural heritage through their actions. Cultural heritage is one of foundations for tourism development (McKercher, Du Cros, 2002; Ismagilov et al., 2014; Sharpley, Telfer, 2014).

5. Discussion

This part of the paper will identify the facts obtained by talking with people who produce food in the traditional way. As the survey showed, local producers of traditional food products do not have sales problems. However, according to their words, sales could be even higher. The chance to increase is seen in tourism. Food products of traditional crafts are referred by tourists as 'tasty souvenirs'. Producers of traditional food products are already well-affirmed in touristic sense at various gastronomic events (Gagić et al., 2013). Among the most visited are: 'Strudel fest' in Bačka Palanka, 'Kulen sausage festival' in Bački Petrovac, 'Sausage festival' in Turija, 'Pihtije festival' and 'Bean festival' in Temerin, 'Šajkaška Mundijada', 'Golden pot' and 'Škembijada' in Žabalj (Internet, 2017). Getz, Page (2016) observe an increased interest in the events, so these are rapidly developing and making a significant contribution to business and leisure-related tourism. As gastronomic manifestations in the area of Bačka are organized once a year, and the potentials for the production and sale of these products exist most often throughout the year, there is a consideration of other types of tourist movements, such as various gastronomic routes.

The reasons for validity of the organization of gastronomic routes are numerous. Unlike manifestations, they can be organized always or when a group of interested parties is formed. In the form of visits to workshops of traditional food producers, they can be organized indoors. This means that weather conditions do not constitute a limiting factor for them. In addition, both in terms of time, and in terms of other wishes of tourists, their routes can be adjusted. Time means they can last a part of the day, all day or more days. Bačka has an area of about 8671 km square. It extends along the north-south direction in a length of about 100 km. In the east-west direction, Bačka extends up to 90 km. The infrastructure is such that all main roads are asphalted and the international route E-75 goes in the north-south direction. Therefore, it can be said that every village is reached in less than two hours of drive. Routes can be adjusted according to the wishes to visit some other natural, cultural-historical, sports-recreational and similar sites.

Traditional knowledge of the production of traditional food products has been passed from one generation to another for centuries. In each settlement there are 'those who know' to make them. Quality standards should be respected, for which the competent authorities would have to devise and organize control mechanisms.

The Figure 2 shows the proposal of 'sweet route', that is, locations of the producers of traditional sweet foods from honey and sugar. The Figure 3 shows those who make the so-called 'salty' products primarily from meat and milk. Locations on maps show those who have agreed to participate in the survey. Based on this, it was concluded that they were more willing to contact with tourists than those who were not willing to contact even with researchers. At each stopping point in the gastronomic route, tourists can get acquainted with the production process, then taste and eventually buy any gastronomic product.

The production process of some products is short, so it can be directly observed in the observation rooms. With longer production processes, tourists can attend a certain stage of production, while others can be demonstrated virtually, through a story or using props.

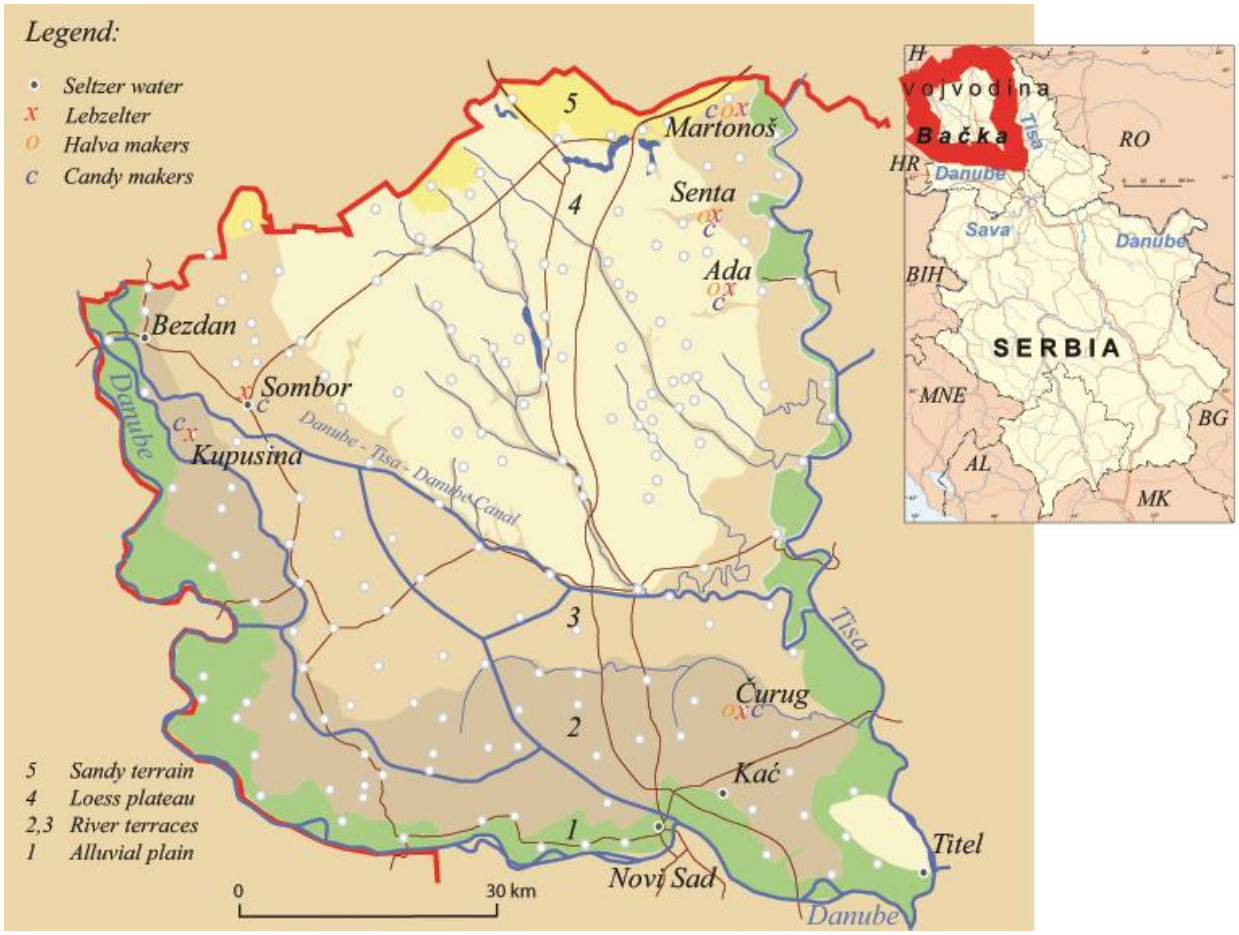


Fig. 2 Famous locations where sweet products are made can be potential spots on the 'Sweet Route'

Interviewed interlocutors agreed that souvenirs of traditional craft food products are unique. Each workshop has its own secret recipe achieving an unrepeatable taste. Souvenirs are rarely edible, let alone of phenomenal taste, as one of the interlocutors says. Namely, the interlocutors praised their use value. Many products have already received attractive packaging so they are also attractive, observing from this segment of marketing. The respondents agreed that not all products by which Bačka is recognizable have protected their geographical origin and that this potential has not been fully exploited.

In support of the sustainability of such a tourist offer, all other pull factors must be perfect, such as: organization, environmental standards, accommodation capacities, marketing and promotion of complementary tourism potentials that are not gastronomic, cultural-historical, manifestation ones or of some other nature. Knowledge of ancestors about food production is valuable. Experience along 'small secrets' influences the originality of taste. Emancipation of hard-working people of 'good will' with respect to the prescribed quality standards can positively affect their standard of living. The higher standard brings greater interest among the population, especially young people, in the production of traditional food products, which affects the sustainability of old crafts related to food production. Handmade production raises the price of finished products, however, it is affordable to markets of higher standard than Serbia has. So it can be said that a more aggressive promotion of products abroad will contribute to sustainability, for which it is also necessary to achieve a certain level of productivity increase.

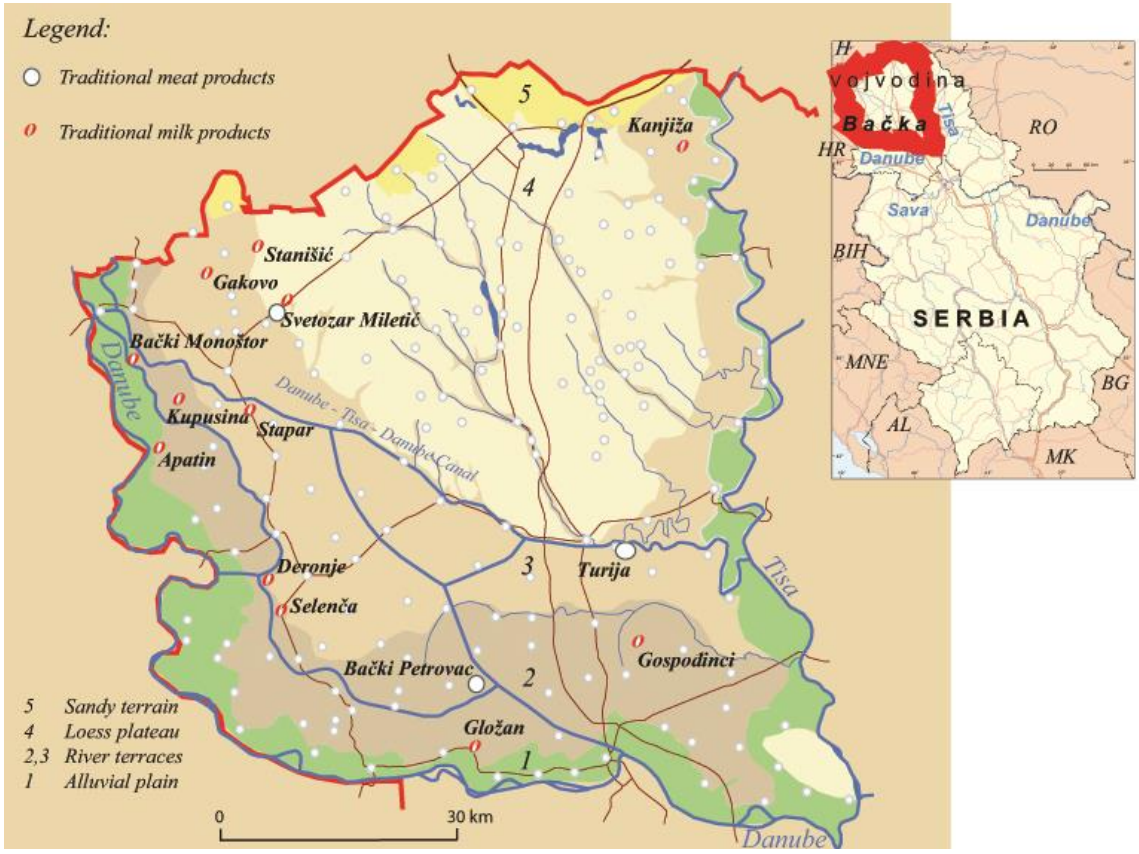


Fig. 3 Famous locations where salt products are made can be potential spots on the 'Salt Route' Source: Basic map adapted from Bugarski, 2000

Vojvodina is affected by the process of depopulation (Kosic et al., 2015; Stojšin, 2015; Simić, Bajčetić, 2016). Negative natural increase and migration towards urban centers and abroad are empting rural settlements. Real estate is sold at low prices, that is, a drastic fall in real estate prices is recorded (Ranisavljević, Hadžić, 2016). They can be viewed as potential accommodation capacities on the mentioned routes. Based on that, in addition to the traditional food producers, it would be possible to affirm the entrepreneurial ideas of the local population about the organization, arrangement and maintenance of accommodation capacities. It is superfluous to talk about the benefits that would come with the success of the longer stay of tourists in the territory of Bačka.

6. Conclusion

Food products made in a traditional manner in the workshops of traditional craftsmen have a perspective and are sustainable. The ecological sustainability of this activity is obvious, because the raw materials are in the nature. Often they are totally usable. If in some process of making unusable rests remain, they are bio-degradable and as such do not pollute the environment. Economic sustainability is visible, but everyone is striving to increase it. Financial support and government support that would be significant for expanding production. Expanded production would produce surpluses for exports. Target export groups are members of the diaspora, who recognize these products by quality, can afford them and affect their sense of nostalgia. Establishing certain economic sustainability would have a positive impact on social sustainability. The lack of a workforce will be overcome if the possibility of good earnings is determined. Money attracts young people, but also all working people. Based on this, it can be said that the products of the traditional food production influence the maintenance of the rural area of Bačka, and Vojvodina as well. Tourism in all its forms, primarily routes in this case, only 'goes in favor of' the need to increase jobs in production, placement, and in other related activities (care about procurement, accommodation capacities, marketing, etc.). People are run by the money. Based on this, it can be concluded that everyone with entrepreneurial ambition and in accordance with

standards can become food craft producers. The results of the paper can be a motivation, a business idea for young people and be an incentive to spread the same and similar activities.

7. Acknowledgment

This paper is part of the project No. 142-451-2669/2017 *funded by the Provincial Secretariat for Higher Education and Scientifc Research of the Vojvodina Province, Serbia. The authors are grateful to the reviewers, whose comments and criticisms have ensured the quality of the paper*. The authors wish to thank Dr Tatjana Stojanovic who has helped in communication with respondents.

References

Bessiere, Tibere, 2013 – *Bessiere, J., Tibere, L.* (2013). Traditional food and tourism: French tourist experience and food heritage in rural spaces. *Journal of the Science of Food and Agriculture*, *93*(14), pp. 3420-3425. DOI: 10.1002/jsfa.6284

Janjetović, 2009 – *Janjetović, Z.* (2009). Serbian influences on the everyday culture of the Germans in Vojvodina. *Yearbook for Social History*, *16*(2), 19-33. (in Serbian)

Hadži-Zarić, 2010 – *Hadži-Zarić, G.* (2010). *Vojvodinas cook book – culinary geography*. Beograd: Cicero. (in Serbian)

Stojanović, 2017 – *Stojanović, T.* (2017). Geospatial aspects of the sustainability of old crafts in Backa. PhD thesis in the manuscript (on Serbian)

Fabeil, 2013 – *Fabeil, F.* (2013). *Entrepreneurship in Rural Malaysia: An Investigation of Handicraft Producers in Sabah Region*. The University of Edinburgh, Edinburgh.

Lee et al., 2009 – *Lee, Y., Kim, S., Seock, Y.K. and Cho, Y.* (2009). Tourists' attitudes towards textiles and apparel-related cultural products: A cross-cultural marketing study. *Tourism Management*, *30*(5), pp.724-732. URL: https://doi.org/10.1016/j.tourman.2008.10.007

Xie, Wall, 2008 – *Xie, P.F., Wall, G.* (2008). Authenticating ethnic tourism attractions. *Managing visitor attractions*, pp. 132-147.

Hung et al., 2016 – *Hung, W.L., Lee, Y.J., Huang, P.H.* (2016). Creative experiences, memorability and revisit intention in creative tourism. *Current Issues in Tourism*, *19*(8), pp. 763-770. URL: http://dx.doi.org/10.1080/13683500.2013.877422

Ali et al., 2016 – *Ali, F., Ryu, K. and Hussain, K.* (2016). Influence of experiences on memories, satisfaction and behavioral intentions: A study of creative tourism. *Journal of Travel & Tourism Marketing*, *33*(1), pp. 85-100. URL: http://dx.doi.org/10.1080/10548408.2015.1038418

de Molina et al., 2016 – *de Molina, M., de Molina, B., Santamarina Campos, V. del Val Segarra Oña, M. (*2016). Intangible Heritage and Gastronomy: The Impact of UNESCO Gastronomy Elements. *Journal of Culinary Science & Technology*, *14*(4), pp. 293-310. http://dx.doi.org/10.1080/15428052.2015.1129008

Cobos et al., 2015 – *Cobos, A.V., del Carpio Ovando, P.S., Melchor, N.G.* (2015). Agrofood Crafts and Public Policy at the Crossroads of Globalization. *European Journal of Business and Social Sciences*, *4*(05), pp. 139-156.

Vaugeois, Predyk, 2016 – *Vaugeois, N.L., Predyk, J.* (2016). Consuming places through food tourism: Insights on the food artisan sector from BC. Conference Making Destinations Come Alive through Research, Travel and Tourism Research Association Canada at ScholarWorks@UMass Amherst.

Smith, Costello, 2008 – *Smith, S., Costello, C.* (2008). Culinary tourism: Satisfaction with a culinary event utilizing importance-performance grid analysis. *Journal of Vacation Marketing* 15(2): 99.

Pallarès-Blanch et al., 2015 – *Pallarès-Blanch, M., Tulla, A.F., Vera, A.* (2015). Environmental capital and women's entrepreneurship: A sustainable local development approach. *Carpathian Journal of Earth and Environmental Sciences*, *10*(3), pp.133-146.

Edima et al., 2014 – *Edima, H.C., Tem Nnam, R.K., Awono Enama, T., Biloa, D., Ndjouenkeu, R.* (2014). Case Study of the Street Food Sector in the Metropolitan Areas of a Cameroonian City, Yaounde. *Int. J. Curr. Microbiol. App. Sci*, *3*(9), pp.740-751.

Tregear, 2005 – *Tregear, A.* (2005). Lifestyle, growth, or community involvement? The balance of goals of UK artisan food producers. *Entrepreneurship & Regional Development*, *17*(1), pp.1-15. http://dx.doi.org/10.1080/08985620420002497777

Petrović et al., 2016 – *Petrović, M.D., Blešić, I., Ivolga, A, Vujko, A.* (2016). Agritourism impact toward locals' attitudes-an evidence from Vojvodina Province (Serbia). *Journal of the Geographical Institute Jovan Cvijic, SASA*, *66*(1), pp. 105-123.

Jegdić et al., 2017 – *Jegdić, V., Škrbić, I., Milošević, S.* (2017). Models of Entreprenurship Development in Rural Tourism Destinations in Vojvodina. *Economics of Agriculture*, *64*(1), pp. 221-237.

Vujko et al., 2017 – *Vujko, A., Petrović, M.D., Dragosavac, M., Ćurčić, N. and Gajić, T.* (2017). The Linkage Between Traditional Food and Loyalty of Tourists to the Rural Destinations. *TEME*, pp. 475-487.

Sekulic et al., 2016 – *Sekulic, D., Mandaric, M., Milovanovic, V.* (2016). Motivation of Travelers for Participation in Wine Tourism in Serbia. *Ekonomika Poljoprivrede*, *63*(4), P. 1237.

Radovanović et al., 2017 – *Radovanović, V., Đorđević, D.Ž., Petrović, J.* (2017). Wine Marketing: Impact of Demographic Factors of Serbian Consumers On the Choice of Wine. *Economic Themes*, *55*(2), pp. 199-215.

Bjeljac, Ćurčić, 2016 – *Bjeljac, Ž., Ćurčić, N.* (2016). An Evaluation of Folklore Events in Serbia in Terms of Tourism. *Issues in Ethnology and Anthropology*, *5*(3), pp.227-242.

Blešić et al., 2014 – *Blešić, I., Pivac, T., Đorđević, J., Stamenković, I., Janićević, S.* (2014). Cultural events as part of cultural tourism development. Case study: Sombor and Apatin (Serbia). *Acta geographica Slovenica*, *54*(2).

Bjeljac et al., 2014 – *Bjeljac, Ž., Terzić, A., Lukić, T.* (2014). Tourist events in Serbian part of Banat. In *Forum geografic*, June. Vol. 13, No. 1, pp. 110-117.

Banjac et al., 2016 – *Banjac, M., Kalenjuk, B., Tešanović, D., Gagić, S. and Cvetković, B.* (2016). Gastronomic tourism in rural areas of Vojvodina (Serbia). *Turizam*, *20*(4), pp. 180-191.

Vuksanović et al., 2017 – *Vuksanović, N., Tešanović, D., Kalenjuk, B., Portić, M., Knežević, M.* (2017). Socio-demografske karakteristike kao determinente razlika u percepciji lokalne gastronomije. *Ekonomika poljoprivrede*, *64*(1), pp.359-373.

Lukić et al., 2015 – *Lukić, T., Stojanović, T., Đerčan, B., Živković, M.B. and Živković, J.* (2015). The Geographical Aspects of Traditional Handicrafts in Serbia. // *European researcher. Series A*, (11), pp. 747-758.

McKercher, Du Cros, 2002 – *McKercher, B., Du Cros, H.* (2002). Cultural tourism: The partnership between tourism and cultural heritage management. Routledge.

Ismagilova et al., 2014 – *Ismagilova, G.N., Safiullin, L.N., Bagautdinova, N.G.* (2014). Tourism development in region based on historical heritage. *Life Science Journal*, *11*(6s), pp. 363-367.

Sharpley, Telfer, 2014 – *Sharpley, R., Telfer, D.J. eds.* (2014). Tourism and development: concepts and issues, Vol. 63. Channel View Publications.

Gagić et al., 2013 – *Gagić, S., Tešanović, D., Ivkov-Džigurski, A., Pivac, T., Jovičić, A.* (2013). Motives and attitudes of food and drink festival visitors: A case study of Serbia. *Journal of Food, Agriculture & Environment*, *11*(1), pp. 1055-1059.

Internet, 2017 – Internet (2017). Retrieved from http://www.skgo.org/reports/1274/ Gastronomske-manifestacije-u-Srbiji (16.9.2017)

Getz, Page, 2016 – *Getz, D., Page, S.J.* (2016). Event studies: Theory, research and policy for planned events. Routledge.

Kosic et al., 2015 – *Kosic, K., Demirovic, D., Pejanovic, R., Lazic, L. and Stamenkovic, I.* (2015). Key principles of rural tourism households development strategy-case study of Vojvodina. *Ekonomika poljoprivrede*, *62*(4), P. 975.

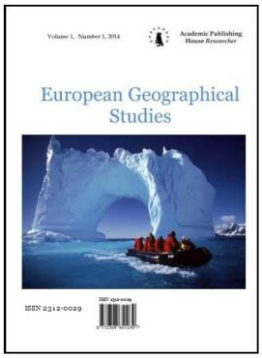
Stojsin, 2015 – *Stojsin, S.* (2015). Ethnic Diversity of Population in Vojvodina at the Beginning of the 21st Century. *European Quarterly of Political Attitudes and Mentalities*, *4*(2), pp. 25-37.

Simić, Bajčetić, 2016 – *Simić, I. and Bajčetić, R.* (2016). SMALL Towns as Mediators Towards Spatial Resilience: The Case Study of Network of Settlements in Vojvodina Region. *Facta Universitatis, Series: Architecture and Civil Engineering*, pp. 331-342.

Ranisavljević, Hadžić, 2016 – *Ranisavljević, D., Hadžić, M.* (2016). Realistic Evaluation of the Ratio: Loan-To-value–The Key to Minimising the Credit Risk. *Economic Themes*, *54*(3), pp. 449-468.

Published in the Slovak Republic
European Geographical Studies
Has been issued since 2014.
ISSN: 2312-0029
E-ISSN: 2413-7197
2017, 4(2): 80-91

DOI: 10.13187/egs.2017.2.80
www.ejournal9.com



Problems of Sustainable Solid Waste Management in Urban Area: A Case Study of Varanasi City of India

Vineet Kumar Rai [a], Pravin Kumar [a], Praveen Kumar Rai [a, *]

[a] Institute of Science, Banaras Hindu University, Varanasi-221005, U.P., India

Abstract

This paper presents the current status of solid waste management, future estimation of waste generation and related problems in Varanasi city, India. The city is located on the proper ridge of kanker which forms the northern bank of the river Ganga for distance of little over 5 km. This part of the city is quite above the normal flood level. The city is 76.21m above the sea level. Varanasi (25° 13'N to 25° 24'N latitudes and from 82° 54'E to 83° 04'E longitude) is one of the most important and historic city located almost in the middle Ganga valley in the northern plain of India. For the convenience of civic administration, the city is presently divided into 90 Wards and 14 sanitary wards. Present work is based on the secondary data, in the first phase of the study, data pertaining to ward wise generation of solid Waste and distributions of waste storage depots for secondary storage is collected from MCV (Municipal Corporation Varanasi). The data regarding population is obtained from District Census Handbook, 2011. Data on generation of solid waste is calculated by multiplying the urban population by the amount of waste generated per capita per day. In the second phase of the study, ArcGIS.10.1 software was used to create maps for municipal solid waste management. Besides this preliminary field investigation was also conducted through GPS. The results shows that Like other cities in India, Varanasi is also facing the problems created by improper and unscientific disposal of solid waste. Due to increasing population, change in dietary habits, standard of living, consumption pattern of commodity and lack of awareness, the problem of collection, transportation and disposal of solid waste has become a herculean task for the local civic bodies or the municipal corporation of the city.

Keywords: solid waste management, MCV, population and problem of collection, transportation and disposal of solid waste.

1. Introduction

Solid waste management is an integral part of the urban environment and planning of the urban infrastructure to insure a safe and healthy environment while considering the promotion of sustainable economic growth. Rapid economic growth by industrialization of the developing countries in Asia has created serious problems of waste disposal due to uncontrolled and unmonitored urbanization (ISWA & UNEP, 2002). The country's municipal solid waste (MSW) generation showed an increasing trend parallel to the development of economic condition, urbanization, and rapid growth of population (Visvanathan et al., 2004). The problem is further aggravated by the lack of financial as well human resources trained in solid waste management

* Corresponding author
E-mail addresses: rai.vns82@gmail.com (Praveen Kumar Rai)

practices in the sphere of collection, transportation, processing and final disposal. Whereas aspects like recycle, reuse and recovery of the solid waste is grossly demand and supply driven or disorganized in most cases. The waste quantity is increasing at an alarming rate in India due to rapid urbanization and a high population growth. The growth rate of population for India in the last decade was 17.6 % (Census of India, 2011). The issue is exacerbating in urban areas due to rapid population growth, coupled by an economic boom that encourages the consumption of goods and waste generation. The situation is becoming critical with the passage of time (Talyan et al., 2008). Domestic, commercial, biomedical and variety of toxic and domestic hazardous wastes are generally disposed of by the citizens on the streets, drains, open spaces, water bodies, etc., causing serious problems of health and environment (Abbasi et al., 2012). Several studies have been made to assess the problems caused by improper disposal of solid wastes in cities at national and international level. The WHO (1950) has studied about the environmental consequences and health problems taking into account such aspects as drinking water supply, waste water treatment, solid waste management, vector control, etc. (Rai, Nathawat, 2017). Stread (1960) has analysed the impact of technology and associated solid waste disposal problems. Bhide et al., (1992) in their study have critically analyzed the existing disposal sites and pointed out the deficiencies and have suggested the most economical solution for refuse disposal of Calcutta city. Olaniya and Saxena (1973) in their study have examined the relationship between sanitary landfill and river water quality. Flintoff (1976) in his study has suggested the most economical solution for waste disposal in developing countries. Park and Park (1979) also studied about effects of different types of pollution such as water, air and solid waste on human health. Brown (1982) studied about effects of sanitary landfill on ground water and streams. Jhon (1983) discussed about problems of waste disposal in the Third World cities in relation to climatic conditions. Kayastha and Kumra (1986) have highlighted the generation, collection and disposal methods of solid waste in some Indian towns and cities. The probable reason for its higher accumulation might be its greater sequestration capacity in soluble forms in the vacuoles of the root (Adriano 1986). Taylor et al., (1990) in their study have analyzed the psycho-social impacts caused by solid waste disposal in Southern Ontario. Khan (1994) in his paper identifies the problems of municipal solid waste generation in India in the context of population growth in urban areas. Teotia et al., (1996) describe about the effects of improper disposal of refuse and its management. The difference in per capita waste generation between low and high income groups vary from 180 gms. to 800 gms. per day (Sekher, 2007). As per a 2008 joint paper by NEERI and CPCB on the assessment of the status of MSW management in metro cities, state capitals, Class I cities, and Class II towns in India, (examining over 59 cities across India), the per capita generation in India lies between 0.2–0.6 kg per capita per day. Cities with a population of less than 0.1 million have a per capita waste generation of about 0.17–0.5 kg; however, cities with over 2 million population, mainly the metros and Class I cities such as Delhi, have a per capita waste generation in the range of 0.22–0.62 kg. According to a latest CPCB report, in 2016, India produced some 52 million tons of waste each year, or roughly 0.144 million tons per day, of which roughly 23 per cent is processed—taken to landfills or disposed of using other technologies. Like other cities in India, Varanasi is also facing the problems created by improper and unscientific disposal of solid waste (Rai, Nathwat, 2017). Due to increasing population, change in dietary habits, standard of living, consumption pattern of commodity and lack of awareness, the problem of collection, transportation and disposal of solid waste has become a herculean task for the local civic bodies or the municipal corporation of the city.

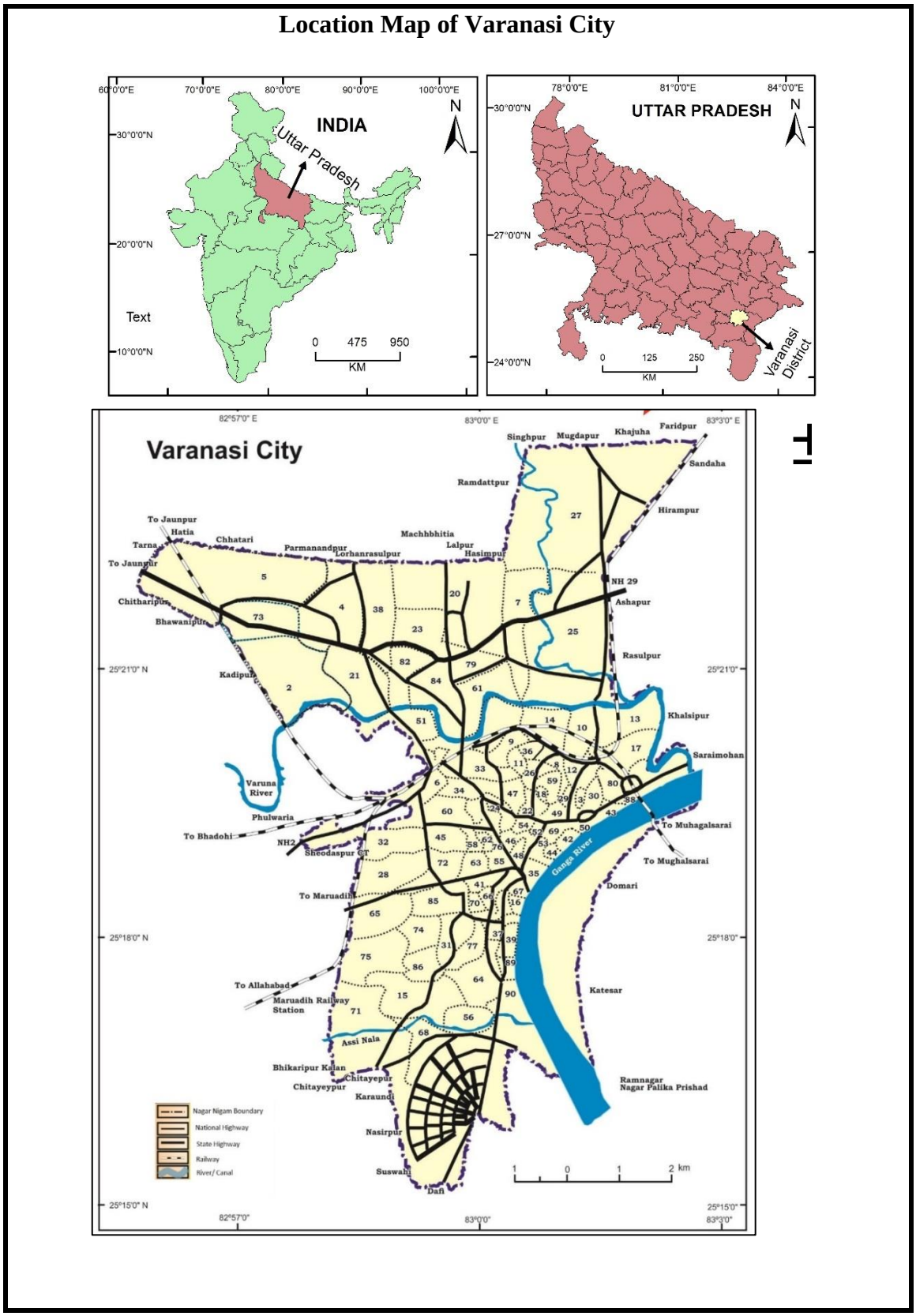


Fig. 1. Location map of Varanasi city

2. Study Area

Varanasi enjoys a commanding position on the crescent shaped left bank of the river Ganga (Fig. 1). The city is located on the proper ridge of kanker which forms the northern bank of the river

Ganga for distance of little over 5 km. This part of the city is quite above the normal flood level (Rai, Mohan, 2014). The city is 76.21m above the sea level. Varanasi (25° 13'N to 25° 24'N latitudes and from 82° 54'E to 83° 04'E longitude) is one of the most important and historic city located almost in the middle Ganga valley in the northern plain of India. It lies by rail at a distance of 696 km from Kolkata, 1505 km from Mumbai, 797 km from Delhi, 143 km from Allahabad, 230 km from Gorakhpur and 301 km from Lucknow- the capital of Uttar Pradesh. The city is also situated at one of the most important road systems of India since long back. The Grant Trunk road (G.T. road) passes through the city proper. From the very beginning, the river Ganga is serving as an important route of movement to facilitate the transportation of goods and traffic in addition to water supply to the city and as a natural defense barrier. For the convenience of civic administration, the city is presently divided into 90 Wards and 14 sanitary wards. For efficient and effective water supply, the city is divided into 16 water supply zones. As per 2011 Census, Varanasi city has a total population 11,98,491 (municipal corporation) of which 6,35,140 are males and 5,63, 351are females. In city total number of households were 1,90,835 and household density was recorded as 24 household/ha. Population density of the city is 150 persons/ha. About 70.30 percent of the population of city is literate. The sex ratio of the city is found to 887 females/1000 males (Mishra, Rai 2014).

Objectives of Study

i. To assess existing status of generation, collection, storage, transportation, treatments and disposal methods practiced in the study area.

ii. To assess how improved waste management practices can contribute to sustainable development processes in Varanasi city.

iii. To provide effective measures for future management and planning.

3. Material and Methods

The present work is based on the secondary data which is obtained from Municipal Corporation of Varanasi city, India. In the first phase of the study, data pertaining to ward wise generation of solid waste and distributions of waste storage depots for secondary storage is collected from Varanasi Municipal Corporation. The data regarding population is obtained from District Census Handbook, 2011. Data on generation of solid waste is calculated by multiplying the urban population by the amount of waste generated per capita per day. In the second phase of the study, Arc GIS 10.1 Software was used to create maps for municipal solid waste management. Besides this preliminary field investigation was also conducted through Global Positioning System.

Table 1. Status of Solid Waste Management in Varanasi

S. No.	Parameter	Present Status
1	Total household served with D2D collection	0 %
2	Total waste generation	600 TPD
3	Total waste collected	480 TPD
4	Total number of dustbins	373
5	Total number of vehicles	1000
6	Frequency of collection (trips/day)	2-3
7	No. of sweepers	2800

Source: Varanasi Municipal Corporation, 2013

Table 2. Availability of Equipment's for Solid Waste Management

S. No.	Particulars	Existing Number
1	Truck tippers	12
2	Compactor	35
3	Tricycles	800
4	JCB	3

5	Tata ace	150
	Total number of equipment	1000

Source: Varanasi Municipal Corporation, 2013

Table 3. Overall Composition of Waste Generation in the City

Biodegradable	**Recyclable**	**Other Waste**
51.25 %	15.30 %	33.45 %

Composition of Recyclable Waste					
Paper	**Polythene**	**Plastics**	**Glass**	**Metals**	**Miscellaneous**
32.8	25.6	7.3	5.7	5.8	22.8

Source: Municipal Corporation Varanasi

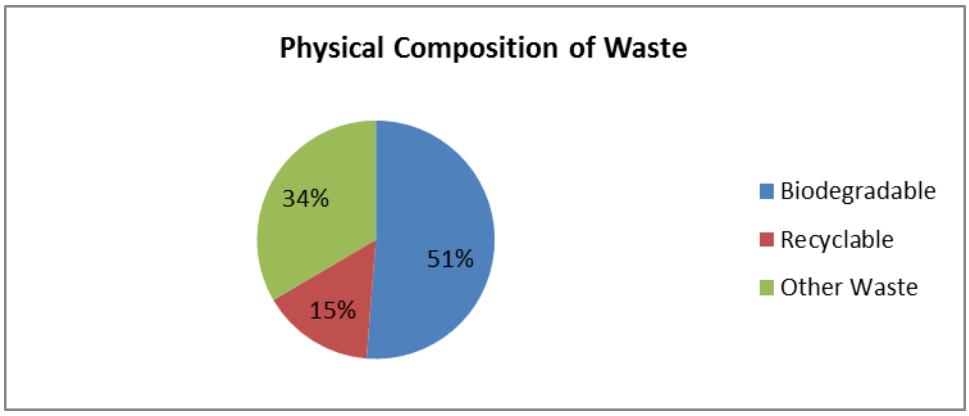


Fig. 2. Physical Composition of Waste

4. Result & Discussion

Solid Waste Management and Existing Systems

The solid waste management system in Varanasi is managed by Varanasi Municipal Corporation. Till recently, the waste management was being managed by A2Z Infrastructure Private Limited Company Kanpur Uttar Pradesh India. The concessionaire was responsible for door to door collection, transportation, treatment and disposal of solid waste from all wards. However, due to non-payment of past dues by Varanasi Municipal Corporation, the concessionaire has abandoned the project and now the contract has been terminated. Now Varanasi Municipal Corporation is making use of its own resources to collect and transport the solid waste from other parts of the city to the dumping site in addition to street sweeping. Door to door (D2D) collection facility has been withdrawn, due to termination of contract. Waste is collected from secondary collection points by Varanasi Municipal Corporation and transported directly to dumping grounds. It has also been found that generation of solid waste was 600 Tons per day (TPD) in 2013. While total waste collected is 480 Tons per day. Waste collected is disposed of in a landfill site at 'Padav' along Ramnagar road. There are 1000 equipment's including 12 Truck tippers, 35 Compactor, 800 Tricycle, 3 JCB and 150 Tata ace for the transportation and disposal of solid waste. Vehicles are operated by the concessionaire and make 2-3 trips a day. Currently, most of the vehicles are not being operated as Varanasi Municipal Corporation employees do not have the skill to operate these vehicles. All these vehicles were procured under JNNURM in 2011. There are 2,800 permanent and contractual sanitary workers for street sweeping. In the absence of door to door collection facility in all the wards and lack of practice of waste storage at source, majority of the waste is collected by street sweepers. Total manpower available with Municipal Corporation could not manage 600 Tons every day. Most of the waste generated comprises biodegradable, compostable, and recyclable materials. This is due to the high quantum of religious and vegetable waste the city generates along with a high amount of plastic waste. Recyclable items include paper, plastics, polythene, glass, metal and other miscellaneous items. The disposal site is located 20 km. away from the city in

Karsada on a 40 acre site. Currently, the site is not operational as it is still being developed and it is expected. Population growth and solid waste generation in the city has varying trend and correlation between population and solid waste generation of city is not cop with suitable manner. The solid waste generation in 2041 is expected to be 1206 Tons per day. This has been calculated for the projected population, with waste per capita increasing from 400 grams in 2013 to 420 grams in 2041. City has so far adopted only open dumping method for the disposal of waste. Currently, the wastes are not treated in a systematic and scientific manner. Status of solid waste management and availability of equipment's for solid waste management are given in the Table 1 & 2. Physical composite of waste is shown in the Fig. 2.

Table 4. Ward Wise Generation of Solid Waste

S. N.	Name of Wards	Solid Waste Generation/cap./day	S. N.	Name of Wards	Solid Waste Generation/cap./day
1	Indrapur	6.75	46	Kamalgarha	5.71
2	Vinayaka	6.16	47	Omkaleshwar	4.87
3	Tarna	8.12	48	Madhyamaheshwar	4.49
4	Rajghat	3.51	49	Jangamwari	2.74
5	Narayanpur	6.71	50	Saraiya	6.81
6	Sirsauli	5.00	51	Daraganj	4.75
7	Hukulganj	6.80	52	Piyarikala	5.31
8	Nagwa	8.41	53	Birdopur	3.81
9	Lahartara	6.50	54	Bhadaini	3.07
10	Sunderpur	6.40	55	Iswargangi	5.06
11	Chawkaghat	5.16	56	Jalalipura	6.60
12	Tulsipur	8.08	57	Didhori Mahal	6.05
13	Sarai Surjan	9.83	58	Nawapura	5.86
14	Nawabganj	3.22	59	Lahangpura	4.18
15	Nadesar	4.01	60	Luxbagha	4.08
16	Dindayalpur	5.15	61	Pandariba	5.11
17	Shivpurwa	10.34	62	Raj Mandir	3.46
18	Khajuri	5.40	63	Garhwasi Tola	3.75
19	Shivpur	7.86	64	Ramapura	4.02
20	Sikraul	5.53	65	Baghara	4.66
21	Habibpura	3.90	66	Prahlad Ghat	5.30
22	Rajabazar	6.50	67	Gola Dinanath	3.84
23	Aliapur	7.54	68	Benia	4.01
24	Jagatganj	3.41	69	Sarai Gowardhan	4.46
25	Jolha	11.59	70	Pandey Haweli	3.05
26	Ramrepur	6.01	71	Pathani Tola	6.14
27	Mawaiya	6.58	72	Rewari Talab	4.38
28	Newada	7.98	73	Lallapura Kala	4.00
29	Nai basti	6.32	74	Dashashwamegh	3.95
30	Sarnath	5.42	75	Dhupchandi	5.58
31	Loko-chhittupur	7.00	76	Baluabir	4.86
32	Naria	9.36	77	Ranipura	5.80
33	Pandeypur	7.57	78	Bangali Tola	3.61
34	Konia Gao	7.19	79	Harha Sarai	3.07
35	Kajipura	4.74	80	Katehar	4.06
36	Paharia	7.39	81	Jamaludinpura	3.76
37	Lalpur Khurd	6.95	82	Bandhukachchibagh	3.95
38	Bajardiha	6.13	83	Kal Bhairav	4.30

39	Shivala	3.87	84	Kamalpura	3.11
40	Sigra	3.87	85	Basnia	4.93
41	Kameshwar Mahadev	3.79	86	Kajisadullapura	4.68
42	Katuapura	4.67	87	Aagaganj	3.23
43	Khojwa	4.68	88	Rasulpura	3.13
44	Bhelupura	4.42	89	Chhittanpura	4.09
45	Chetganj	4.18	90	Madanpura	3.44

Source: Based on calculation on the basis of per capita per day generation of solid waste

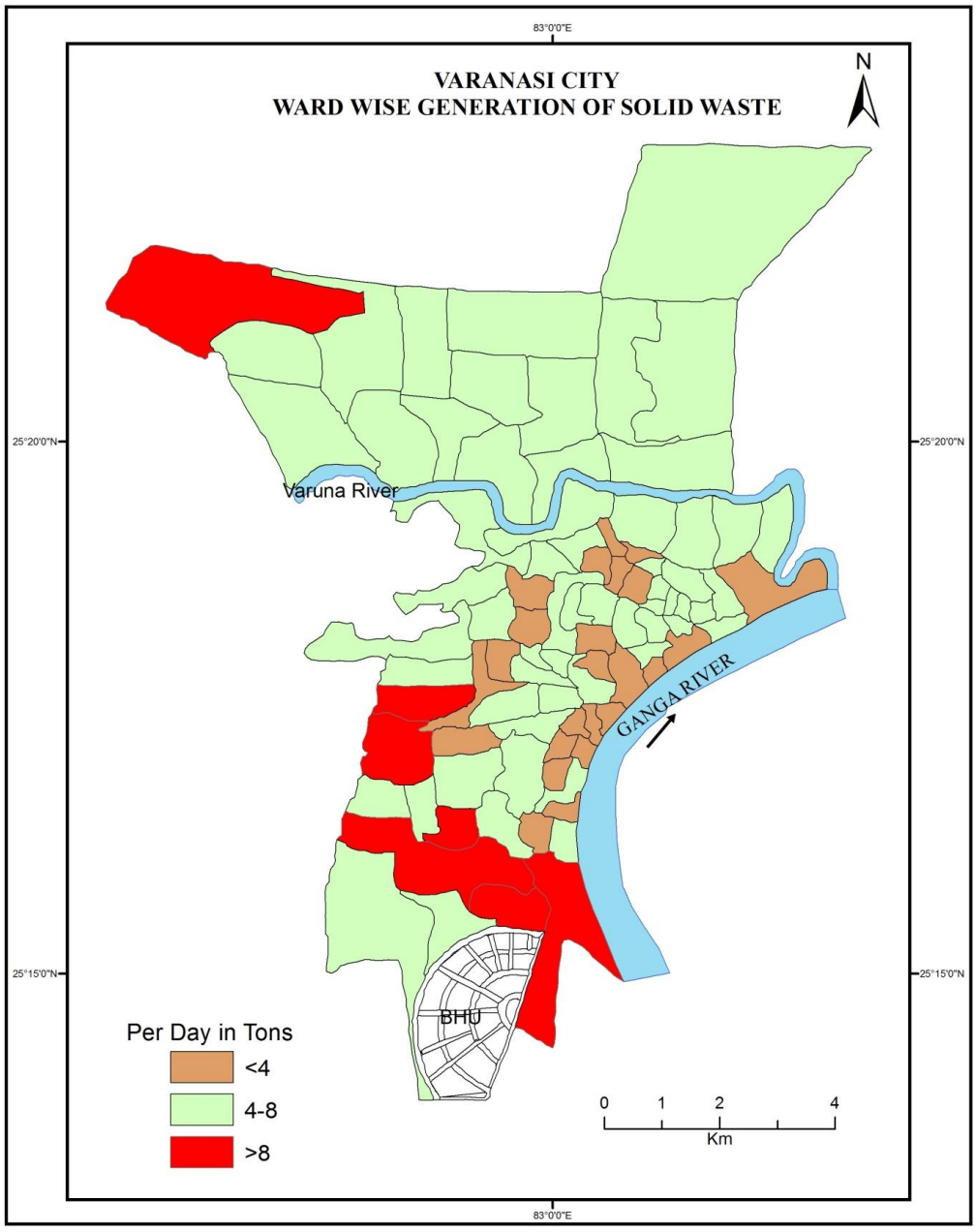


Fig. 3. Ward Wise Generation of Solid Waste

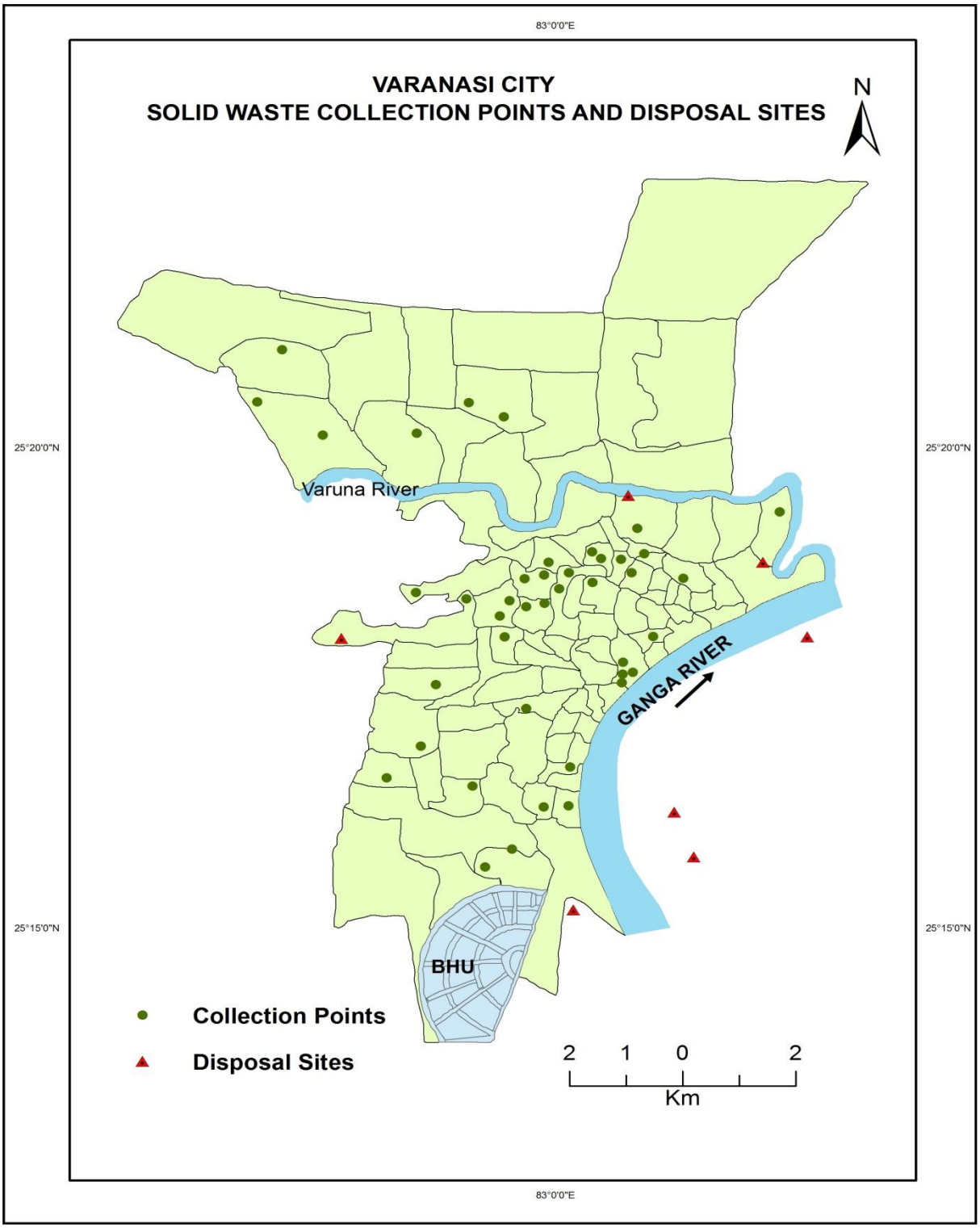


Fig. 4. Solid Waste Collection Points and Disposal Sites Identified through GPS Survey

Per Capita Waste Generation Parameters

Urbanization is now becoming a global phenomenon. Rapid urbanization and uncontrolled growth rate of population accelerate the generation of municipal solid waste. The increasing population directly influences the municipal solid waste generated around the surrounding areas. The socio-economic profile of the population, the consumption patterns govern the characteristics

of the waste generated. The industrialization not only influences the quantity of waste but also affects level of urbanization & increases population levels which results in increase in the overall waste generated. In Varanasi, approximately 2.6 lack metric tons of waste is generated per year, with per capita values ranging. From 0.40 to 0.42 kg per person per day and an average of 0.41 kg/capita/day. From the above scenario we can analyze that per capita waste generation is gradually increasing decades to decades and the figure also indicating that average kg per capita per day of waste generated within this region up to projected year.

Estimation the Quantity of Waste Generation in Each Year up to projected Year

Storage of waste at source is the first essential step of Solid Waste Management. Every household, shop and establishment generates solid waste on day to day basis. The waste should normally be stored at the source of waste generation till collected for its disposal. In Varanasi, such a habit has not been formed and in the absence of system of storage of waste at source, the waste is thrown on the streets, treating streets as receptacle of waste. Generally no bins for storage of domestic, trade or institutional waste are kept at source.

The future amounts of waste are closely coupled to economic growth given un-changed waste intensities in economic and human activities. Again the waste generation is directly proportional to the rate of change of population. A mathematical calculation is ultra-process beginnings with the estimation of future population based on the average increase in population of last two decades and then calculate the future amount of municipal solid waste generation as below:

$$\text{Future population } (Pf) = Po\,(1+R/100)^{y}$$

Here, Po= Initial Population, R= Percentage of growth rate = {(x1+x2)/2}/10, x1&x2 is the population increasing percentage of last two decades and y = years.

The rate of increasing population is very decades to decades. Here average increasing rate i.e. 2011-2021 is 29 %, 2021-2031 is 22 % and 2031-2041 is 23 % are chosen for the study.

Future amount of municipal solid waste generation per day

$$\text{Quantity } (Wq) = (Pf) \times (wr) / 1000$$

Here, Pf = Predicted population, and wr = Waste generation rate (kg/capita/day)

Table 5. Population and Waste Generation Projection of Varanasi up to Projected Year

S. No.	Year	Population	Quantity (MT/Day)
1	2011	1198492	479
2	2021	1457579	591
3	2031	1874945	776
4	2041	2376749	998

Source: Calculated from the Data of Municipal Corporation of Varanasi

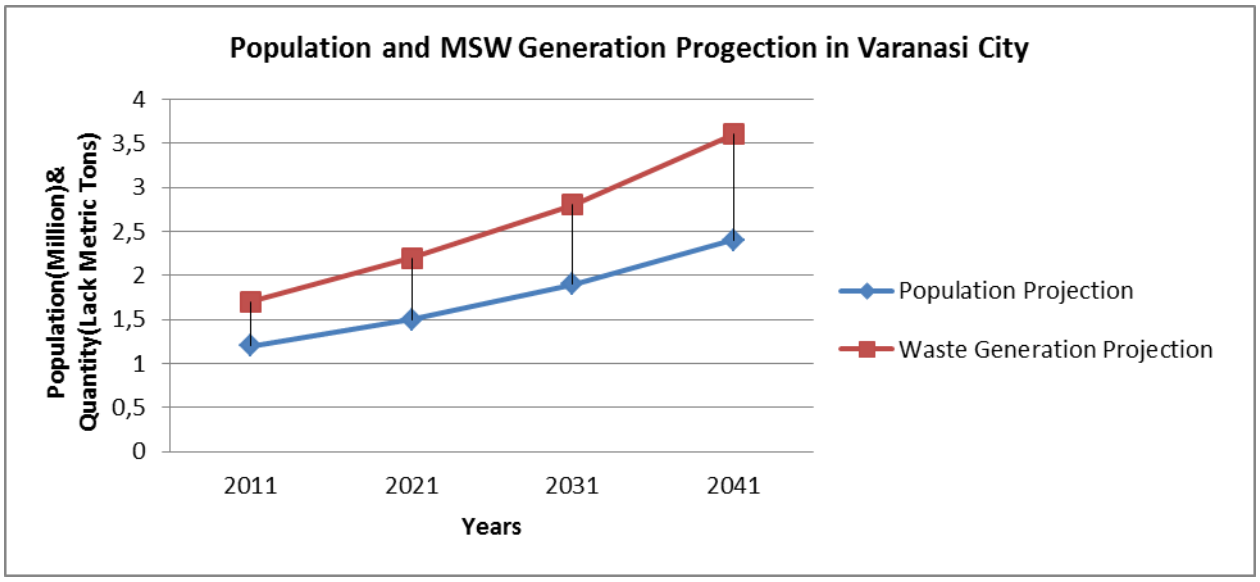


Fig. 5. Population and MSW Generation Projection in Varanasi City

Projections for urban municipal solid waste generation in 2041 were made by factoring expected growth in population and estimated per capita waste generation. The population data collected from census of India as per the report of technical group on population projections constituted by the national commission on population to the office of the Registrar general & Census commissioner of India. The population projection is calculated by forecasting method. The population growth in Varanasi from 2011 to 2041 shall have a growth of 21 % in 30 years at a rate of 2.25 % of annum. This growth rate is considered in the model from 2011 to 2041 to predict the MSW generation. The MSW data collected from various municipalities as per the office records and survey work. It is estimated that the amount of waste generated in Varanasi will increase at a per capita rate of approximately 0.41 % annually is considered for estimate of MSW from the year 2011 to 2041. The population versus increase of municipal solid waste generation of year wise from 2011 to 2041 is obtained from forecasting method shown in fig. 5.

Ward Wise Generation and Collection of Solid Waste

The per capita per day contribution of garbage is calculated as 400 gms. The generation of solid waste also varies from one ward to the other, depending upon size of population, dietary habits of the residents, type of the residential area and functional characteristics of the ward. (Fig. 3) shows the spatial variation of solid waste generation in Varanasi. The quantum of solid waste generation of wards have been calculated on the basis of 2011 District Census Handbook data and present generation of solid waste per capita per day (400 gms), (Fig. 3 & Table 3). Further, it is observed that generation of solid waste also varies from one season to another. Some sizeable portion of the city remains water logged during rainy season, causing interruption in the regular collection of garbage. Consequently, less amount of garbage is collected during these months. For smooth collection of garbage, the corporation area (79.79 km^2) has been divided into 90 wards with 42 collection sites (Fig. 4) these collection sites have a specific open enclosure locally called 'taka', characterized by walls on three sides. These open refuse depots on the one hand provide access to cows, pigs, birds and rodents and on the other the decomposed filth transmits diseases through viruses and bacteria. In many parts of the city, particularly along the river front, the lanes are so narrow that it becomes difficult to transport garbage up to the specified disposal sites. As a result, garbage finds its way into the river Ganga, increasing organic pollution load of the river. in addition, a number of private nursing homes, hospitals, diagnostic centers and pathological labs are frequently involved in dumping the waste on the roads and these have mushroomed in recent times, seems to the worst affected on account of improper disposal of bio-medical wastes. In the city primary collection of wastes from the door steps has not been introduced in any part of the city. The entire city population continues to through the waste on the street, open space, drains,

water bodies etc. during the course of field investigation, it has been observed that only some people dispose of waste at the waste storage depots. The primary collection of MSW is done manually by conventional wheel barrows and hand carts. The waste from households is taken out for collection in garbage bins, located in different parts of the city. At the primary stage the sweepers collect waste and put into dust bins on street corners from where it is transported to secondary collection depots. Solid waste generated in the city is not given any treatment before disposal. There is no specific site for waste disposal and it is dumped in and around city in the nearest available low lying areas. Population and waste generation projection of Varanasi up to Projected Year (2041) is given in the Table 4. Population and MSW generation projection in Varanasi City is shown in the Fig. 5.

Review of Existing Problem

Some of the problems faced by the Municipal Corporation of Varanasi in the solid waste management. Currently, there is no proper system of collection and transportation of the waste. Loading and unloading is fully manual causing health hazard to the workers. Varanasi has not provided adequate number of dustbins for storage of wet and dry wastes for the clearance through their regular primary collection process. As per the norms/standards Municipal Corporation of Varanasi has to provide containers, for proper collection of waste wherever possible throughout the city for better management of the waste. The vehicles are not covered resulting in spread of foul smell as the vehicle moves around the town for collection and disposal of the waste also the lighter waste materials fly and fall down the way. There is not enough staff for sweeping the roads of Varanasi, making it difficult to clean the city. Condition of the vehicles carrying waste is very poor and needs proper maintenance/replacement. An important issue here is that, the bio-medical waste is also disposed of along with the municipal solid waste at this site. Monitoring process is also non-existent at the dumping site. Lack of formal sanitary landfill site, lack of segregation of waste and need to introduce composting to minimize the quantum of waste going to landfill. Waste dumps in nallahs and rivers lead to water logging and unsanitary conditions.

5. Conclusion and Suggestions

On the basis of this study, it may concluded that solid waste management in Varanasi city is in very bad shape. The present work reveals that municipal corporation is unable to meet the requirement of increasing population due to inadequate manpower and modern equipments. Proper disposal of bio-medical wastes from hospitals, diagnostic centers and pathological labs could not be takes place in the city. Such wastes not only cause threat to environment by contaminating the land, air, and water resources but also believed to cause intestinal, parasitic and skin diseases among sanitary workers engaged in collecting refuse .In the city Due to lack of adequate capacity to transport wastes and there are no sanitary landfills to dispose of the waste. The existing landfills are neither well equipped nor well managed. Also, they are failed to protect against contamination of soil and groundwater. At present most of the Municipal solid waste in the city is disposed of unscientifically. Waste treatment and disposal sites can create health hazards for the neighborhood. Improperly operated incineration plants cause air pollution and improperly managed and designed landfills attract all types of vectors, insects and rodents that spread diseases such as dysentery, diarrhea etc. which affects the health of human beings. To minimize the solid waste generation adopt the policy of 4R's. That is Refuse, Reuse, Recycle and Reduce. The current regulations (MSWM Rules, 2000) are very stringent. Norms are to be developed for ensuring a proper MSWM system. But unfortunately, there is a large gap between policy and implementation. Therefore, there is urgent need to bridge up these gaps. Besides these, the involvement of people and private sector through NGOs should be sought to improve the efficiency of MSWM. Public awareness should be created at large scale for awaking people from hazards caused from improper disposal of garbage. Littering of MSW should be prohibited and house-to- house collection of MSW should be organized through methods like collection on regular, pre-informed timing and scheduling. Furthermore, municipal authority should maintain storage facilities in such a manner that these do not create unhygienic and insanitary conditions. Proper maintenance of MSW transportation vehicle should be done. Municipal Corporation of Varanasi should involve proper monitoring for safe disposal of daily solid waste. Solid waste management is definitely not only a technical challenge. Understanding and taking into account the environmental impact, financial and economic

calculations, social and cultural issues, and the institutional, political and legal framework, is most crucial for planning and operation of a sustainable solid waste management in the city.

References

Adriano, 1986 – *Adriano, D.C.* (1986). Trace Elements in the Terrestrial Environment. *Springer,* New York.

Bhide et al., 1992 – *Bhide, A.D., Titus S.K., Alone B.Z., Basu A.K., Dave J.M., Arceivala S.J.* (1992). Refuse Disposal of Calcutta City, *Indian Journal of Environmental Health*, pp. 121-130.

Brown, Shaw, 1982 – *Brown, L.R., Shaw P.* (1982). Six Steps to a Sustainable Society, *World Watch Paper.*

Census of India, 2011 – Census of India (2011). Ministry of Home Affairs, Government of India, New Delhi, India.

CPCB, 2016 – CPCB (2016). Management of Municipal Solid Waste. Central Pollution Control Board, Ministry of Environment and Forests, New Delhi, India.

Flintoff, 1976 – *Flintoff, Frank* (1976). Management of Solid Waste in Developing Countries, WHO Regional Publication, South-East Asia Series No.1, WHO, New Delhi, pp. 1-231.

John, 1983 – *John Pickford* (1983). The Solid Waste Problem in Third World Cities, Practical Solid Waste Management, John Wiley and Sons Ltd. London, p. 485.

Kayastha, Kumra, 1986 – *Kayastha, S.L., Kumra V.K.* (1986). Environmental Studies: Fundamental Problems and Management, Tara Book Agency, Varanasi, pp. 108-114.

Olaniya, Saxena, 1973 – *Olaniya, M.S., Saxena K.L.* (1973). Solid Waste Disposal Problem, *Indian Journal of Environmental Health*, Vol. 10, No. 3, p. 176.

Rai, Nathawat, 2017 – *Rai, P.K., Nathawat, M.S.* (2017). Geoinformatics in Health Facility Analysis (book), Springer International Publishing, Switzerland. DOI: 10.1007/978-3-319-44624-0.

Rai, Mohan, 2014 – *Rai, P.K., Mohan, K.* (2014). Remote Sensing Data & GIS for Flood Risk Zonation Mapping in Varanasi District, *Forum Geographic Journal* (Romania), Vol. 13 (1), 25-33. DOI: http://dx.doi.org/10.5775/fg.2067-4635.2014.041.i.

Mishra et al., 2014 – *Mishra, V. N., Rai, P.K., Mohan, K.* (2014). Prediction of Land Use Changes Based on Land Change Modeler (LCM) Using Remote Sensing: A Case Study of Muzaffarpur (Bihar), India, *Journal of the Geographical Institute*, Jovan Cvijić" SASA (Serbia), 64 (1), 111-127. DOI: 10.2298/IJGI1401111M.

Park, Park, 1979 – *Park, J.E., Park K.* (1979). Text Book of Community Health for Nurses, Asrani publisher, Jabalpur, pp. 94-119.

Stread, 1960 – *Stread, Frank. M.* (1960). Levels of Environmental Health, *American Journal of Public Health*, Vol. 50, pp. 312.

Talyan et al., 2008 – *Talyan, V., Dahiya, R.P., Sreekrishnan, T.R.* (2008). State of Municipal Solid Waste Management in Delhi the Capital of India. *Waste Management*, pp. 1276-1287.

Teotia et al., 1996 – Teotia, U.S, Ghosh D., Srivastava P.C. (1996). Urban Waste Disposal: From Futility to Utility, *Yojana,* Vol.40, No.6, June, pp. 17-19 & 41.

Visvanathan et al., 2007 – *Visvanathan, C., J.P., Juanga, C. Chiemchaisri* (2007). Municipal Solid Waste Management in Thailand and Disposal Emission Inventory. *Springer Science + Business Media,* Verlag, Berlin.

W.H.O., 1950 – W.H.O. (1950). Report of Expert Committee on Environmental Sanitation, *Technical Series*, No.10, pp. 5-15.