Quarterly Journal of Environmental Education and Sustainable Development
Vol. 8, No. 4, Summer 2020 (37-54)

فصلنامه علمی، آموزش محیط‌زیست و توسعه پایدار
سال هشتم، شماره چهارم، تابستان ۱۳۹۹ (۵۴-۳۷)

Social Factors Affecting on Sustainable Gas Consumption (Household Subscribers of Mazandaran Province)

Zahra Pazokinejad[1], *Sadegh Salehi[2], Ali Asghar Firouzjaeyan[3], Assgari Hossaini[4]

1. Ph.D. Student of Sociology of Social Issues of Iran, Mazandaran University
2. Associate Professor of Environmental Sociology, University of Mazandaran
3. Associate Professor of Sociology of Social Issues of Iran, University of Mazandaran
4. Industrial Consultant of Mazandaran Province Gas Production and Distribution Company

(**Received:** 01.03.2020 **Accepted:** 28.06.2020)

بررسی عوامل اجتماعی مؤثر بر مصرف پایدار گاز (مشترکین خانگی استان مازندران)

زهرا پازوکی نژاد[۱]، *صادق صالحی[۲]، علی‌اصغر فیروزجائیان[۳]، عسگری حسینی[۴]

۱. دانشجوی دکتری جامعه‌شناسی مسائل اجتماعی ایران، دانشکده علوم انسانی و اجتماعی، دانشگاه مازندران

۲. دانشیار جامعه‌شناسی محیط‌زیست، گروه علوم اجتماعی، دانشکده علوم انسانی و اجتماعی، دانشگاه مازندران

۳. دانشیار جامعه‌شناسی مسائل اجتماعی ایران، گروه علوم اجتماعی، دانشکده علوم انسانی و اجتماعی، دانشگاه مازندران

۴.کارشناس ارشد مهندسی شیمی، مشاور صنعتی پروژه شرکت گاز استان مازندران

(دریافت: ۱۳۹۸/۱۲/۱۱ پذیرش: ۱۳۹۹/۰۳/۳۱)

Abstract:

Purpose of this study was to investigate the sustainability of domestic gas consumption and identify the social factors that affect it. Three questions were asked in this study. 1) How stable is the gas consumption practice at home? 2) What are the elements that affect gas consumption as a sustainable practice?3) What solutions can be offered to increase gas consumption sustainability? After reviewing the research literature and the concepts of sustainable development and sustainable consumption, two categories of factors were identified as predictors of sustainable gas consumption changes. The research strategy is deductive and the explanation was used to investigate the research problem. The approach of this study was quantitative, and the survey method was used for measurement. The data collection tool is questionnaire. Structural validity, face validity and Cronbach's alpha were used to assess the validity and reliability. The statistical population consisted of household subscribers in Mazandaran province. Using systematic random cluster sampling method, 430 individuals were selected as the statistical sample. The findings of the study showed that the level of sustainability of gas consumption by household subscribers was at an average level. After exploratory factor analysis, three dimensions were considered for sustainable gas consumption. Findings showed that and after-sales support and pro-norms had the greatest impact on the dimension of consumer safety. Environmental values and knowledge of gas consumption have the most impact on the dimension of consumer awareness, pro-norms, Environmental values and pre-norms had greatest effects on responsible consumption.

Keywords: Sustainable gas consumption, Environmental values, Knowledge of gas consumption, Support after-sales, Consumers.

چکیده:

هدف از انجام تحقیق حاضر، بررسی میزان پایدار بودن مصرف گاز خانگی و تعیین عوامل اجتماعی مؤثر بر آن است. سه سؤال در این تحقیق مطرح شد. ۱) عمل مصرف گاز در خانه تا چه اندازه پایدار است؟ ۲) عوامل اجتماعی مؤثر بر مصرف گاز به‌عنوان یک عمل پایدار کدام‌اند؟ ۳) چه راهکارهایی برای افزایش پایداری در مصرف گاز می‌توان ارائه کرد؟ پس از مرور ادبیات تحقیق و مفاهیم توسعه پایدار و مصرف پایدار، دودسته از عوامل به‌عنوان پیش‌بینی کننده‌های تغییرات مصرف پایدار گاز تعریف شدند. از روش پیمایش برای سنجش استفاده شد. ابزار گرداوری داده‌ها، پرسشنامه است. به‌منظور بررسی روایی و پایایی از اعتبار سازه، اعتبار صوری و آلفا کرونباخ استفاده شد. جامعه آماری، مشترکین خانگی استان مازندران بودند که با استفاده از شیوه نمونه‌گیری خوشه‌ای تصادفی سیستماتیک، ۴۳۰ نفر به‌عنوان نمونه آماری انتخاب شدند. یافته‌های تحقیق نشان داد که میزان پایدار بودن مصرف گاز در سطح متوسط قرار دارد. پس از انجام تحلیل عامل اکتشافی سه بعد برای مصرف پایدار گاز در نظر گرفته شد. مطابق با نتایج حاصل از مدل‌سازی ساختاری، ارزیابی مصرف‌کنندگان از پشتیبانی پس از فروش خدمات توسط شرکت گاز و هنجارهای توصیفی مصرف گاز بیشترین تأثیر را بر بعد ایمنی در مصرف گاز، ارزش‌های محیط زیستی و دانش مصرف گاز بر بعد آگاهی در مصرف و در نهایت، هنجارهای توصیفی، ارزش‌های محیط زیستی و هنجارهای تجویزی مصرف گاز بیشترین تأثیر را بر بعد مصرف مسئولانه گاز تأثیر داشتند.

واژه‌های کلیدی: مصرف پایدار گاز، ارزش‌های محیط زیستی، دانش مصرف گاز، ارزیابی مصرف‌کنندگان از پشتیبانی خدمات پس از فروش، مصرف‌کنندگان.

*Corresponding Author: Sadegh Salehi E-mail: s.salehi.umz@gmail.com

Introduction

Nowadays, the role of human beings and their environmental behaviors either in protecting the environment or preventing the environmental degradation seems very important. Excessive energy consumption poses a serious threat to natural resources which may lead to climate change and global warming, ultimately. The United Nations, through the 2030 Agenda, has developed a 17 sustainable development goals among which goal number seven is refereeing directly to the energy sector: "Affordable and clean energy" (Zaharia, 2019). Natural gas is one of the main sources of energy that is a pollutant, but due to its low level of pollution compared with fossil energy sources, still is considered as a rational source by human societies. Some researchers believe that natural gas has now become the world's dominant source of energy (Gross & Mautz, 2018). This suggests that the share of natural gas in the supply of fuel for domestic, commercial, industrial, and transportation sectors will have an upward trend. Unlike the goals of sustainable development, evidence in Iran as a society with high waste and unsustainable productivity indicates that natural gas consumption is unsustainable, especially in the domestic sector (Salehi, 2015). Excessive energy consumption can become a problem that leads to other problems like environmental pollution, destruction of resources, and these all problems create a situation that causes increased pressure on Iran by the international community. Undoubtedly, the need to pay more attention to the issue of unsustainable energy consumption in the country, given the upward trend in its consumption, requires some proper actions. Some researchers have acknowledged that excessive energy consumption in society has caused most of the money, resources, energy, and creativity to be spent on solving the problems that people have created in this regard (Moktari et al., 2014). While economic theorists consider consumption as a behavior made largely based on rational, accounting and conscious considerations, sociologists focus on consumption as a behavior that is less conscious and mainly influenced by habits. Unsustainable energy consumption has social and cultural dimensions and needs to be examined. The principle of sustainable consumption is to make the fundamental changes in production techniques and consumption patterns in order to maintain the quality of the environment (Salehi & Pazokinejad, 2017). Therefore, energy production and consumption are fundamental elements of any policy aimed at sustainable development (Sutten, 2016). Furthermore, the implementation of government policies for sustainable energy consumption requires a general and sustainable commitment. These problems are reduced by changing human behavior significantly. To change human consumption behavior, we need first to identify factors influencing people's behavior. In general, understanding of consumer action is done in two dimensions. The first dimension focuses on material assets, pricing policies, socio-technical innovations, and tax (Schmidt & White 2013), and the second dimension is to reduce consumption by utilizing psycho-social factors. Accordingly, the practice of consumption is a function of individual and collective attitudes that are important in socio-technical processes. Attitudes affect action, but to analyze the transition process to sustainability, individual-level trends must be considered along with a sociological explanation of agency-structure relationships. To understand consumer practice in the first place, we need to know the attitudes and structures that affect consumer behavior. To reach a level of desired energy consumption requires a structural and social change in values and lifestyles. In other words, if government policies are to get succeed in sustaining energy consumption and achieving the goals of society - sustainable

energy efficiency and reducing the ecological footprint of consumers – should be occurred at the micro-level. Actually, consumers need to change their energy consumption patterns. The purpose of this study is to identify the degree of sustainability in gas consumption and to identify the social factors that explain it. Overall, in the present study, three questions will be answered: 1) How sustainable is gas consumption at home? 2) What are the factors affecting gas consumption as a sustainable practice? 3) What are the appropriate solutions for sustainable domestic gas consumption?

In this section, the theory of energy consumption culture is introduced as a theoretical framework. The concept of cultural change has been used to point out the importance of the obvious need to make a fundamental change in mindset and practice of energy consumption. Culture is a distinct set of beliefs, values, behaviors, and artifacts. The theory of energy consumption culture is the sunset of the social practice approach. The culture of energy consumption (culture of energy consumption of an individual, family, company, nation) is the interaction between norms, practices, and objects. Energy consumption culture has an independent agency; however, it is likely to be determined by structural factors over which it has direct control. The framework of energy consumption culture understands the behavior of energy consumption as interrelationships between norms, infrastructures, and consumption practices, as well as external influences (structures) that are the necessary basis for these interactions (Stephenson et al., 2015). Consumption is a set of social actions that, on the one hand, is influenced by social norms and lifestyle, and on the other hand, is influenced by organizations, institutions, and structures of society (Ghasemi, 2016). As mentioned earlier, the purpose of this study is to explain the gas consumption of household subscribers by considering the influence of social factors. Here, the type of strategy to rely on is a deductive strategy. The main task of deductive strategy seems explanation and prediction is specific to this strategy. As Blake (2010) argues, concepts are the cornerstone of social theories, and hence, we first define the concepts of consumerism and sustainable consumption and then identify factors affecting the development of sustainable consumption.

A) Sustainable consumption

Goods and services must be consumed in a way that meets both basic needs and provides a better quality of life with minimal use of natural resources. Sustainable consumption does not mean a reduction in quantity consumption, it means consumption in a different way than before: it also means efficient consumption and improving the quality of life accordingly. Sustainable consumption in the context of the Environmental Renewal Discourse Framework emphasizes the emergence of new business opportunities and the improvement of quality of life simultaneously (Sutten, 2016).

B) Social factors affecting sustainable consumption

Paul Stern (2000) in examining environmental behaviors, identifies two categories of factors: attitude dependent factors and structural factors. In addition to Stern, Triandis has a special concern for combining both social and emotional factors. Social factors include norms, patterns, and self-concept. According to Triandis, social norms are social rules of what should and should not be done (Gholam Reza zade, 2017). Emotional factors also play a role in Triandis's view of behavioral intentions, assuming that emotional responses to decision or decision-making conditions are results of logical-instrumental evaluations of consequences and may include both positive and negative emotional responses with variable powers. So far, it has been found that two categories of factors at two levels of agency and structure can affect sustainable gas consumption.

1) Attitude-dependent factors

The theory of rational action is one of the theories derived from the theory of rational choice. In his famous book, *The Logic of Collective Action*, Manser Olsen sought to examine the problem of collective action, that is, how individuals who act in their own self-interest cannot guarantee to provide goods or services that are collectively beneficial to them (Javadi Yegane, 2008) .In social psychology, Ajzen and Fishbein developed a theory of rational action in 1985, entitled "Planned Behavior Theory," which was able to explain how people's attitudes and levels of control over their actions can explain their consumption behavior. Attitudinal factors are intrapersonal factors that create the necessary motivation for a responsible lifestyle. It also affects the overall readiness for action according to environmental intent (Stern, 2000).

2) Structural factors

Social norms, legal constraints, regulations, and technologies are the contextual factors that can have different functions: directly affect behavior or attitudes that lead to behavioral changes. Contextual factors can affect the relationship between norms and behavior. In their combined model, Ölander and Thøgersen (1995) see contextual factors as opportunities as part of the objective preconditions for behavior. Opportunities are mainly institutional facilities or conditions that relevant institutions provide for individuals to facilitate behavior or behavioral development in society (EmamGholi, 2019). In this study, we look at the set of services that a gas company provides for the public as opportunities that include consumer evaluation of service value, service quality, and after-sales service support. We now define each of these three variables.

2-A) Consumer evaluation of service value. A buyer's computational understanding of the quality of a product or service and comparing it to the cost he or she is going to pay for it is called service value assessment. The meaning of the concept of service value goes back to the theory of fairness. The concept of fairness refers to the fact that a customer evaluates the fairness and desirability of service consumption in contrast with the costs it incurs. In fact, the perceived value is a trade-off between the benefits gained and the costs paid by the customer (Faize et al., 2011)

2-B) Consumer evaluation of service quality: In-service sector, quality assessment is performed when a service delivery processes. Quality of the service system, quality of the behavioral services, quality of the machine services, and the accuracy of the service exchanges can be considered as characteristics of the quality of service delivery and sales. The more appropriate and desirable the characteristics of the services provided, it becomes the first source of competition and the most important factor for the success of companies providing services in the long run (Torkashvand & Divandari, 2010).

3-C) Consumer evaluation of after-sales service support: If manufacturing companies focus on after-sales service, they can sell four times as much and experience more than three times the financial turnover of the original purchase rate during the product life cycle. Researches have shown that manufacturing companies can obtain feedback information on product development and service improvement from after-sales service and customer support. As such, they need to continue their relationship with customers and strengthen their position in the competitive market (Nasiri et al., 2015).

In conclusion, sustainable gas consumption is affected by two main categories of factors. Attitudinal factors include environmental values and knowledge of gas consumption, which, by creating concern as well as providing information about the consequences of action allows the consumer to evaluate the consequences of her/his action. In addition, consumers are members of a consumer society

that follows its consumption pattern. In addition, by providing opportunities and information to actors, society can guide them toward the desired action, which is the sustainable gas consumption. These opportunities include service value, service quality, and after-sales service support. With these explanations and a general overview of what has been said, our theoretical framework is outlined here.

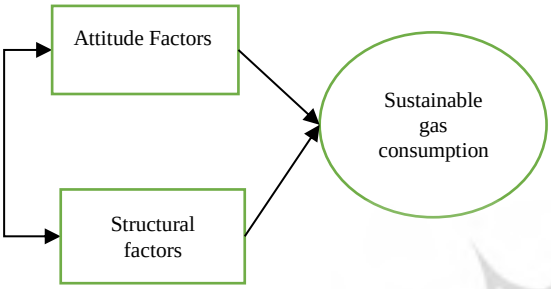

Figure 1. Theoretical Model of Research

Previous researchers have studied sustainable consumption from different dimensions and some of them are mentioned in this section.

Vahida et al. (2010) examined the effect of social and economic factors on the modification of householders' gas consumption patterns. The statistical population of the study was 8191 subscribers of domestic gas in Semirom city and 270 people were selected as the sample. The sampling method was random and proportional to the bulk. The results of regression analysis showed that social status, mass media, religiosity, number of family members, and quality of the building have affected the improvement of gas consumption patterns.

Rezaei et al. (2011) measured the sustainability of water using a hybrid index. The study showed that the number of household members and the land utilization system had a negative impact on sustainable water consumption. The results also revealed that household income levels, irrigation transmission facilities, and participation in training classes had a positive effect on sustainable water consumption.

Zare Shahabadi et al. (2012) identified cultural and social variables affecting energy consumption patterns. The statistical population of the study was 383 households in Yazd who were selected by the cluster sampling method. The researchers' findings showed that the consumption pattern of households was appropriate and factors such as education, media, income, marital status, weak religious beliefs, and social norms had negative impacts on consumption patterns. Also, education, the media, the place of residence, religious emotion, the number of family members, lifestyle, awareness, and the rate of living in the city of Yazd explained 30% of the changes in energy consumption patterns.

Salehi (2015) examined the cultural factors affecting household gas consumption behavior. This research was conducted by survey method and data collection was through a questionnaire. The statistical sample included 437 household gas subscribers in urban areas of Mazandaran province. Research has shown that environmental knowledge, attitudes, and concerns are directly related to gas consumption behavior.

Pourjamshidi et al. (2016) examined social factors affecting on the tendency to sustainable consumption behavior. Data were collected using the survey method and questionnaire. 386 residents of Khorramabad were selected by multi-stage cluster random sampling. The findings showed that environmental attitudes, environmental knowledge, environmental concerns, health concerns, and social responsibility directly and the variables of education, internet access, medical history, and food allergies indirectly explained 30% of the variance in sustainable consumption behavior.

Rezaei and Abbasi (2017) have studied factors affecting sustainable consumption behavior by applying the structural equation method. The research method was descriptive-survey. The sample members were 390 consumers of organic products in Tehran's Refah Stores. The results showed that modernity, price,

environmental attitudes, social norms, and recycling opportunities, and pricing policies had the greatest impact on the desire for organic products.

Zaharia et al. (2019) examined factors affecting sustainable energy consumption. The meta-analysis method was used to identify the factors. Through the study, 671 articles were considered from 1975 to 2019. Keywords included energy, economics, and greenhouse gas emissions. The result of the study showed that GDP and the growth of the labor force had a positive effect on energy consumption, and an increase in the female population, an increase in health care costs, and an energy tax had a negative effect on energy consumption.

White et al. (2019) used a meta-analysis method to study the research literature in the field of sustainable consumption marketing. A range of marketing journals was identified, including the Journal of Marketing, Marketing Research, Consumer Psychology, and Consumer Research. These journals had a high impact factor of 0.3. The keywords used were sustainability or ecology, environment or green, consumer behavior, selection, adaptation, or acceptance. Social norms, social identity, social desirability, habits, punishment and reward, ease of use, time, self-efficacy, efficacy, knowledge, and attitude were identified as factors influencing sustainable consumption.

Guo et al. (2018) studied factors affecting household electricity consumption with a qualitative approach and documentary method. Demographic and economic factors affecting electricity consumption included a number of family members, having children, the social status of the family, the economic status of the family, and the type of housing. Social psychological factors explaining household electricity consumption also included attitudes, beliefs, values, habits, consumption priorities, mental norms, environmental awareness, and self-efficacy.

Johnson et al. (2017) examined factors influencing drivers' tendency to electric cars. The approach was quantitative and the survey method was used to study and the questionnaire was used to collect data. The sample was 3,000 drivers aged 20 to 75 in 2014. some 1,192 people submitted validity questionnaires. The results showed that there was a difference in the tendency to use electric cars by gender, and personal. Social norms had shown the greatest impact on the use of these cars.

Nordlurd et al. (2016) examined the tendency of drivers to clean fuel. Structural modeling was used to test the theory of value-belief-norm. The results showed that environmental awareness, self-efficacy, and mental norms had greater impacts on groups with clean fuel vehicles.

Steg et al. (2006) examined the factors influencing the acceptance of energy policies by applying the theory of value-belief-norm. The research strategy was quantitative and the survey method was used. A questionnaire was used to collect the data, which was completed by 112 people in the Netherlands. The result of the study showed that environmental values were significantly related to environmental concerns. Awareness of the consequences moderated the relationship between environmental attitudes and belief in acceptance of responsibility. The result also revealed that environmental attitude moderated the relationship between environmental values and awareness of the consequences.

Generally, a review of research conducted in the field of sustainable consumption showed that researchers such as Vahida et al. (2010) and Zare Shahabadi et al. (2012) paid attention to the discussion of modifying gas consumption patterns. Rezaei et al. (2011) discussed the sustainability of water consumption in agriculture using a fuzzy approach. Pourjamshidi et al. (2016) and Rezaei and Abbasi (2017) also examined

sustainable behavior in the field of health and food or buying green products in stores. Zaharia et al. (2019) and White et al. (2019) used a meta-analysis technique to examine the role of marketing in promoting sustainable products. Furthermore, Guo et al. (2018) have applied documentary methods to identify factors that affected electricity consumption. Johnson et al. (2017) and Nordlurd et al. (2016) also used sustainable fuel consumption in the transportation sector. Finally, Steg et al. (2006) used the theory of value – belief- norm to study energy behavior in a general form. These all the above-mentioned studies, have raised the following hypothesis about factors predicting sustainable gas consumption.

1) It seems environmental values effects on sustainable gas consumption
2) It seems knowledge of gas consumption has an impact on sustainable gas consumption.
3) It seems descriptive norms have an effect on sustainable gas consumption
4) It seems prescribing norms have an effect on sustainable gas consumption.
5) It seems consumers' evaluation of the quality of the gas company's services affects sustainable gas consumption.
6) It seems consumers' assessment of the value of the gas company's services has an effect on sustainable gas consumption.
7) It seems consumers' evaluation of after-sales service support has an impact on sustainable gas consumption.

Methodology

In the present study, a survey method was used and the questionnaire has been applied for collecting data. Due to the fact that the data should have been collected in the East, West, and Center of Mazandaran province, invigilators were employed who were familiar with the local culture. The invigilators were trained and got familiar with the structure of the questionnaire and how to collect information. The questionnaires were completed by home gas subscribers in the sample cities.

To create a questionnaire, in the first step, questions were compiled. Some of them were extracted from previous studies (like Salehi, 2015; Survey of customer satisfaction of Mazandaran Gas Company 2017) The remaining questions were made by the researcher or in consultation with the experts of the gas company. A pre-test was conducted to assess the wording of the questions and questionnaires.

The analysis unit in this research is individual and the statistical population of the study was all home subscribers of Mazandaran Gas Distribution Company who were over 18 years old. According to the statistics, home subscribers of the Mazandaran Gas Distribution Company figured as 542944 people. The Cochran's formula and $\frac{Nt^2}{Nd^2}$ was used to determine the sample size. The sample size was estimated at some 430 people. In order to get access to the samples, some criteria were applied such as the number of cities in Mazandaran province, climate, and resource constraints. A systematic random cluster sampling method was used. To apply cluster sampling, in the first stage, Mazandaran province was divided into three regions: East, West, and Center. In the next step, according to the climate of the triple regions' temperature, temperate cold and temperate hot, three cities were counted as clusters from each region systematically. In the third step, based on the population in the selected cities, the required samples were calculated for each city.

In order to assess the validity and reliability of the research tools, Cronbach's alpha coefficient, formal validity, and structural validity were used. Exploratory factor analysis was also used to more accurately examine gas consumption patterns to extract gas consumption clusters. The table below shows the exploratory factor analysis.

A factor load typically indicates the correlation between items and agents. The load value of all items is greater than 0.3, which means it is in an acceptable area. The

value of the KMO index is 0.767, which indicates the ability of the data to apply the factor analysis technique on them. The value of the Bartlett test reported as 564.319, with a significant level of 0.000, which indicates the generalizability of the results of factor analysis to population. In general, the results confirm the validity of the sustainable gas consumption structure. In this analysis, having a utilized rotation of Varimax, three factors with Eigenvalues higher than 1 were extracted. Based on the meaning of the items and also in consulting with some expertise in Mazandaran Gas Company, the factors were labeled as the first factor as safety, the second factor as awareness, and the third factor as responsible consumption. All these factors were loaded above 0.3. Table 2 shows the Eigenvalues, percentage of explained variance, and percentage of unexplained variance by all three factors were discovered.

Table 1. Exploratory factor analysis of sustainable gas consumption

items	Factor load	Factor load after rotation		
		First factor	Second factor	Third factor
How often do you check the gas connection rubber hoses?	0.74	0.85		
How often do you review the metal gas piping at home?	0.69	0.80		
How often do you close the gas valves that have not been connected to any gas burner before and are not in use?	0.63	0.75		
How often do you check for a blue gas heater flame?	0.70		0.75	
How much do you use hooded chimneys?	0.71		0.83	
How much do you use standard gas burners?	0.66		0.72	
How much do you use a thick curtain for the window of the room?	0.45			0.50
To what extent do you use a dish that fits the stove flame when cooking?	0.67			0.76
To what extent do you wear more clothes in the cold season instead of increasing the temperature of the heater?	0.59			0.70

Table 2. Factor analysis of exploratory questions of sustainable gas consumption

Factors	Eigen Values	variance%	Cumulative%
Safety (first factor)	3.11	34.59	34.59
Awareness (second factor)	1.78	19.87	54.46
Responsible consumption (third factor)	1.05	11.71	66.18

Generally, all these three factors accounted for 66.18% of the variance in sustainable gas consumption. Safety dimension 34% of the total variance of gas consumption behavior, the factors of awareness, and responsible consumption explained 19 and 11% of the changes in the sustainable gas consumption, respectively. Among these factors, the first factor, namely safety, with the eigenvalue of 3.11 has the largest share in explaining the sustainable consumption of gas.

Theoretical and Operational Definitions

A) Sustainable gas consumption: Sustainable consumption means a set of procedures that reduce the destructive effects of the environment and also reduce the exploitation of natural resources in the production cycle, behavior, or services (White et al., 2019).

Three dimensions were considered for indexing the concept of sustainable gas consumption: Safety, awareness, and responsible consumption. To determine these dimensions, the opinions of the experts of Mazandaran Gas Company were utilized. 9 items were presented in the form of a Likert spectrum (always, often, sometimes, rarely, never). The range of changes in the scores of this variable is between 5 and 45. Alpha Cronbach's value of these 9 items was estimated at 0.76.

B) Environmental values: the environmental values represent a person's basic orientations about the environment and reflect his or her worldview about the natural world (Barr et al., 2003). Operationally, the present study utilized 5 items in the form of a Likert spectrum. These items were: optimal consumption means creating equal opportunities to benefit from gas; We need to use gas in a way that others can use it in the future; Optimal gas consumption means respecting the rights of other consumers; It is not the right of consumers to use gas as much as they want and can afford it; We should not save on gas just when we can't afford it. The range of scores on this scale is from 5 to 25. The validity of these items is 0.79.

C) Knowledge of gas consumption: Knowledge of gas consumption means practical information that people have about gas as a natural source and supplier of energy and the impact of human actions on how to use it. Here, gas consumption knowledge consists of 5 items. These items include it is convenient to use long hoses to deliver gas to different parts of the house; there must be enough air for the gas to burn well; length of the hose should be proportional to the place where the heater is connected; maximum temperature of the water heater and boiler in the cold seasons of the year should be 55 degrees Celsius; temperature of the water heater and radiator in the hot seasons of the year should be a maximum of 35 degrees Celsius. These items are measured on a rating scale (zero to 2) (I don't know = 0, no = 1, yes = 2) and the range of changes in the scores of this variable varies between zero and 10. The alpha coefficient for measuring the validity of this variable is 0.70.

D) Descriptive norms of gas consumption: This concept means the person's perceptions of the observance of do's and don'ts in society by others (Salehi, 2020). 2 items are placed in a five-part Likert range (completely agree to completely disagree) so that the respondent can express her/his opinion about each of the items on one of the points in this range. These items include: Most people consume gas regardless of its pressure drop for other subscribers; it seems that people to be saving on gas consumption for fear of debt to the gas company. The validity of these items is 0.65 with the alpha α test.

E) Prescriptive norms for gas consumption: Prescriptive norms refer to the estimation of the pressure caused by other people's sensitivity to one's own consumption action, and the person expresses her / his opinion about the reaction of others to the way she/ he acts (Salehi, 2020). To measure the prescriptive norms of gas consumption used 2 items in the form of a Likert spectrum (protest = 0, get upset = 1, ignore = 2, encourage = 3, recommend performance to others = 4). The items are as follows: If you wear more clothes instead of increasing the temperature, how will others react? How do others react when your gas money goes down? Its validity is 0.61 and the range of responses is between zero and 8.

F) Evaluate the value of services: The customer's overall assessment of the desirability of a product or service is based on his or her perception of the benefits received versus the costs paid for it (Faize et al., 2011). Four items were used for the operational definition. The items were placed in the Likert range (very good to very weak). Four indicators were considered for this evaluation, which is: How do you evaluate the company's performance in terms of sharing time (counter installation time)? How do you evaluate the company's performance by the time taken to

install the branch (Alamak)? How do you evaluate the company's performance in providing safe gas? How do you evaluate the company's performance in terms of shareability (file formation)? The alpha value for measuring the validity of the service value assessment was 0.78.

G) Service quality assessment: Service quality is the customer's view of the company's services (Faize et al., 2011). To measure the quality of services, five items were used in the form of a Likert spectrum. Respondents rated the quality of services in the form of a Likert range with a very good to very poor response range, which includes: How do you evaluate the skills and knowledge required by employees to provide the desired services and guidance to customers? How do you evaluate the company's performance in providing timely gas bills? How do you assess the increase in the 45-day period for reading and distributing gas bills? How do you evaluate the company's performance in providing customer service through government counters? How do you evaluate the accuracy of the performance of the meter reading when referring to read the counter? The validity of service quality was also at a good level (α= 0.78).

J) After-sales service support evaluation: Support refers to the services provided to the customer after delivery of the goods (Divandari & Torkashvand, 2010). 5 items were considered in the Likert range. These items include: How do you evaluate the timely action to repair the counter and regulator failure by the gas company? How do you assess the performance of gas company relief workers in accidents and critical situations? How do you evaluate the company's performance in training safety tips? How do you evaluate the information on the necessary times to cut off or connect the gas in your area? How do you evaluate the company's performance in handling your complaints and grievances? The alpha value of Cronbach is 0.82.

Findings

The present study was conducted in Mazandaran province. The sample was selected by temperature and cities included Kelardasht, Pol-e Sefid (mountainous temperate), Chalous, Ramsar, Tonekabon (tropical temperate), Babol, Amol, Sari and Ghaemshahr (temperate climate). Of the samples examined, 134 were male and 68 were female. 65% of respondents had a bachelor's degree. 45% have self-employed. 69% of the respondents live in modern buildings (concrete or iron skeletons). The lifespan of the building of 32% of respondents was between 5 and 10 years. The most widely used material in the building was clay brick (27%). The ceiling of houses of 31.7% of the respondents was shared with others. The floor of the building 30.9% of the respondents are also shared with a common residential unit. The wall of housing 33.7% of the respondents is perforated clay brick. The doors and windows of the house of 37.5% of respondents are aluminum. The infrastructure of the building of 36.2% of respondents is between 70 and 100 square meters. The main heating devices are water heaters and heaters (46.2%), which there are between 2 and 3 heaters in each house. 31.4% of the respondents earn 2 million Tomans per month.

The mean safety dimension was 3.68, awareness was 27.7 and responsible consumption was 3.90 of 5. Among the three dimensions of sustainable consumption, the level of awareness of respondents about how to use gas appliances is high. Barr (2000) in his examining the clusters of environmental behaviors, called the first cluster as environmentalists, those who consider irresponsibility in their consumer behavior means at a high cost to society and the environment. In the safety dimension, the mean is lower than the average of the previous

two dimensions (3.68 of 5). In general, the mean of sustainable gas consumption is 3.92 out of 5, which indicates gas consumption is relatively sustainable. S.D of the sustainable gas consumption is 0.84 and since it is less than 1, it shows the similarity of the respondents in evaluating the sustainability of gas consumption.

The mean of environmental values was 4.42 of 5. S.D was 0.84, indicating that the respondents were consistent in their assessment. Thus, the environmental values of the respondents are positive and altruistic.

The mean knowledge of gas consumption is equal to 1.49 of 2 with S.D of 0.50, so the knowledge of gas consumption is at an average level and the respondents are uniform in their evaluation. The average of descriptive and prescriptive norms is very low, which are: (2.44 of 5) and (2.44 of 4), respectively.

The mean of evaluation of the value of services is 3.81 of 5, which shows that the respondents evaluated the value of services at an average level. The standard deviation value is 0.87, which is less than 1, so respondents are consistent in evaluating the value of the service. The mean of the evaluation of service quality is 3.97 of 5 with S.D is 0.93. In general, the quality of services is assessed at a moderate level. The mean of after-sales service support is 3.73 of 5 with S.D of 0.92. Respondents rated in the after-sales service support as moderate.

In this section, we first compare the differences between the three dimensions of sustainable consumption by gender, education, age, employment status, and economic variables. Then, using structural modeling, the factors affecting these three dimensions, and the experimental test of the theoretical model are examined.

Comparison of sustainable gas consumption by gender

In this survey, three dimensions of sustainable consumption gas were measure by interval scale and the independent variable (gender) is two-state nominal. Therefore, to compare the differences, the T-test with two independent samples was used. The test results showed that there was no significant difference in the sustainable consumption by gender. Safety dimension (T = 1.09, sig = 0.19), awareness dimension (T = -1.47, sig = 0.06) and finally responsible consumption (T = -0.891, sig = 0.16).

Comparison of sustainable gas consumption by education and age

Statistically, an appropriate test to measure the relationship between these three dimensions of sustainable gas consumption and education is ANOVA. ANOVA analysis shows that there is no significant relationship between education and three dimensions of sustainable consumption. From the point of safety dimension (F = 0.374, sig = 0.97), awareness dimension (F = 0.99, sig 0.45) and responsible consumption dimension (F = 1.67, sig = 0.09), gas consumption also did not differ significantly by education (F = 29.7, p = 0.50).

The Pearson test also confirmed that the age variable had no significant relationship with any of the three dimensions of sustainable consumption. Safety dimension (r = 0.096, p = 0.21), awareness dimension (r = 0.01, p = 0.82), responsible consumption dimension (r= 0.05, p = 0.86). Finally, gas consumption practice did not differ significantly by (r = 0.009, p = 0.91).

Comparison of sustainable gas consumption by employment status

The ANOVA test showed that the safety dimension of gas consumption varies by employment status and the comparison of the mean of the job groups also shows that this dimension varies by employment status (F = 2/22, sig = 0.01). The compare mean of job groups also shows that employees and retirees care more about safety than their counterparts. But dimensions of awareness (F = 0.879, sig = 0.56) and responsible consumption did not differ by employment status (F = 0.690, sig = 0.71). Gas consumption also is varied by employment status (F = 29.7, p = 0.02).

Comparison of the difference between

sustainable gas consumption by economic variables

The relationship between economic variables and gas consumption was examined using the Pearson correlation.

Table 3. correlation test of economic variables and dimensions of sustainable consumption

Dimensions of sustainable consumption	Independent variables	R	sig
Safety	Gas price	0.03	0.72
	Income	-0.051	0.58
Awareness	Gas price	-0.005	0.95
	Income	-0.005	0.95
Responsible consumption	Gas price	0.01	0.86
	Income	-0.11	0.20
The practice of gas consumption	Gas price	0.13	0.13
	Income	-0.11	0.23

The findings of the research as shown in the above table indicate that there is no significant relationship between economic variables (gas price and income) and three dimensions of sustainable consumption. Also, gas consumption is not significantly related to gas prices and income.

Theoretical model test (using structural equation modeling)

It has already been pointed out that sustainable consumption has three dimensions. Figure 2 shows the direct and indirect effects of independent variables on the safety dimension. As the model shows, variables of consumer evaluation of after-sales service of the gas company and the descriptive norms of gas consumption, respectively, have the most direct effects on the safety dimension. Table 4 shows the most important fitness indicators of this model.

Table 4. Summary of fitness indicators of safety in consumption dimension

Fit index	(x^2)	p	GFI	RMSEA	NFI	CFI
values	54.15	0.00	0.84	.010	0.91	0.93

The ratio of CMIN/DF is 3.61 which according to Byrne, is less than 3 desirables (Alavi, 2014). Values of NFI, GFI, CFL indexes are close to 1 which indicates good fitness of the model. The value of RMSEA is greater than 0.05 which is acceptable.

Figure 3 shows the direct and indirect effects of independent variables on the dimension of awareness.

Table 5. Summary of fit indicators of awareness in the consumption dimension

Fit index	(x^2)	p	GFI	RMSEA	NFI	CFI
values	31.31	0.00	0.90	0.069	0.95	0.97

The ratio of CMIN/DF is 2.23, which shows good fitness. Values of NFI, GFI, CFL indexes are close to 1 which indicates good fitness of the model. The value of RMSEA is less than 0.05 which is acceptable.

The next model is the responsible consumption dimension of gas consumption.

Table 6 summarizes the most important fitness indices of the model.

Table 6. Summary of fit indicators of responsible consumption dimension

Fit index	(x^2)	p	GFI	RMSEA	NFI	CFI
values	49.81	0.00	0.86	0.09	0.93	0.94

The ratio of CMIN/DF for the responsible consumption model is 3.55. The value of RMSEA is 0.09, which is greater than 0.05. the values of GFI, NFI, and CFI are close to 1 and indicating that the fitness of the model is complete.

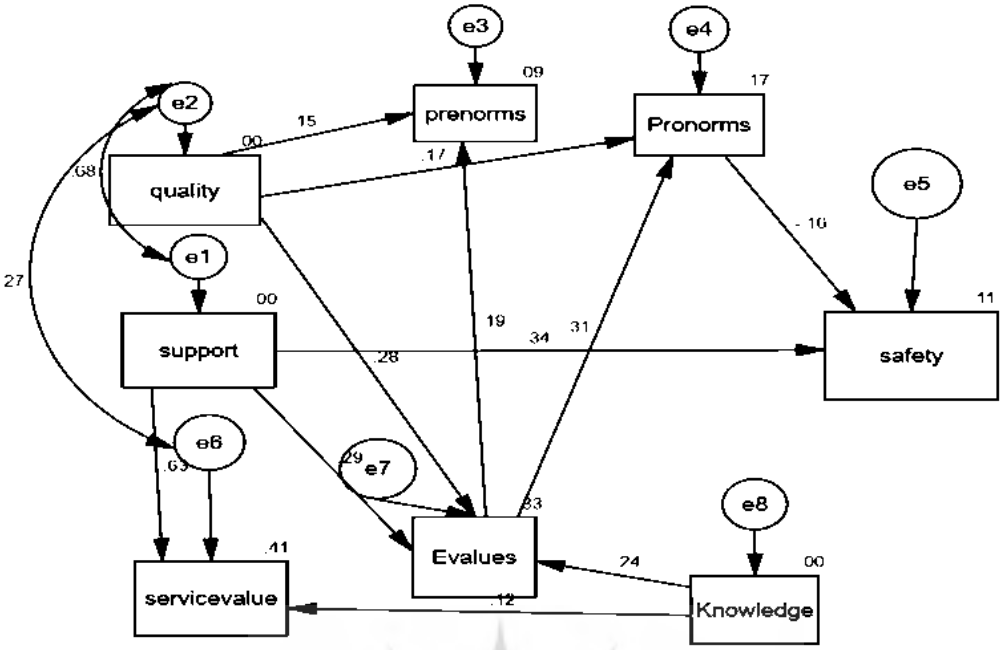

Figure 2. Structural modeling of safety in consumption dimension

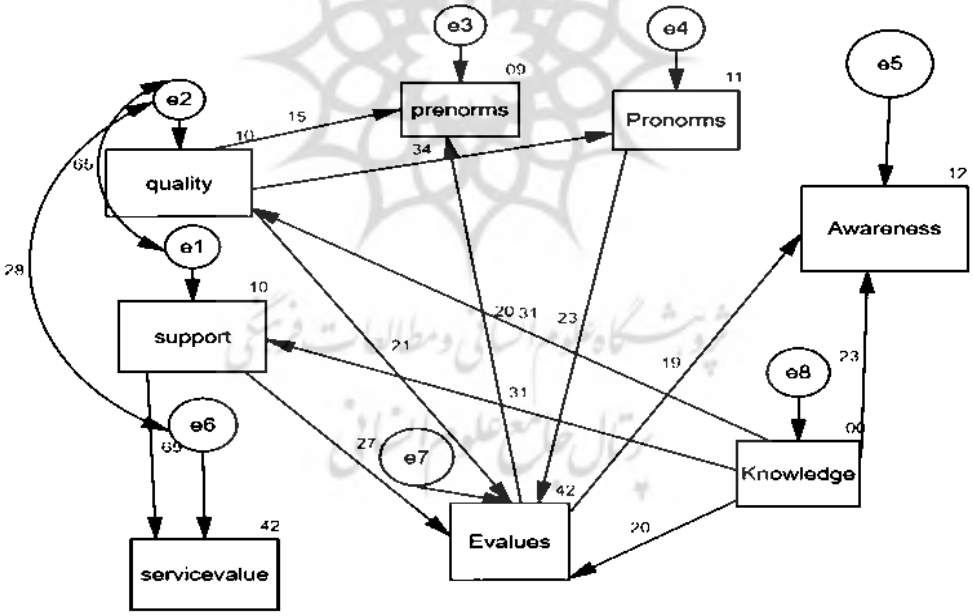

Figure 3. Structural modeling of awareness in the consumption dimension

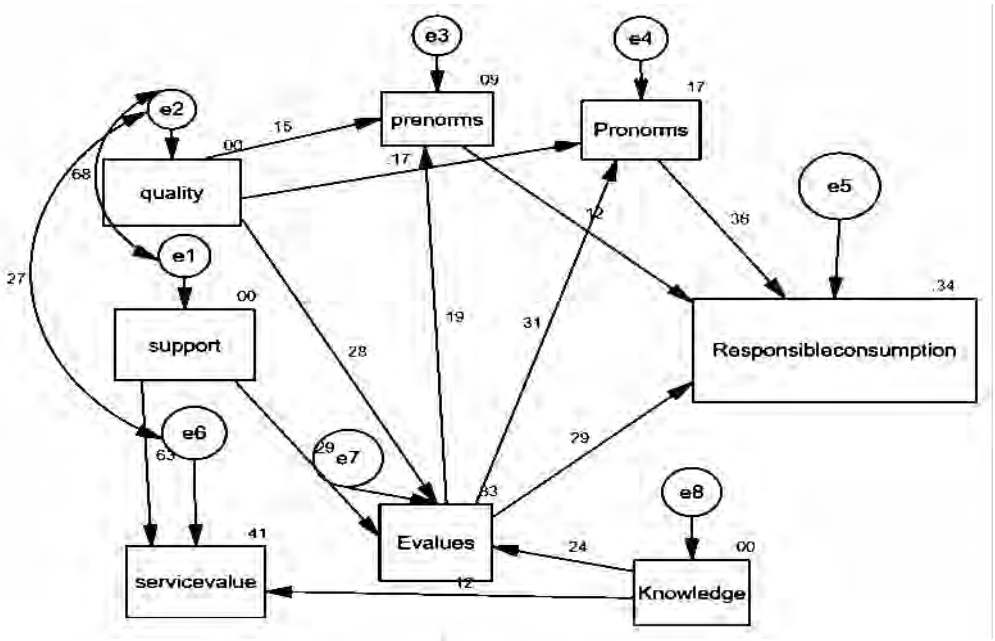

Figure 4. Structural modeling of responsible consumption dimension

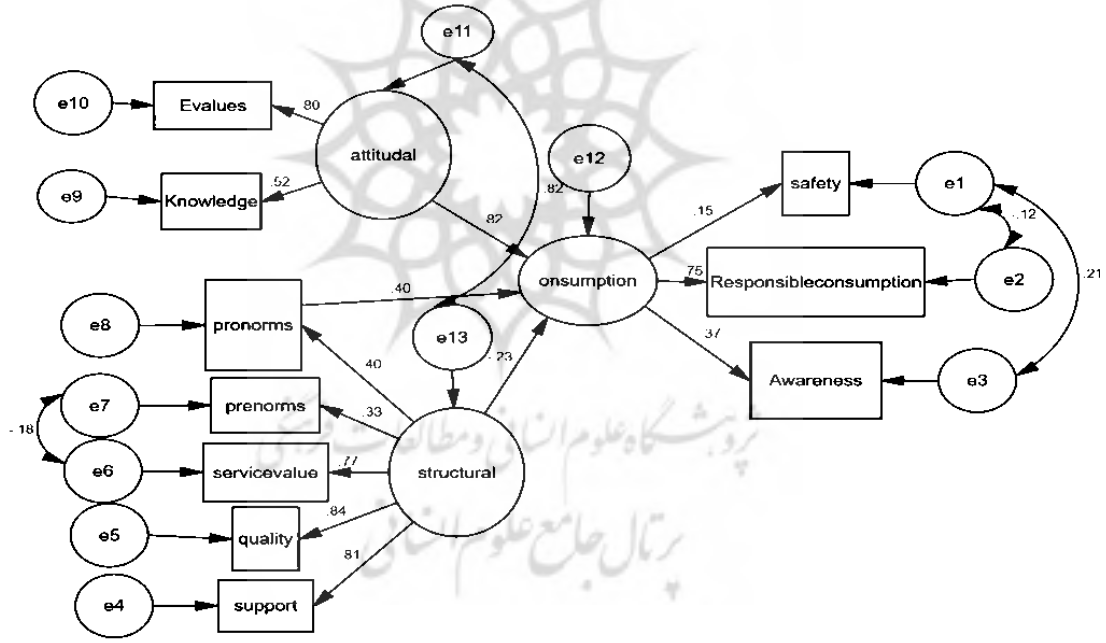

Figure 5. An experimental test of the theoretical research model using structural modeling

The correlation coefficient of attitude with sustainable gas consumption is 0.82, while the same coefficient between structural and sustainable gas consumption is -0.23. In other words, the attitudes of consumers towards the value of the service, its quality, and after-sales service of the gas company are positive, the gas consumption is decreased. Also, by reducing the effect of descriptive and prescriptive norms on gas consumption, gas consumption is more sustainable.

Table 7. Summary of fitness indicators of a theoretical model

Fit index	(x^2)	p	GFI	RMSEA	NFI	CFI
values	92.95	0.00	0.82	0.09	0.89	0.92

The ratio of CMIN/DF is 3.24. The value of RMSEA is 0.09, which is greater than 0.05. the values of GFI, NFI, and CFI are close to 1.

Discussion

The purpose of this study was to identify the factors affecting the sustainable consumption of domestic gas. Three questions were examined.

First, how sustainable is household gas consumption? We measured sustainable consumption by using variables including, "Use of goods and services to meet basic needs and achieve a better quality of life, while minimizing the use of natural resources, toxins and waste and pollutants in the life cycle, so that the needs of future generations do not endanger " (Sutten, 2016: 230) which are based on the definition of Brantland's report on the sustainable development. Having considered the mean of gas consumption of 3.92 of 5, we can say that the sustainability of consumption is at a moderate level.

The second question was "what social factors affect the sustainable consumption of domestic gas?" From the point of safety and compliance with the principle of caution in the use of gas for daily uses, the results of the study showed that consumer evaluation of after-sales service support and descriptive norms of gas consumption has been most influential. Then the awareness dimension was most affected by environmental values and knowledge of gas consumption. The third dimension of responsible consumption was influenced by environmental values, descriptive and prescriptive norms of gas consumption. In general, the results of the present study showed that environmental values and knowledge of gas consumption affect the awareness dimension. Steg et al. (2006), Nordlard et al. (2016), Rezaei et al. (2011), Zare Shahabadi et al. (2012), Salehi (2015), Pourjamshidi (2016), White et al. (2017) and Guo et al. (2018) also found that environmental values and environmental knowledge affect the sustainable energy consumption. But in relation to the impact of structural factors on the sustainable gas consumption, the results of the study revealed that descriptive and prescriptive norms also had an impact on the sustainable consumption (safety and responsible consumption dimensions). This result was consistent with the results obtained by researchers such as Nordlard et al. (2016), Johnson et al. (2017), Zhivo et al. (2018), White et al. (2017), Rezaei and Abbasi (2017) and finally Zare Shahabadi et al. (2012). They found that energy consumption was increased with the weakening of environmental norms in the society. Another structural factor was after-sales service support, which has affected sustainable gas consumption (safety dimension). In this study, it was found that sustainable gas consumption was not varied by gender, age, education, income, gas. However, the results showed that the awareness dimension of gas consumption was different according to employment status. These results are consistent with the results achieved by Rezaei et al. (2011), Zare Shahabadi et al. (2012), Pourjamshidi (2016), Rezaei, and Abbasi (2017), Zaharia et al. (2019) and Johnson et al. (2017).

The third question of this study was "what solutions can increase the sustainability of gas consumption?" To answer this question, three suggestions were made.

A) Increasing after-sales service support

This survey found that most subscribers of the gas company had poor evaluation towards training on safety tips and handling complaints. Therefore, it is necessary for the gas company to increase the customers' knowledge about safety as well as how to report his/her complaint.

B) Increasing service quality

Timely delivery of gas bills, strengthening the responding services to the customer, and hearing his/her complaints (both in-person and online), creating organizational, technical, and cultural infrastructure is essential to better implementing a customer relationship system.

This requires that more training classes be held for the staff of the province's gas departments in order to become more familiar with the customer relationship system.

C) Increasing sustainability knowledge

In the discussion on energy consumption, two factors must be considered. The first is energy consumption and the second is energy conservation. Consumers often pay more attention to energy consumption and meet their biological needs through it, while energy conservation seems less important due to the invisible nature of energy. If a consumer is asked why you are saving gas consumption, she/he may refer to the gas bill. However, the reasons for protecting gas resources or the importance of national wealth for future generations seem less important. This means, lifestyle change is necessary to reduce the gap between attitudes and consumption practices, specifically, when energy consumption habits are unsustainable.

REFERENCES

Alavi, M. (2014). "Reporting the Results of structural equation modeling writing". *Nursing Management*, 3(2), 8-19. [in Persian]

Barr, S., Ford, N.J., & Gilg, A.W. (2003). *"Attitudes Toward Recycling Household Waste in Exeter*". Devon: Quantitative & Qualitative.

Blaikie, N. (2010). *"Designing social research: the logic of anticipation*". Translated by Hassan Chavoshian, Ne Press. [In Persian]

Divandari, A., & Tourkashvand, G. (2010). "Identifying the factors affecting the quality of after-sales service and investigating the relationship between those factors and customer satisfaction in IT services". *Marketing Management*, 2(6), 83-96. [in Persian]

Faize, D., Zarei, A., Zargar, M., (2011). "Investigating the relationship between quality of service and customer satisfaction through the perceived value of services [Case Study of Raja Passenger Trains Company]". *Business Strategies*, 47(9), 311-324. [In Persian]

Ghasemi, F. (2016). *"The motivation for sustainable consumption*". Tehran: Publications of the Secretariat of the Supreme Council of the Cultural Revolution [in Persian]

Gholamrezazade, F. (2017). *"Sociological explanation of waste distribution behavior among citizens*". Thesis of the undergraduate course, Supervisor: AliAsghar Firouzjaeen, Mazandaran University.

Gross, M., & Mautz, R. (2018). *"Renewable energies*". translated by Sadegh Salehi, Babolsar, Mazandaran University Publications, and Mazandaran Gas Co.

Guo, Z., Zhou, K., Zhang, C., Lu, X., Chen, W., & Yang, S. (2018). "Residential electricity consumption behavior: Influencing factors, related theories, and intervention strategies". *Renewable and Sustainable Energy Reviews*, 81(2018), 399-412.

Jansson, J., Nordlund, A., & Westin, K. (2017). "Examining drivers of sustainable consumption: The influence of norms and opinion leadership on electric vehicle adoption in Sweden". *Journal of Cleaner Production*, 154(2017),176-187.

JavadiYegane, M.R. (2008). "Sociological approaches of choice theory". *Culture strategy*, No.3, 33-64 (in Persian)

Mazandaran Province Gas Company (2017).

"A survey measuring the satisfaction of stakeholders of Mazandaran Gas Company". Executor of the plan: Dr. Sadegh Salehi, Published by Mazandaran University. [In Persian]

Moktari MalekAbadi, R., Abdollahi, A., Sadeghi, H. (2014). "Analysis and recognition of urban environmental behaviors (A Case Study of Isfahan City)". *Journal of Urban Research and Planning*, 5(18): 1-20. [In Persian]

Nasiri, M., Akhondzade Noghabi, E., Minaie Bidgoli, B. (2015). "A new approach on using data mining techniques in identifying effective factors on customers' satisfaction". *Journal of Business Management*, 7(1), 231-251

Nordlund, A., Jansson., & Westin, K. (2016). "New transportation technology: norms activation processes and the intention to switch to an electric /hybrid vehicle". *Transportation Research Procedia*, 14(2016), 2527-2536.

Pourjamshidi, H., Mahdizade, H., Gholamrezayi, S., Shiri, N. (2016). "Factors affecting sustainable consumption behavior: (City of Korram Abad)". *Environmental Education and Sustainable Development*, 4(4), 55-64. [In Persian]

Rezayi, A. & Abbasi, J., (2017). "Investigating factors affecting sustainable green consumer behavior". *Journal of Development Evolution Management*, 31(2017): 71-81. [In Persian]

Rezayi, M., Mohammadi, H., & Karami, A. (2011). "Investigating the factors affecting water resources utilization and its sustainability in different geographical conditions in Fars province", *Ecology*, 38(4), 67-78. [In Persian]

Salehi, S. & Pazokinejad, Z. (2017). "Sociological explanation of sustainable lifestyle among university students". Journal of Higher Education, 29(2016): 92-106. [In Persian]

Salehi, S. (2015). "Assessing the impact of cultural Factors on gas consumption behavior". *Social Studies and Research in Iran*, 4(4), 551-570. [in Persian]

Salehi, S. (2020). *"Measurement of social responsibility of rural society towards the environment and its promotion*". Research Report, Iran National Science Foundation, Tehran, Code No: 9601612. [in Persian]

Schmidt, S. & White, H. (2013). *"A Review on Energy Consumption from a Socio-Economic Perspective: Reduction Through Energy Efficiency and Beyond* (December 17, 2013)". Available at SSRN: https://ssrn.com/abstract=2376169 or http://dx.doi.org/10.2139/ssrn.2376169

Steg, L., Drijerink, L., & Abrahamse, W. (2006). "Factors influencing the acceptability of energy policies: A test of VBN theory", *Journal of Environmental Psychology*, 25(2006), 415-425.

Stephenson, J., Barton, B., Carrington, G., Doering, A., Ford, R., Hopkins, D., Lawson, R., Mccarthy, A., Rees, D., Scott, M., Thorsns, P., Walton, S., Williams, J., & Wooliscroft, B. (2015). "The energy cultures framework: Exploring the role of norms, practices and material culture in shaping energy behavior in New Zealand and the pacific". Accepted for *Energy Research and Social science*, Author 's copy.

Stern, PC., Dietz, T., Abel T., Guagnano, G., & Kalof, L. (2000). "A value-belief-norm theory of support for social movements: the case of environmentalism". *Human Ecol Rev* 6(2):81–97.

Sutten, F. (2016). *"Sociology of Environment*". translated by Sadegh Salehi, Tehran: Samt Publications. (In Persian)

Vahida, F., Hertmani, A., Ganbari, R(2010).

"Investigation of social, cultural and economic factors affecting the gas consumption pattern of households in Samirom", *Journal of Social Sciences of the Islamic Azad University of Shoushtar Branch*, 4(10), 1-30. [In Persian]

White, K., Habib, R., & Hardisty, D.J. (2019). "How to shift consumer behaviors to be more sustainable: a literature review and guiding framework", *Journal of Marketing*, 83(3), 22-49.

Zaharia, A., Claudia Diaconeasa, M., Brad, L., ladaru, G.L., and Ioanas, C. (2019). "Factors influencing energy consumption in the context of sustainable development", *Sustainability*, 2019, 11, 41-47, DOI: 10.3390/su11154147.

Zareshabadi, A., Hajizade, M., Lotfiani, A., Solaimani, Z. (2012). "The effect of socio-cultural Factors on energy consumption pattern in Yazd households", *Energy Planning and Policy Research*, 25-26(2013), 145-167. [in Persian]