REPUBLIC OF TURKEY

ADANA ALPARSLAN TÜRKEŞ SCIENCE AND TECHNOLOGY UNIVERSITY

SOCIAL SCIENCES INSTITUTE

FACULTY OF BUSINESS ADMINISTRATION

REGRESSION MODELS AND APPLICATIONS ON RECYCLING OF DOMESTIC WASTE

GÖKAY YİĞİT KILIÇER

MASTER OF BUSINESS ADMINISTRATION

ADANA 2021

REPUBLIC OF TURKEY
ADANA ALPARSLAN TÜRKEŞ SCIENCE AND TECHNOLOGY UNIVERSITY

SOCIAL SCIENCES INSTITUTE
FACULTY OF BUSINESS ADMINISTRATION

REGRESSION MODELS AND APPLICATIONS ON RECYCLING OF DOMESTIC WASTE

GÖKAY YİĞİT KILIÇER
MASTER OF BUSINESS ADMINISTRATION

SUPERVISOR
Asst. Prof. Dr. SELİM GÜNDÜZ

ADANA 2021

ABSTRACT

REGRESSION MODELS AND APPLICATIONS ON RECYCLING OF DOMESTIC WASTE

Gökay Yiğit KILIÇER

Department of Business Administration

Supervisor: Asst. Prof. Dr. Selim Gündüz

July 2021, 82 pages

Domestic waste management has an important place in developed and developing country societies due to its contributions to economy and environmental health. It is known that its historical development started with the settled life of humanity. This process, which was made to make the soil productive by managing only organic wastes in ancient times, differentiated with the developing technology and today it is divided into different groups. The first purpose of the recycling systems is created in today, is to make researches and developments that will keep the efficiency of the system at the maximum level. In this study, the aim is to investigate human beings that have direct effects on production inputs and outputs. With the help of the literature survey, it is observed that developed countries have efficient household waste management systems because of the demographic analysis. From this point of view, it will be much more convenient to establish a system in developing and non-developed countries that use degrees of relation between participation, household waste type and demographic information on that region to develop system and enlighten the all responsible regarding to waste management system. Online based survey is arranged between 436 participants for the collection of data and it is analyzed by Multi-Linear Regression and Logistic Regression methods. It is found out that different types of demographic information are effective on different types of waste and it is highly suggested to arrange system according to demographic information.

Keywords: Multi-Linear Regression, Logistic Regression, Waste Management

ÖZET

EVSEL ATIKLARIN GERİ DÖNÜŞÜMÜ ÜZERİNE REGRESYON MODELLERİ VE UYGULAMALARI

Gökay Yiğit KILIÇER

İşletme Anabilim Dalı

Danışman: Asst. Prof. Dr. Selim GÜNDÜZ

Temmuz 2021, 82 sayfa

Evsel atık yönetimi, ekonomiye ve çevre sağlığına yaptığı katkılardan dolayı gelişmiş ve gelişmekte olan ülke toplumlarında önemli bir yere sahiptir. Tarihsel gelişiminin insanlığın yerleşik hayatıyla başladığı bilinmektedir. Eski zamanlarda sadece organik atıkların yönetilerek toprağı verimli hale getirmek için yapılan bu işlem gelişen teknoloji ile farklılaşmış ve günümüzde farklı gruplara ayrılmaktadır. Günümüzde oluşturulan geri dönüşüm sistemlerinin ilk amacı, sistemin verimliliğini maksimum seviyede tutacak araştırma ve geliştirmeler yapmaktır. Bu çalışmada amaç, üretim girdi ve çıktıları üzerinde doğrudan etkisi olan insan varlığının araştırılmasıdır. Literatür araştırması yardımıyla, gelişmiş ülkelerin demografik analizler nedeniyle etkin evsel atık yönetim sistemlerine sahip olduğu gözlemlenmiştir. Bu noktadan hareketle, gelişmekte olan ve gelişmemiş ülkelerde, katılım, evsel atık türü ve o bölgeye ilişkin demografik bilgiler arasındaki ilişki derecelerini kullanan bir sistem kurmak, sistemi geliştirmek ve atık yönetim sistemi ilgili tüm sorumluları aydınlatmak çok daha uygun olacaktır. Verilerin toplanması için online tabanlı anket 436 katılımcı ile düzenlenmiş ve Çoklu Doğrusal Regresyon ve Lojistik Regresyon yöntemleri ile analiz edilmiştir. Farklı demografik özellikerin farklı atık türleri üstünde etkisi olduğu gözlenmiş ve kurulacak sistemlerin demografik özellikler dikkate alınarak işleme alınması önerilmiştir.

Anahtar Kelimeler: Çoklu Doğrusal Regresyon, Lojistik Regresyon, Atık Yönetimi

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Everything has started with the solid decision of the humanity. When the age of collection got feeling of destruction intensively, people created the idea of ownership. This action activated so many ideas but most importantly it triggered the settled life. This was the time that wastes were collected at the specific areas which are defined only for these purposes. These historical details will be explained chronologically in the further aspects but the starting point must be some definitions that will be used every step of this study. Firstly, the question of what is waste, must be answered. The waste is all substances that must be throwed away or dropped in or created no electively as a result of organic or inorganic process that are proceeded by living or lifeless formations. These formations can be exampled as monocellular, animals, humans, mechanical or chemical processes, radiations etc. More basically, waste definition could be anything which would be no longer required by someone or something. After these general definitions, specific details can be shared. First waste formation in milky way galaxy is started with the Sun. Study of Zakariya and Khan (2014) shows that there are direct and indirect lights of Sun and most important indirect sunlight is the radiation process between Sun and any substance is considered as first inorganic formation of waste, will be explained later, because of it is a heating process of Sun but it is not required by Sun and it is considered as a disposal type of Sun light. After the formation of Earth, living species are observed on the world's surfaces and organic waste formation, will be explained later, starts with the in this time of period. As similar with every living species, monocellular are creating their own wastes and also, they dispose their waste by specific process. Monocellular doesn't have specialized organs that help to dispose or throw their waste but in contrast they have specialized organs that removed these wastes directly in the cell. This information is the first inspiration point of this study because of if the monocellular living species does their own waste management, how the complex human species can handle their waste management, this will be discussed detailed but before that other historical information will be shared. After the monoculture's evolution age, multicellular life forms have taken the stage on the world. This shows up creates different types of multicellular life forms and in the parallel variety of waste types. In early age of the world, multicellular life forms reveal two types of organically waste. One of them is that after the consumption of the nutrition, there is a biological rejection and another one is the before the consumption of the nutrition to arrange and become appropriate of nutrition. In this stage of the

study, one definition must be explained. What is the organic-biodegradable waste? In the further steps, this definition will be analyzed detailed but as a brief definition, it comes from plants, animals and humans or generally comes from multicellular in manifold forms. The waste is generated by these multicellular is in a natural waste management. This is the second inspiration point of this study. This natural waste management is consisting of different type of life cycles that provides different advantages of benefits from one to another. This must be detailed with the examples.

First example is about the terricolous, who is living earth surface. All the living species has limited life and eventually when they died and intersect with the soil, decomposers, for instance fungi and bacteria, break down the organically materials into smallest types e.g., molecules and these molecules enrich the solid. This rich solid in terms of molecules, supports to plants growing healthier. These plants provide food for other multicellular life forms and these life cycles will continue at the end of world. Second example is about the aquatic waste cycle. In this example, algae are defined as decomposers. They are using the ammonia which is the waste of nearly all type of nektons, to convert it nitrite and as a final form of nitrate. These nitrates are used by marine plants to create food for smallest nektons and the cycle will be continue. All these information shows that waste could be considered as a valuable and must be handled by collective approach. As of today, waste and waste management are inevitable problems and requires analytic approaches to understand fundamentals of problems and basis of solutions. In today's world, there are different applications to collect waste and its management. These applications are varying between continentals, countries, cities and districts because of the economical, sociological and cultural backgrounds of the areas. Additionally, non-negligible businesses and trades behind the today's waste and waste management creates obstacles to establish a collective approach between the areas. Currently, areas are named as developed, developing and non-developed by their economical, sociological and cultural backgrounds. In this study, given examples will be matched by areas and named with respect to this information.

Today's applications are generally depending on systems, production processes and efficiency. These parameters are related to applied science and this is the way to go but one thing is missing in today's applications. Generally, all these sciences are natural sciences e.g., engineering sciences, economic sciences and physical sciences. Besides from these, social sciences must be considered to create a complete system analysis with region by region. All these sciences cannot be thanked separately and they have to be applied as on the system to see

every parameter. Unfortunately, social sciences are not considering in today's world applications and there are always some lose in the system because of it. In this study, aim is to show how crucial the social sciences are in these types of applications and provide solid understanding related to waste management. Firstly, all sub-applications of social sciences are considered to analyze waste management system. Regarding to output of this considerations, where the humanity is involved in the system is observed and aftermath what type of process are related to humanity is observed. In the waste management, it could be easily found that humanity is in every step of these processes.

Besides from the economic and social analysis, waste management is one of the most important things for the public health management and in the large-scale world's health policy. This topic must be considered into two sections. If it is studied from down to top, first one will be the public health issues. Unfortunately, there is a lack of waste management system in the majority of the all countries and related to it, there are different types of disease are come out which are highly dangerous for both human life and all the other multicell. This issue shows that there is still lack of analysis to apply waste management and not to consider all living creatures because in the parallel of it, not to consider social sciences in all studies. Second one is the global warming. According to study of Shahzad (2015), because of the disposal methods Because of the disposal methods, which will be explained in detail, this is already a greatest problem in the world history. This topic will be explained detailed in the upcoming sections.

Considering all this information, it is so loud and clear that user analysis of waste management is ignored all of these applications. However, it is also so transparent that if the all these systems are perfect and provide highest efficiency why world is facing still different types of problems regarding to waste and waste management. All the systems must be user friendly and designed with the feedback from the user. Otherwise, there will be a lack of participation and following that, problematic working orders and low efficiency. In shortly, user must be considered as customer of these systems and must be satisfied according to first law of marketing. The study of Bokhari (2005) on usage and user satisfaction, supports these arguments. In the study, it can be easily seen that if the user needs meet with system objectives, then system can be considered as successful. Additionally, it is also stated that system cannot be considered only from induvial decision-making perspective, but also complete users' decision must be considered and also, combination of system quality and user satisfaction will define the individual impact and society impact. This issue can be exampled by the study of Bano and Zowghi (2015) carried by empirical findings. In this study, it is stated that there are

various factors that affect user role in the system and the spotting the user involvement depends on the level of involvement and choice of research method. And also, it is stated that there is no empirical results available at this point. Another point of view is the efficiency issue. For this perspective, study of Bano, Zowghi and Rimini (2017) shows that management strategies and the user involvement are the crucial points of sustain high level of efficiency in the system. Addition to it, evolution of the user must be observed in the course of time. In shortly, it is stated that user leads to objectives and objectives lead to system success. Lastly, feedback mechanism should be considered in the system. The starting point of this study is the user consideration and the there is no perfect system. All the systems must be developed in the course of time continuously. According to study of Wong and Tate (1994), feedback mechanism will improve the system quality and the efficiency. Advantage of this model is that there is already user involvement and it is easily to provide or get feedback from them. With this perspective, system will be more precise and characteristic and there will be a common agreed point in general.

In today's world, there are lots of different applications on waste and waste management applications. In this study, aim is to search and analyze all types of applications in the world, to extrapolate solid structure from these studies, to establish a fined basis for understanding the user behaviors and opinions in Turkey about the waste and waste management. There are some applications regarding to waste and waste management but unfortunately, level of participation and efficiency is not enough as expected. For this purpose, survey based collected data will be used to understand what type of demographic parameters are important for the participation and in what degree, they are effective in the Turkey's solid household waste management. Besides of it, to provide solid information to engineering and economical studies, what types of wastes are generated depends on the demographic parameters will be provided. This is also important to understand which type of management system is required in Turkey. For this study, it is considered that regression analysis will be a perfect method to identify above outcomes because of the type of survey questions and answers. There are binary and multi-characteristics answers. For this reason, logistic regression and multiple-linear regression models will be applied on the survey data. In the conclusion section, all outcomes will be discussed in detailed. Study of Miocic, Zekanović-Korona and Hotti (2020) shows that aim of regression analysis is designation of personal effects of individual items as predictors on overall associations. This is a unique study for Turkey and before all the model, application and analyze information, firstly, types of waste and waste history in humanity will be shared to provide clear basis. These are

needed information to understand the importance of this study and aim. In these sections, there will be examples from developed and developing countries in order to compare the type of systems and wastes.

1.1. Waste History of Humanity

As stated in the previous sections, all the human wastes were in the nature cycle before the settled life. There was only organic solid waste which are produced by humanity. This issue continues with the settled life but only one thing had changed. All these wastes had created different types of problems e.g., odor and diseases. To avoid these problems, people tried to find solutions about them. In this part of study, what humanity have evolved about waste management will be shared. According to study of Barles (2014), which is perfect study to inform about history, primitive community created dust lands to collect their waste. These lands have soft solid ground to ease the waste disposal when the rain comes. These wastes are generally human or animal disposals. They were arranged according to weather conditions and it shows that there is a system adaptation. After the primitive age, first management which could be called as a system, defined by Roman Community at 6^{th} Century BC. This system is consisting of from the drains as similar as canal network, which is laying out under the all the living spaces. These drains collect all the refuse materials and forward them to the specific area. In the Middle-Ages in Europe, these drains are updated to collect rainwater drainage water. This is also created different professions and creates new job opportunities. This is the first time that waste management provides economical benefits on its location.

In the waste history, most important turning point is the Industrial Revolution which has changed the all the aspects regarding to made of material. Until this point of time, wastes are considered as organic wastes in highly ratio but with the industrial revolution, inorganic wastes are generated with the developed technology. With increasing number of humanity needs created some solution and humanity started to process different type of material to satisfy their needs. This also triggered the collection ideas that some of the people cannot reach the all the utilities and old shoes, animal bones, used papers are collected in this time of point. This is the first time that non-organic wastes are collected in the world waste history. When the different type of wastes is created, all regions tried to establish some solutions according to their needs. This information could be detailed by few examples. In Japan, after the world war period, most of the wastes are dumped into rivers, lakes or streets with the lack of collection mechanism and this issue created both economical and health problems. Additionally, wastes are collected from

the homes manually and due to the lack of human power, desired collection is not reached. After the reorganization of this issue, Ministry of Environment in Japan has taken several solutions to prevent spread of diseases and provide a national economical benefit on public wealth. They have established an automation system that collect wastes from defined areas but in this time, they have faced a lack of participation. To overcome this issue, government has released the Public Cleaning Act in 1954. With this solution, some obligations are released for residents that increased the participation of system. It is stated that this is not only for the municipality responsibility, it is also responsibility of residents to prevent pollution in the country. Another example can be from west side of the world. According to study of Louis (2004), U.S is the country that suffering from the pollution. Especially in New York City, there is a pollution nearly ten times of the other cities. This issue has put pressure on the shoulders of federal government. They have created a sanitation services to handle this issue. But unfortunately, fragmentation between federal and municipal government is a big obstacle to establish a nation-wide system. This also shows that in this type of applications, some of the political conflicts must be put away to provide nation wide benefits. Otherwise, there will be lack of participation and efficiency which is stated above aspects. This situation also created technology problems because of each side was not sharing their know-how between them. Until the 1970s, this issue was the main reason for the several diseases and related death in U.S. After this point of time, President Johnson released nation-wide acts which includes municipal government and public health services together with the desired financial assistance. This act shows that additional to the participation, there must be a several financial assistances to support this type of systems. Last example in this topic could be from south of the world. Study of Godfrey and Oelofse (2017) could be a solid understanding of the waste management in South Africa. When the comparison held between Japan, U.S and South Africa, this country is 20-30 years behind the East and West in economical and technological wise. Instead of it, in South Africa, there is governmental legislation regarding to waste management from the date of 1989. They have released the Environmental Conservation Act in 1989 by the Department of Water Affairs and Forestry. They have outsourced the required technical guidance from the Danish Cooperation for Environment and Development. This is also proof that at some point of time, if there is a lack of know-how regarding to topic, with economical analysis, outsourcing could be a better option. Following this act, they have published Polokwane Declaration related to zero waste aim in 2001. This declaration includes every part of the society e.g., civil society, military and businesses. It can be understood that for this type of actions, all the part of society

must be considered and included in the actions. Otherwise, there will be a lose in the system. Currently, South Africa is managing their waste successfully and creating economical benefits for their countries.

1.2. Types of Waste

As stated in the previous introduction, wastes are categorized by their formation or contents of them. As in all division in life, categorization can provide easy access and control over all data and it could provide understandable outcomes when it is analyzed. Study of Yu (2010) shows that categorization plays important role in academic research studies. It must be defined in suitable and particular level. Another study from Lerner and Lomi (2018) concluded that categorization is important for sharing information because of the quality of items or substance can be evaluated easily and sharing platform can be established position by position. While discussing categorization, one topic must be stated. Besides from waste, in this study, demographic parameters which are affective on the waste management, will be discussed and it is related to sociological categorization. According to study of Vergne and Wry (2014), mutual recognition can be estimated with the proper categorization. This will be detailed in the further analysis to understand household behaviour.

According to study of Amasuomo and Baird (2016), wastes can be classified under three main titles. These titles are related to their physical states, sources and environmental impacts.

- Physical state
    - Solid waste
    - Liquid waste
    - Gaseous waste
- Source
    - Household/Domestic waste
    - Industrial waste
    - Agricultural waste
    - Commercial waste
    - Demolition and construction waste
    - Mining waste
- Environmental impact
    - Hazardous waste
    - Non-hazardous waste

These classifications can be divided into sub-titles according to level of reusable, bio degradable and type of production.

As stated in previous aspects, Turkey is considered as developing country. As of today, developing countries are facing problems to manage their waste but most importantly, there is a big problem on management of household waste. Besides from household waste, other waste types e.g., Industrial waste, agricultural waste, commercial waste, construction waste and mining waste, are being controlled under governmental laws. There are also some common international agreements and laws to manage these types of wastes. European Commission Extractive Waste Directive in 2016, could be a perfect example on this situation. Most of the countries are following these directions to handle their mining waste to avoid damaging the environment. On the contrary, there is no specific international law or agreement about the household waste. For this reason, every region is trying to handle the situation by their selves. Depends on the region, solutions can be outsourced or insource. From this point of view, this study will be focused on solid household/domestic wastes in Turkey. Before the information that how household waste management is proceeded in Turkey, there must be solid identification about the solid household waste types. The list of the solid household wastes which are defined by the Ministry of Environment and Urbanisation of Turkey, can be found at below.

- Plastic
- Metal
- Paper/Made of Paper
- Glass
- Organic Waste (kitchen stuff)
- Medical Waste
- Electronic/Electronical Waste

In this study, due to the limitations of data, environmental affects and Turkey's household waste management systems, liquid household wastes which are disposed by different services or networks, are excluded. Only solid household wastes which are listed above, will be discussed in the further parts of this study.

2. LITERATURE REVIEW

2.1. Waste Management Studies with Different Applications

According to committed literature search, no exact study is found related to neither analyze of the demographic parameters on the participation to recycling of household wastes with the usage of regression models nor analyze of the demographic parameters on generated household waste types with usage of regression models. There are quite similar studies related to household wastes, recycling and waste management with the usage of the regression models but these have different aims, details will be shared at below. Additionally, there are different studies related to user characteristics of household wastes, recycling and waste management with the usage of different models, systems and data. Beside of it, some studies have been found that they analyze the different characteristics with the usage of regression models. In this section literature search have committed according to three different topics. These are which characteristics are important in the waste management and recycling, what type of systems and applications in the world are applied and the what type of challenges or problems are faced in the application. For the first section of the research, characteristics which are related to waste management, both non-developed, developing and developed countries have analyzed. Secondly, there will be studies about the systems and different applications regarding to countries development level and finally, what type of challenges emerge in the world will be shared. Study of Han et al. (2015) is focusing on characteristics and management of domestic waste in rural areas of Tibetan. Additionally, willingness and influence factors are analyzed with help of data which is collected by questionnaire survey. Aim of study to find how many kilograms waste is generated per capita and what type of waste is generally occupy this ratio. His findings are plastics, kitchen stuff and papers because of the area's income level and geographical position. Study recommends that classification in the collection must be held on to provide profits from these types of wastes. There must be collection areas in every 800m in the region. For the effective waste management, study suggest that education and income level should be considered. Another study which is held by Karim and Nawshin (2012) focused on the characterization of household wastes and its system in Bangladesh. The study shows that household wastes are not collected in proper way and there is no real attention use the exist system properly. Research, with the help of survey study, finds that wastes are generally consist of bio-degradable and reusable wastes but because of the inefficient usage, there is no profit

both economical and health aspects. Study is giving focus on three income level which are low-income, middle income and high income. Generally, low-income level household are generating high amount of waste because of the number of people living in the one house. In this study, average calculation is used as mathematical model. Most important finding of the study is dumping period of the household wastes. Because of the irregular dumping periods and economic power of the government, is not allow the collect wastes properly. Study of Jereme et al. (2015) shows that at some point of time, unfortunately, governmental acts or laws are not enough to get sufficient usage of the waste management systems. It is stated that system and economical support are quite relevant to get enough efficiency. Furthermore, all citizens must be included when all these acts and laws are designed. Additionally, these economic issues cannot be provided from the several taxes or cannot be landed on peoples shoulders as invisible costs. This issue will create avoidance of usage. If it is used, there must be solid investigation related to waste generation for each area to define specific costs instead of fixed fee for everyone. For this investigation, all social characteristics must be searched. Because of these reasons, it frustrating to see only 5% of total waste can be collected for recycling in Malaysia. Most important outcome from this study is that educated community can provide higher participation and get responsibilities without any assignment. This study is supported by Noor (2016) which shows the situation in the developing countries. It is stated that with the number of increasing population and instead of using the recycling systems, wastes are dumped in the illegal areas and there is no initiative response from the government. The study aims that what will be the parameters for the participation of recycling system. For this aim, questionnaire survey is held between approximately 1,200 participants. Demographic parameters are defined as age, gender, type of housing, education level and number of people in same house. Analysis of collected data shows that main reasons for the less usage of the current recycling system are no proper implementation of system, absence of regular information about system usage, lack of information about profits of recycling system and a smaller number of collection bins. The study recommends that promotion could be a good solution to increase participation on established recycling system. Another study from Yoada, Chirawurah and Adongo (2014) is focusing another important point of the proper waste management and recycling which is the health aspect in Ghana. This issue is much more critical for the developing and non-developed countries because of the economic support to prevent diseases. For the study, data is collected with the questionnaire survey from 400 households and parameters are defined as income level, type of house, house properties, number of people in the house and cooking schedule in the

house. In the parallel of it, most common generated wasted is asked in the study and finally, relation between proper waste management and the diseases. Most of the participants believed that proper waste management could prevent the diseases. The study suggests that illegal areas which are used for dumbing wastes must be identified and must be blocked for the usage. Shams and Ibrahimu (2013) is focusing on the participation, economic benefits and health issues regarding to waste management and recycling processes in Tanzania. In this study, it is stated that characteristics of the wastes depends on the income level of the country and for each country there must be a specific waste management. Tanzania is considered as the one of the poorest countries in the world and generally, waste type is the food wastes or organically wastes. In Tanzania, instead of specific collection methods, people collect recyclable wastes individually to create an income opportunity. It can be easily seen that if the specific waste collection methods are defined in the country, there can be a regular job opportunity for these people. For this aspect, recycling is much more critical for the countries in the economical aspect. Additionally, collection bins are not specified for each waste type, for example, biological wastes need much more durable bins to prevent diseases or smells. With the proper system, there must be regular informative studies for the people to increase participation. Developed countries have different issues regarding to waste management and recycling. They have proceeded in the early age of their countries, generally, they are focusing on the system upgrade, environment and economical viewpoint. Study of Smol et al. (2020) shows that waste management is in consideration for many years and issue is that how waste management could be improved and included in the circular economy. The study is focusing the waste management system in Poland and reasons behind why it is under average comparing to other European countries. Outcomes prove that main reasons are the basis of the system and public knowledge about the system. Additionally, study suggests that actions must be taken by governmental with the involvement of the households. To be able to establish a sustainable system, there must be a system that satisfy all needs. For example, sharing instead of dumbing must be generalized in the public. Tonini, Albizzati and Astrup (2018) has another point of view. The study is related to environmental effects of the food wastes in food services, industries and households. Firstly, there is an illegal land use for the food wastes and this will create a control and collection problems. It can be considered as less harmless compared to other type of waste e.g., plastics, medical wastes but it has a great impact on the global warming. The collection and disposal methods of food wastes in United Kingdom releases a non-negligible harmful gas to the atmosphere. Because of this reason, some unfortunate but avoidable consequences occur. These

are global warming, toxicity and related to it cancer disease, fossil resource reduction, water reduction and aquatic effects. The study suggests that acts for covering and improvements are so crucial to establish a sustainable system. Another example of systems in the developed countries could a study of Choe and Fraser (1998). The study is focusing on the worries about the disposal of wastes without any concerns in Australia. It is stated that there are some acts, policies and charges to avoid any irregular disposal of waste but it is only achieved by the extensive model which includes every stakeholder in this process. The study also shows that how these implementations are important for the economical point of view. The studies finalized with two main outcomes. First one is the federal and municipal government needs to act together to create a proper system. Otherwise, there will be an inefficient system and the second one is that each area must be investigated differently because of the type of waste and generation. It is also stated that generally, governments tend to provide more solutions to areas which have high income level. Bassi, Christensen and Damgaard (2017), has another and so valuable aspects for the developed countries. In this study, France, Germany, United Kingdom, Italy, Greece and Poland are investigated according to their household waste type, waste management system and their environmental impacts regarding to differences they have. Generally, all these countries have benefits from their waste management system. They use recycling systems to provide energy and it creates job opportunities for the locals. According to analyzed data, France has the more recycling ratio rather than the other countries. Greece has more organic household wastes rather than the other countries and as stated in the previous studies, it creates much more damage to environmental effects because of the disposal type and carbon dioxide emission. The study is concluded that despite the high efficiency gained from the current system, there is still opportunities to improve the current system. This could be acquired by the investigation for each type of housel hold waste specifically. Besides from the characteristics and systems analysis, there some problems or obstacles in developing and non-developed countries to get desired efficiency. Jereme et al. (2015) pointed out these problems very well. Even If the governmental acts or laws are published, unfortunately, developing countries are not getting enough efficiency in current systems and in the parallel of it, they are not getting benefits both economically and socially. This study is focusing on the recycling ratio of collected wastes in Malaysia. In the study, it is sated that, only 5% of the total wastes are recycled. Additionally, study shows that there is 80% recycling possibility for the all-solid wastes. In the study, it is state that most important challenge in front of the nation-wide recycling is the awareness of the local people and ignorance of the government. Additionally,

it is stated that second important challenge against efficient mechanism is the traditional methods which areas still used. For example, collecting and burying them is in the landfill is the most un-efficient way. Another challenge is stated as cultural background of the community. Some regions have already cultural attitudes against environment, for example, environment is considered as religious and acts are getting shapes around it. Furthermore, if the comparison is held between developed countries and developing countries, environment is one of the most important differences. In developing countries, recycling is only considered in economical point of view, but in contrary, developed countries, the protection of environment is first step of healthy life. Strydom (2018) could be another example for the non-developed countries. The issue is more desperate in these countries. The study is held in Africa to understand barriers to get sufficient efficiency from the recycling systems. According to analysis of data, there are five main reasons for it. First one is that there is no enough space for recycling system. Both inside and outside of the houses, people cannot find enough space to collect their wastes separately. Secondly, time is another concern. Because of the long working hours, people don't find enough time to separate their wastes or use the recycling system. Third reason is the perception. People think that only clean materials can be recycled instead of dirty ones. This is a common mistake in both developing and non-developed countries. Another reason is the lack of knowledge. This could be considered with the third one but difference is that people don't know which materials can be recycled or how they can be recycled. Because of it, people have less responsibility about the issue. Last reason is the materials and facilities in the system. Every people in the region must have equal access to the system. If there is a inequality, areas with high usage ratios will be neutralized by areas with less usage ratio. After all these information, one question is coming to minds. Is it possible to have global waste management or recycling system? This is well answered by Singh et al. (2014) to provide solid information against this question and answer is the peeling off from the economic aspects and establish an environmental awareness. Because of the economical aspect, there will be always competition and it will be main obstacle for the global system. Instead of design for economy, there must be a design for the environment and it must be supported by policies e.g., Montreal Protocol, where the all participants are trying to prevent ozone depletion. For all these, every stakeholder must be included and interacted in all level. Literature search also have committed purposes for only Turkey. Turkey is currently considered as developing country and generally, all of the above studies related to developing countries are also valid for the Turkey. Berkun, Aras and Anılan (2011) is focusing on the solid waste management practices in Turkey. According to the

study, metropolitan cities in Turkey are managed well in terms of household wastes. It is stated that there are over thousand facilities regarding to solid waste management. But on the other hand, there is no information about the much more smaller cities in the study. It is stated that all these systems are based on the central collection method which can be called traditional and because of it gaining from the recycling is less when the comparison done with the developed countries. Additionally, it is stated that nearly all of the collected waste can be used for recycling and this advantage is unlikely became lost. As of today, in Turkey, collection of the household wastes is in responsibility of municipality. But this is not enough for the growing number of population and because of the economical obstacles, there is no sufficient services. The major problems are stated that number and size of open dumbs areas, economical support and lack of environmental awareness. In some seaside cities, sea is used as dumping area without any treatment on wastes. To overcome this issue, study suggests that systems must be updated with the today's technology and instead of central system, separated collection system must be put in place. From this point of view, different city analysis could be a support on these statements. Gündüzalp and Güven (2016) is related to capital city of Turkey. Study is focusing on the applications in Ankara and its district Çankaya which is the biggest district in Turkey. Starting point of the study is the again growing number of population and related to it, increasing number of consumption ratio. The study points out that with the increasing consumption ratio, environmental effects must be considered. Similar with the other studies, economical support is pointed out as the major problem to establish a sustainable recycling system. In this study, one different point is highlighted. In Turkey, unfortunately, there is increasing number of migrations from the rural areas to the metropolitan cities. This issue is creating unplanned waste generation and creating problems for the collection. Extrapolating from this point, population is also critical to analysis of recycling systems. To overcome these problems, study suggests that there must be an exact information for the consumers about the recycling, encouragement to use exist system, coordination between government and municipalities and involves all stakeholders in the closed loop system. Another study from Bekmezci and Cetin (2020) is related to City of Eskisehir. In this study, focusing point is the how Eskisehir is managing with their solid waste and which profits are gained from them. This example is the successful implementation. According to study, with help of its waste management, 55.000 household is supported in terms of electricity. Additionally, municipality achieves two and a half million Turkish Lira per year with the exist system. Main advantage of the system is that wastes are collected separately in the collection area and because of it so much cost reduction is gained.

Additionally, municipality have arranged too many information sessions and program to increase awareness and participation. Furthermore, Eskisher is considered as city which has one of the most sustainable waste management. Another example is related to City of Kütahya which is held by Yılmaz and Bozkurt (2010). As stated in the previous examples, economical support is the one of most inevitable problem in Turkey. This study is focusing on the system in Kütahya which is established by European Union grants. It is stated that before the establishment of this system, there is an illegal disposal on the open areas in Kütahya. This created different types of environmental effects e.g., air pollution, increasing number of disease and deterioration in natural habitats. Additionally, before the establishment of this system, disposal method was selected as incineration. This created again above problems. After establishment of the new system, collection and staring type, disposal methods was changed and recycling is used very effectively. Furthermore, this is followed by intuitional arrangement and acts. After all these improvements, as of today, Kütahya has the system that considers both public health and environment. This study is proof that if the desired economical support could be provided, high efficiency systems can be established easily in Turkey. Durmus et al. (2012) is focusing on the economic and technical points of these systems. Waste type are defined as paper, plastic, glass, metal, and organic waste for the virtual system. The study suggests that the method must be defined as all solid wastes should be collected separately in the collection areas. With the usage of this kind of system, there will be an estimated five-thousand-euro revenue per seven thousand wastes could be gained. This calculation is supported by Kemirtlek (2005) which provided the basic calculation for recycling. It is stated that If recycling amount is divided by total waste amount, recovery rate can be calculated. In this study also, supports the idea of separated collection for the household wastes. Additionally, the study highlighted that involves all of the stakeholders to provide efficient system is crucial. For this aim, printed and visual media must be used very effectively. There must be a scheduled seminar to inform all stakeholders. Lastly, providing both technical and application supports to consumers and collectors will define the progression of the system.

2.2. Waste Management Studies with Regression Applications

The The study of Noufal et al. (2020) is related to determinants of household waste in Syria. In this study, it is stated that modern solid household wastes are concern for the both national and local managers in Syria. According to governmental data, 80% of solid household

wastes were disposed on illegal areas. Aim of study is to find relation between the amount of waste and characteristics. Focusing on different income areas is the main inference from this study. There are four type of income level which is analyzed as low income, lower-middle, middle-higher and higher in this study. Multi-linear regression analysis is applied on the collected data. For this analysis independent variables are defined as household size, monthly income, education level, gender and age. Also, dependent variable is defined as waste generation per capita. Data is collected with questionnaire survey. In regression models, R square, F and t tests are used to test significance of outputs. SPSS and Microsoft Excel are used as computer delivered analysis. Handayani et al. (2018) which focuses the relation between the growing population and waste management in Indonesia. Study suggests that household waste management is so curial and must be considered as first step in nation-wide waste collection. Study used the country Family Life Survey 2014 as a master data. Multiple linear regression is applied on the master data. Independent parameters are defined as area type, gender, age, education level and participation. Dependent parameter is defined as type of waste management method. Most important findings from this study are, region and education are the major parameters for the waste characterization. Additionally, level of income is affecting household waste management positively according to study. Also, if the user age is increasing, in the parallel, participation to household waste management is improving. Another study is from Darban Astane and Hajilo (2017) about waste management in Iran. Study is generally focusing on the factors that define the type and amount of waste. Data is arranged by collection of household wastes from 318 rural houses and 11 villages. After the collection of wastes, they are classified into the main types of household wastes. For the amount calculation, kriging interpolation is used and for the type analysis, multiple-linear regression is used as well. Study outcomes shows that organic wastes are forming the approximately 90% of the household wastes. Dependent variables are defined as age, income level and assets. In this study, education level of household is not considered. This is the point that must be highlighted. Results shows that generally, high-income level in Iran is producing much more household wastes than the low-income level. Additionally, elderly people are trying to produce less household waste because of their life experience. Most important outcome is the people must have education about waste management and must be informed regularly. Similar study is held by Ezeudu, Ozoegwu and Madu (2019) to understand characterization of household wastes. The study is focusing on the Awka area in Nigeria. The data is collected specifically in that region with the help of observation method to define each day waste type in 810 households. According to

collected data, it can be seen that 73% of the total waste consists of organic type of waste and rest of its other recyclables. Study is focusing on income basis analysis as characteristic study. For this purpose, income level is divided by three as low-income level, middle-income level and high-income level and placed into multi-linear regression model. R square and t tests are used to test outputs. The study suggest that city managers must provide more sustainable data to divide possessed sources more equally. Another study from Solano et al. (2020) is related to waste management in Columbia. The study is related to identify critical areas for solid waste management. Aim of the study is to find out relation between socioeconomical parameter and region-based amount of waste. For this aim, polynomial regression model is used in the study. R square is considered to provide usability information of model. Begum et al. (2006) is focusing on the awareness of the waste management for construction companies in Malaysia. The study data is collected by survey method in those companies and random sampling method is used to focus main groups. The data is studied by binary logistics regression analysis. Independent variables are defined as category of group, degree, plan, and years of experience in the companies and the dependent variable is the level of awareness. Another study that uses the logistic regression to analyze waste management is the Julius, Charles and Mufandaedza (2017) which focuses on the desire to pay for solid waste management in Zymbabwe. In this study, independent variables are defined as education level, household size, monthly average purchasing, age and dependent variable is defined as desire to pay for solid waste management. The study highlights the R square values and odd ratios. The study is concluded that level of education and age are the important parameters to pay for solid waste management. According to the study of Grasso et al. (2019) is focusing on the food wastes reduction in developed countries and studying parameters related to food waste generation. The countries are selected as Denmark and Spain. Survey based study is handled. The collected data is analyzed by multiple-linear regression analysis. For this study, independent parameters are defined as age, gender, education, marital status, employment status, household size, shopping routines and food preparation style. The dependent parameter is the food waste amount. Outcomes shows that if the people have no job and being elderly, less food waste is generated by them. If the number of people whose living in the same place is increased, again there is a less food waste generation. Rybova (2019) has different aspects about the waste management in developed country. This study is focusing on the reasons of why Czech Republic is under the European average about the waste management processes. For this aim, instead of organizational characteristics, the study is focusing on individual characteristics. Data is specific collected

from 4897 household and analyzed by multi-linear regression analysis. This study differs from above studies because of the selection of one independent variable. Instead of income level, purchasing power of one person in household is considered. The dependent variable is selected as production of recyclable household waste. Outcomes of the study shows that household size and education is the most important parameters in this study. Fiorillo (2013), this study is focusing on the relation between the social parameters and the exists system. Main type of wastes, which are examined in the study, are glass, paper, plastic, aluminum and organic wastes. In this study, data is collected by questionary survey and Probit Regression is applied on the data sheet. Dependent variables are defined as participation of recycling system for each type of wastes and independent variables are availability of bins in the related area, active or passive membership of any environmental organizations, type of media organs that are used by participant, marital status, age, house size, education level and employment status. It can be easily seen that reason for the usage of Probit Regression instead of logistic regression is the combination of both social and demographic parameters. Study concluded that for the demographic's parameters, education level and income level are the most effective one to use different type of waste bins in Italy. Krupka, Knizkova and Kasparova (2012) is focusing Pardubice region in Czech Republic. Aim of the study is defined that it can support decision making process, cost analysis, optimization process and forecasting. The study is using multi linear regression model to identify data set related to amount of waste monthly and yearly. Stated data set is provided by special company who is responsible to collect wastes in that region. Study is focusing on the R square values to identify usability. To be able to create integrated waste management system, to provide suitable land planning and establish a common knowledge of environmental impacts or human health effects, to optimize operations in every single level or step e.g., transportation, disposal, collection etc., it is suggested that region-based analysis is so crucial.

3. MATERIALS AND METHODS

3.1. Multi-Linear, Logistic Regression

Regression analysis is a statistical application to find out relation between variables. These variables are divided into two groups. Outcome is dependent variable which is observed

and the inputs are independent variables which are collected before application. Regression analysis provides the degree of relation between independent variables and the dependent variable. First application was approached by French mathematician Adrien-Marie Legendre and German mathematician Johann Carl Friedrich Gauss with the method of least squares in 19th century. As stated in the introduction chapter, Sun is so important for the human life and these mathematicians used this method to search Sun orbits. However, the regression named was firstly nominated by English statistician Francis Galton in 19th century. Again, as stated in introduction chapter, first application was held by Galton about biological searches. Regression analysis can be used in variety of fields. Arzu and Onder (2013) is great example to show the what type of data can be used in regression analysis. In this study, it is stated that regression analysis can be used in biology, physics, medical field, chemistry and social sciences. But it also highlighted that, data and the regression type must be coherent to get acceptable results. To support this argument, Gogtay, Deshpande and Thatte (2017) can be a good example. In this study, it is stated that how crucial is correlation analysis, stated and with the regression analysis or models, real-world results can be easily seen. Additionally, regression analysis is directly related to real-life examples. All the topics which are discussed in real life can be analyzed by regression analysis. To be more precise, one example could be fine to share details. In real-life, it is assumed or discussed that if the students have better education, they have better salary in their professional life. This topic can be easily analyzed by collection of correct data that is well defined by proper sampling method and can be analyzed by regression analysis that is there a real relation between well education and salary. This example shows that collection of data is also important because it is related to define correct regression method. According to aim of this study, data collection and sampling method are well defined, will be shared in the application section. According to starting point of this study and collected data, this study is consisting of two types of regression models which are multi-linear regression and logistic regression models.

3.1.1. Multi-Linear Regression

Before the application chapter, first of all, theoretical information of these two types of regression models will be shared.

Multi-Linear Regression is used for variety of fields to analyze relation between different variables in the course of time. According to study of Barnes (1998), first multi-linear regression is told by Peter Haggett in mid of 20th century. Hagget was presenting his newly

published paper at Royal Geographical Society in Bristol and this was the time that he mentioned the multi-linear regression while studying network analysis. All investigations need details to provide more sustainable solution. When it's come to analyze relation between more than one parameter, Multi-Linear Regression provides to control more than one covariant at the same time. These covariants are named as independent variables and beside of it named as response or dependent variable. These independent variables are can be continuous, binary or categorical. A linear regression is based on mathematical equation or linear model that calculate dependent variable with the usage of set of independent or predictor variable. (Darlington 2016: 1-11)

Let y denotes the dependent (or study) variable that is linearly related to k independent (or explanatory) variables $X_1, X_2, \ldots\ldots, X_k$ through the parameters $\beta_0, \beta_1, \beta_2, \ldots\ldots, \beta_k$ and it can be written as

$$y = \beta_0 + X_1\beta_1 + X_2\beta_2 + \cdots + X_k\beta_k + \varepsilon \qquad (1)$$

This is called the multiple linear regression model. The parameters $\beta_1, \beta_2, \ldots\ldots, \beta_k$ are the regression coefficients associated with $X_1, X_2, \ldots\ldots, X_k$ respectively and ε is the random error component reflecting the difference between the observed and fitted linear relationship. There can be various reasons for such difference, e.g., the joint effect of those variables not included in the model, random factors which can not be accounted for in the model etc.

It can be note that the j^{th} regression coefficient β_j represents the expected change in y per unit change in the j^{th} independent variable X_j and assuming $E(\varepsilon) = 0$,

$$\beta_j = \frac{\partial E(y)}{\partial X_j} \qquad (2)$$

A model is said to be linear when it is linear in parameters. In such as case $\frac{\partial y}{\partial \beta_j}$ (or equivalently $\frac{\partial E(y)}{\partial \beta_j}$) should not depend on any β's. It can be exampled as follows.

- $y = \beta_0 + \beta_1 X$ is a linear model as it is linear in the parameters.

- $y = \beta_0 X^{\beta 1}$ can be written as $\log y = \log \beta_0 + \beta_1 \log X$ and $y^* = \beta_0^* + \beta_1 x^*$ which is also linear in the parameter β_0^* and β_1 but nonlinear is variables $y^* = \log y$, $x^* = \log X$. So, it is a linear model.
- $y = \beta_0 + \beta_1 X_1 + \beta_2 X^2$ is linear in parameters β_0, β_1 and β_2 bu it is nonlinear is variables X. So, it is a linear model.
- $y = \beta_0 + \left(\frac{\beta_1}{X - \beta_2}\right)$ is nonlinear in the parameters and variables both. So, it is nonlinear model.
- $y = \beta_0 + \beta_1 X^{\beta 2}$ is nonlinear in the parameters and variables both. So, it is nonlinear model.
- $y = \beta_0 + \beta_1 X_1 + \beta_2 X^2 + \beta_3 X^3$ is a cubic polynomial model which can be written as $y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$ and β_0, β_1, β_2 and β_3 is provide linear model and also $X_1 = X$, $X_2 = X^2$ and $X_3 = X^3$ provides linear model. So, it is a linear model.

After the brief information about linearity, study will continue with information about how the model set up. Let an experiment be conducted n times, and the data is obtained as Table 3.1.1.1.

Table 3.1.1.1. Establishment of Model

Observation Number	Response y	Explanatory Variables $X_1, X_2, \ldots\ldots X_k$
1	y_1	X_{11} X_{12} …….X_{1k}
2	y_2	X_{21} X_{22} …….X_{2k}
.	.	. . .
.	.	. . .
.	.	. . .
n	y_n	X_{n1} X_{n2} ……. X_{nk}

Accoridng to Olive (2017), assuming that the model is similar with the equation (1). The n times observations will create n number of equations as below table.

Table 3.1.1.2. Number of Equations

$$y_1 = \beta_0 + X_{11}\beta_1 + X_{12}\beta_2 + \cdots + X_{1k}\beta_k + \varepsilon_1$$
$$y_2 = \beta_0 + X_{21}\beta_1 + X_{22}\beta_2 + \cdots + X_{2k}\beta_k + \varepsilon_2$$
$$\vdots$$
$$y_n = \beta_0 + X_{n1}\beta_1 + X_{n2}\beta_2 + \cdots + X_{nk}\beta_k + \varepsilon_n$$

According to above number of equations, these can be written as in matrix form and it will create the below equations where y is stated sa n x 1 vecor of n observations on variable, X is stated as n x k matrix of n observations on each of the k explanatory variables, β is stated as k x 1 vector of regression coefficients and ε is stated as n x 1 vector of random error components or disturbance term.

$$\begin{pmatrix} y_1 \\ \vdots \\ y_n \end{pmatrix} = \begin{pmatrix} 1 & \cdots & X_{1k} \\ \vdots & \ddots & \vdots \\ 1 & \cdots & X_{nk} \end{pmatrix} \begin{pmatrix} \beta_0 \\ \vdots \\ \beta_k \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \vdots \\ \varepsilon_n \end{pmatrix} \quad (3)$$

$$y = X\beta + \varepsilon \quad (4)$$

In this vectoral form, "n" is stated as observation number and depends on the data set which is created according to experiment, survey etc. Also, Y_n is the dependent parameter matrix, $X_{n,\,k}$ is the model or independent matrix, β_k is the weight matrix and lastly, ε_n is the error matrix. In here, aim is to compare more than one group vectors. According to Balibeyoğlu (1989), multiple analysis of variance changes can be provided with the variance and covariance distribution which must be homogenous as well. Based on the above equation, each independent variable has weight contant "β" which is called as regression slope which provides the information that how much equation is using the independent variables to calculate dependent variables.

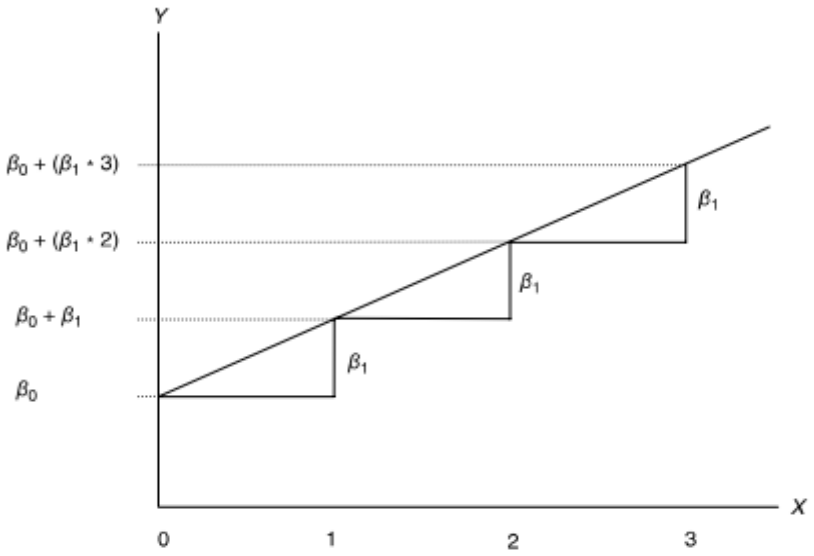


Figure 3.1.1.1. The weight of the equation

Source: Gordon, 2015: 107

According to Fahrmeir et al. (2013: 73-77), some assumptions are needed in the model $y = X\beta + \varepsilon$ for drawing the statistical inferences. These can be found at below.

- $E(\varepsilon) = 0$
- $E(\varepsilon\varepsilon') = \sigma^2 I_n$
- $\text{Rank}(X) = k$
- X is a non-stochastic matrix
- $\varepsilon \sim N(0, \sigma^2 I_n)$

These assumptions are used to study the statistical properties of the estimator of regression coefficients. The following assumption is required to study, particularly the large sample properties of the estimators.

- $\lim_{n\to\infty}((X'X)/n) = \Delta$ exists and is a non-stochastic and nonsingular matrix (with finite elements). The explanatory variables can also be stochastic in some cases. It can be assumed that X is non-stochastic unless stated separately.

A general procedure for the estimation of regression coefficient vector is minimization with the suitable chosen function. For this study, the principle of least square which is related to $M(X) = X^2$ and method of maximum likelihood estimation for the estimation of parameters. For

the ordinary least squares, let the B be the set of all possible vectors of β and if there is no further information, the B is k-dimensional real space. The object is to find a vector b' = ($b_1, b_2, ...b_k$) from B that minimizes the sum of squared deviations of ε_i's.

$$S(\beta) = \sum_{i=1}^{n} \varepsilon_i^2 = \varepsilon'\varepsilon = (y - X\beta)'(y - X\beta) \quad (5)$$

For given y and X, a minimum will always exist as S(β) is a real-valued, convex and differentiable function. Differentiate S(β) with respect to β following equation will be obtained as ordinary least square estimator.

$$X'Xb = X'y \quad (6)$$

$$b = (X'X)^{-1}X'y \quad (7)$$

The estimation error of b is can be found at combination of below equations 8 and 9 as equation 10.

$$b - \beta = (X'X)^{-1}X'y - \beta \quad (8)$$

$$y = X\beta + \varepsilon \quad (9)$$

$$\varepsilon = \frac{b-\beta}{(X'X)^{-1}X'} \quad (10)$$

Since X is assumed to be nonstochastic and E (ε) = 0, following reault will be obtained which shows the unbiased estimator of β.

$$E(b - \beta) = (X'X)^{-1}X'E(\varepsilon) = 0 \quad (11)$$

The covariance matrix of b is can be found as below equation.

$$V(b) = E(b - \beta)(b - \beta)' \quad (12)$$

$$V(b) = \sigma^2(X'X)^{-1} \quad (13)$$

From this point of view, variance of b can be obtained as the sum of variance of all $b_1, b_2, \ldots b_k$. It can be found at equation 14.

$$V(b) = \sum Var(b_i) \tag{14}$$

Estimation of σ^2 can not be obtained with the least square criterion because of it does not appear in S(β). Since E (ε_i^2) = σ^2, so it can be attempted with residuals e_i to estimate σ^2 which is model independent estimator.

$$e = y - y' \tag{15}$$

$$Residual\ Sum\ of\ Squares = \sum_{i=1}^{n} e_i^2 \tag{16}$$

$$Mean\ Sum\ of\ Squares = Residual\ Sum\ of\ Squares\ /\ (n-k) = \frac{\sum_{i=1}^{n} e_i^2}{n-k} \tag{17}$$

$$\sigma^2 = Mean\ Sum\ of\ Squares \tag{18}$$

In the model y = Xβ + ε, it is assumed that the errors are normally and independently distributed with constant variance σ^2, and the likelihood function is the joint density of $\varepsilon_1, \varepsilon_2 \ldots, \varepsilon_n$ can be found as below.

$$L(\beta, \sigma^2) = \prod_{i=1}^{n} f(\varepsilon_i) \tag{19}$$

Comparing with least square and maximum likelihood, below statements can be found.

- β are same and unbiased estimator.
- σ^2 is a biased estimator.

Generally, it is hard to compare the regression weights because of the magnitude that reflects units of measurement. Usually, it is good to study with scaled explanatory variables and study variable that provide dimensionless regression weights. There two options to use for this issue. Both unit normal scaling and unit length scaling can be used as well.

For the coefficient of determination, let be R the multiple correlation coefficient between y, and X_1, X_2 and X_k and square multiple correlation coefficient R^2 is called a coefficient of determination. The value of R^2 commonly describes how well the sample regression line fits the observed data. This is also described as a measure of goodness of fit of the model.

Assumption is the interception term is present in the model then following equations are defined.

$$R^2 = 1 - \frac{e'e}{\sum_{i=1}^{n}(y_i - y')^2} \tag{19}$$

$$R^2 = 1 - \frac{Sum\ of\ Squares\ due\ to\ residuals}{total\ sum\ of\ squares} \tag{20}$$

$$R^2 = \frac{Sum\ of\ Squares\ due\ to\ regression}{total\ sum\ of\ squares} \tag{21}$$

R^2 measures the explanatory power of the model, which in turn reflects the goodness of fit on the model. It reflects the model adequancy in the sense of how much is the explanatory power of the explanatory variables. The limits of R^2 are 0 and 1.

- $R^2 = 0$ indicates that poorest fit of the model
- $R^2 = 1$ indicates that best fit of the model
- For example, $R^2 = 0.80$ which means that 80% of the variation in y is explained by R^2. Or simply, model is 80% fine to fit-adequancy of model.

If the more independent variables are included into model, R^2 will be increased. In case the variables are irrelevant then R^2 will be increased again and provide optimistic picture. For these purposes, adjusted R^2 will be used for the correction. Adjusted R^2 can be formulized as belows which (n-k) and (n-1) shows the degree of freedom that associated.

$$AdjR^2 = 1 - \frac{sum\ of\ squares\ due\ to\ residuals/(n-k)}{total\ sum\ of\ squares/(n-1)} \tag{22}$$

$$AdjR^2 = 1 - \frac{(n-1)}{(n-k)}\ (1 - R^2) \tag{23}$$

Adjusted R^2 will decline if the addition of extra variables that produces too small a reduction. Additionaly, instead of R^2 limitations, adjusted R^2 can be negative value. There are several limitations for the R^2 which can be found at below.

- If the constant term is absent in the model, then R^2 can not be defined. In such cases, R^2 can be negative.
- R^2 is sensitive to extreme values, so R^2 lacks robustness.
- R^2 is always increase with the incremental of number of explanatory variables.
- R^2 is only valid in linear models because of the intercept term of the model.

Additionaly, all these independent variables can be inter-related to each other so that control of the all these independent variables are so important to get correct solution. The opposite way around, these independent variables can be interacting with each other and again controlling of them could have high importancy. And finally, as similar with all type of studies in the scientific areas, assumptions must be applied to model to define the limit of studies.

3.1.2. Logistic Regression

Logistic regression is used for binary situations. As it can be understood from here, dependent variables are binary which means that there are only two solutions also called as dischotomous. In logistic regression model, there is a usage of logarithm of the odds. According to Cramer (2002), logistic regression is firstly used in 19th century for the analysis of growing population and chemicals. First paper was published by Quetelet in 1838 realted to correspondence mathematic and physics but it was not named as logistic regression. After that, second paper was published by Verhulst in 1845 at Belgian Royal Academy and this is the first time that logistic regression name was used. Vehulst was a mathematician but also has attention to social and political topics. From this point of view, it can be said that, logistic regression was firstly used for the social analysis.

In logistic regression, independent variables are designated as 1 or 0. Difference from the other applications, instead of calculating these values, model is calculated for getting probabilities which effect taking these two conditions. As stated in the previous part, logistic regression is generally related to logit which is natural log of the odds and can be expressed as below. According to Szumilas (2010), Odds Ratio is used to calculate relation between input and output, additionaly, it is used for controlling of actions. If Odds Ratio is greater than 1, it means that higher relation with outcomes and If Odds Ratio is less than 1, it means that less realtion with outcomes.

$$odds = \frac{p}{1-p} \tag{24a}$$

$$ln(odds) = \ln\left(\frac{p}{1-p}\right) \tag{24b}$$

Logistic regression can be derived from simple linear regression. In the linear regression model Xβ + ε, there are two types of variables which are explanatory and study. These variables can be measured on a continuous scale as well as like indicator variable. When the explanatory variables are qualitative, then their values are expressed as indicator variable and then dummy variables are used. When these qualitative variables take only two possible values. In these circumtances logistic regression can be used.

$$y_i = \beta_0 + X_{i1}\beta_1 + X_{i2}\beta_2 + \cdots + X_{ik}\beta_k + \varepsilon_i \tag{25}$$

According to above equation, y_i is equal to 0 or 1 in this situation. Assume that y_i follows a Bernolli distribution with a parameter π_i, so probability distribution will be as below.

$$y_i = \begin{cases} 1 \; with \; P(y_i = 1) = \pi_i \\ 0 \; with \; P(y_i = 0) = 1 - \pi_i \end{cases} \tag{26}$$

It can be assumed that $E(\varepsilon_i) = 0$ and according to model $y = x\beta + \varepsilon$, below equation will be obtained which means response function is simply the probability that $y_i = 1$.

$$E(y_i) = P(y_i = 1) \tag{27}$$

Additionaly, model can be written as $\varepsilon_i = y_i - x_i\beta$ and according to binary results, y_i can be 1 or 0. From this point of study, error can be written as below.

$$\varepsilon_i = \begin{cases} y_i = 1, & 1 - x_i\beta \\ y_i = 0, & -x_i\beta \end{cases} \tag{28}$$

Normally, it was assumed that errors have normal distribution but as it can be seen from equation 28, errors can take only two values and cannot be assumed as normal distribution.

Generally, the errors are homoscedastic which means $Var(\varepsilon_i) = \sigma^2$ and so $Var(y_i) = \sigma^2$. Thus $Var(y_i)$ depends on y_i and is a function of mena y_i. However, since $E(y_i) = \pi_i$ and π_i is the probability so that it can take value between 0 and 1, with the parallel of it, $E(y_i)$ can take value between 0 and 1.

When y is a dichotomous variable, then empirical pieces of evidence suggest that the function E(y) on the whole real line that can be mapped as nonlinear S shape as it can be seen in Figure 3.1.2.1. with the interval [0,1].

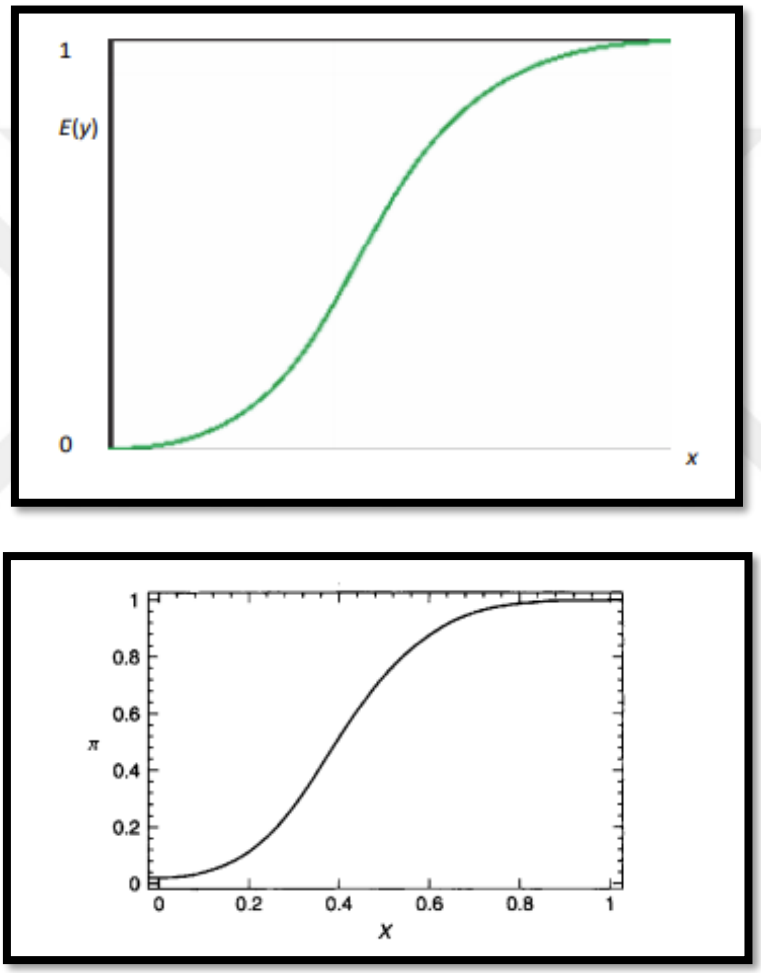


Figure 3.1.2.1. Response Functions

Source: Samprit, 2012: 337

E(y) would be the cumulative distribution function of a random variable. In particular, the logistic distribution, whose cumulative distribution function is the simplified logistic function yields a good link as stated in below.

$$E(y) = \frac{\exp(y)}{1 + \exp\,(y)} \tag{29a}$$

$$E(y) = \frac{\exp(x'\beta)}{1 + \exp\,(x'\beta)} \tag{29b}$$

$$E(y) = \frac{1}{1 + \exp\,(-x'\beta)} \tag{29c}$$

Generally, linear models based on the normally distributed study variable and there is a link that called as identity link. In the logistic regression, the link function is defined as below. As it can be seen here, it is similar with odds ratio formula given in the equations 24 and μ is named as log-odds.

$$e^{-\mu} = \frac{1 - \pi}{\pi} \tag{30a}$$

$$\mu = \ln \frac{\pi}{1 - \pi} \tag{30b}$$

Just a brief information that can be usefull for further studies that there are other functions also which have the same shape as of logistic function. These functions can also be transformed through π . There are two such popular functions which probit transformation and complementary log-log transformation. The probit transformation is based on the transformation of π using the cumulative distribution function of normal distribution and based on this is the probit regression model. For the logistic regression, $y_i = E(y_i) + \varepsilon_i$ is considered as general form of the model where y_i is the independent Bernoulli random variable with parameter π_i which $E(y_i) = \pi$.

3.1.3. Data and Analyze Tool

This study aims that calculation of how the participation of waste management is related to demographic information and how this demographic information is related to produced most common waste type. With the lights of survey studies, it is found out that defining parameters for the model is most important point. For the qualitative data collection is studied by survey-based study which is held between 436 participants. The qualitative method is best for the explain experiences and feelings. It can provide a solid knowledge while the data collection process. This method can include interviews, observations and reports. In this study, survey is choosen as collection method. According to Metin (2015), applied method is defined as online but with the help of this method, study could be reached more participant in today's world. However, question types are defined as mixed of closed-ended and classification based. With the light of literature survey and areas-based experiences, questions are well analyzed to provide solid information about sub-problems and parameters with the parallel of study aim. According to Tan (2009), for some of the studies, it is not possible to apply mathematical or statistical operation and because of it is not possible to get significant outcomes. To be able to prevent this type of issue there must be a scaling method to provide information that how the outcomes are getting significant. This is also defined as a tool that uses for reduction ratio. In this study, scaling method defined as snowball method that provides infrastructure to reach from person to person or person to common situation and the study sample is growing with similar of snowball action. When the data content is reached to desired point, it is finalized. Study of Patton (2005) has great information about snowball method. In the study, it is stated that this method is a supporting application to reach technical information that will be used for critical situation and non-defined or random participants. According to the above information, in the survey, to describe independent variables, questions are defined as below.

- Age
- Marital Status
- Education Level
- Number of people in same household
- Profession
- Income Level

According to aim of the study below two questions are asked to participants to analyze

one of them with Multi Linear Regression and another one with Logistic Regression. These questions are defined to get response for the dependent variables.

- Most common produced household waste type with its quantity
- Participation, If the proper waste management system is established

For the first question, it is asked most common waste type which is produced in household. This question will be analyzed by Multi Linear Regression. For the second question, it is asked participation in binary reponse yes or no. This question will be analyzed by Logistic Regression.

As it can be seen in the independent variables list which is collected by survey study, there are some categorical variables which can creates variation in results if they are not arranged for the computer analysis. To be able to avoid this issue, generally, dummy variables are used in the multi linear regression. Multiple regression provides evaluation whether a continuous dependent variable is a linear function of two or more independent variables. When one or more of the independent variables is a categorical variable, the most common method of properly including them in the model is to code them as dummy variables. Dummy variables are dichotomous variables coded as 1 to indicate the presence of some attribute and as 0 to indicate the absence of that attribute. When there is no obvious order to the categories or when there are three or more categories and differences between them are not all assumed to be equal, such variables need to be coded as dummy variables for inclusion into a regression model. The number of dummy variables which will be needed to capture a categorical variable will be one less than the number of categories beacuase of the one less than the number of categories because the last one would be perfectly predicted by the others.

$$y_i = \beta_0 + \beta_2 D_i + X_i \beta_1 + \varepsilon \tag{31}$$

According to equation 31, D is the dummy independent variable and X is the continuous independent variable. As stated in the above, dummy variable can take two vlues which are 0 and 1 so that equation 31 will be transformed as into below which the D= 0 is the base group.

$$If\ D = 0\ , y_i = \beta_0 + X_i \beta_1 + \varepsilon \tag{32a}$$

$$If\ D = 1\ ,\ y_i = \beta_0 + \beta_2 + X_i\beta_1 + \varepsilon \quad (32b)$$

- Any categorical variable can be turned into a set of dummy variables.
- Because the base group is represented by the intercept, if there are n categories there should be n – 1 dummy variables.
- If there are a lot of categories, it may make sense to group some together.
- y_i individual values of the dependent variable
- X_i individual values of the continuous independent variable
- D_i individual values of the dummy independent variable
- β_0 the intercept, or constant, associated with the regression line
- β_1 the coefficient operating on the continuous independent variable
- β_2 the coefficient operating on the dummy independent variable
- ε the unmodeled random, or stochastic, component of the dependent variable and often called the error term or the residual of the model.

Generally, the usage of least square to estimate values for β_0, β_1, and β_2 is still valid and the coefficients β_1 and β_2 are often called partial slope coefficients, or partial regression coefficients, because they represent the unique independent effect of the corresponding independent variable on the dependent variable after accounting or controlling the effects of the other independent variables in the model. Equation 33 can be used to estimate the coefficient operating on the first independent variable. The same equation can be altered to estimate as well.

$$Estimated\ Value\ of\ the\ Coefficient\ Operating\ on\ Xi =$$

$$\frac{\sum(x_i)(y_i) \times \sum(d_i)^2 - \sum(d_i)(y_i) \times \sum(x_i)(d_i)}{\sum(x_i^2) \times \sum d_i^2 - \sum(x_i)(d_i)^2} \quad (33)$$

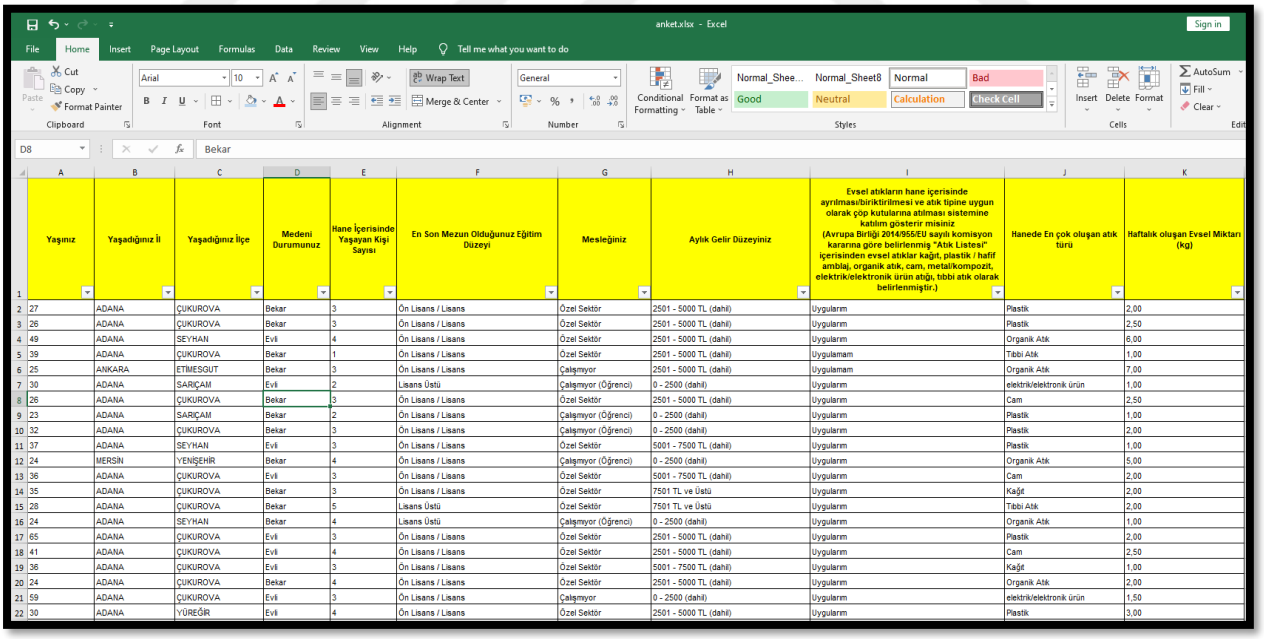
Where $d_i = D_i - D'$ and D is the the sample mean of the dummy independent variable.

Finally, if you have a categorical variable with more than two categories, you would construct a dummy variable for each of those categories except one and include all of those dummy variables in the regression and all assumptions are still valid with this application.

- The dependent variable is a linear function of the independent variables.
- Values of the independent variables are fixed in repeated samples, most critical here is that the independent variables are not correlated with the residual.
- The expected mean of the residual equals zero.
- The variance of the residual is constant.
- The individual residuals are independent of each other.
- The residuals are distributed normally.
- There is no perfect collinearity among the independent variables.

All of the above information will be used in the analysis section with the support of computer-based program. For this issue, SPSS program will be used. Before the results & discussion chapter, how the SPSS program can be arranging well to get proper results, will be explained.

First of all, data arrangement can be done via any program. For instance, Microsoft Excel can be used to transfer data from survey study. Figure 3.1.3.1. shows how collected information is listed in Excel file.



Yaşınız	Yaşadığınız İl	Yaşadığınız İlçe	Medeni Durumunuz	Hane İçerisinde Yaşayan Kişi Sayısı	En Son Mezun Olduğunuz Eğitim Düzeyi	Mesleğiniz	Aylık Gelir Düzeyiniz	Evsel atıkların hane içerisinde ayrılması/biriktirilmesi ve atık tipine uygun olarak çöp kutularına atılması sistemine katılım gösterir misiniz (Avrupa Birliği 2014/955/EU sayılı komisyon kararına göre belirlenmiş "Atık Listesi" içerisinden evsel atıklar kağıt, plastik / hafif ambalaj, organik atık, cam, metal/kompozit, elektrik/elektronik ürün atığı, tıbbi atık olarak belirlenmiştir.)	Hanede En çok oluşan atık türü	Haftalık oluşan Evsel Miktarı (kg)
27	ADANA	ÇUKUROVA	Bekar	3	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygularım	Plastik	2,00
26	ADANA	ÇUKUROVA	Bekar	3	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygularım	Plastik	2,50
49	ADANA	SEYHAN	Evli	4	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygularım	Organik Atık	6,00
39	ADANA	ÇUKUROVA	Bekar	1	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygulamam	Tıbbi Atık	1,00
25	ANKARA	ETİMESGUT	Bekar	3	Ön Lisans / Lisans	Çalışmıyor	2501 - 5000 TL (dahil)	Uygulamam	Organik Atık	7,00
30	ADANA	SARIÇAM	Evli	2	Lisans Üstü	Çalışmıyor (Öğrenci)	0 - 2500 (dahil)	Uygularım	elektrik/elektronik ürün	1,00
26	ADANA	ÇUKUROVA	Bekar	3	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygularım	Cam	2,50
23	ADANA	SARIÇAM	Bekar	2	Ön Lisans / Lisans	Çalışmıyor (Öğrenci)	0 - 2500 (dahil)	Uygularım	Plastik	1,00
32	ADANA	ÇUKUROVA	Bekar	3	Ön Lisans / Lisans	Çalışmıyor (Öğrenci)	0 - 2500 (dahil)	Uygularım	Plastik	2,00
37	ADANA	SEYHAN	Evli	3	Ön Lisans / Lisans	Özel Sektör	5001 - 7500 TL (dahil)	Uygularım	Plastik	1,00
24	MERSİN	YENİŞEHİR	Bekar	4	Ön Lisans / Lisans	Çalışmıyor (Öğrenci)	0 - 2500 (dahil)	Uygularım	Organik Atık	5,00
36	ADANA	ÇUKUROVA	Evli	3	Ön Lisans / Lisans	Özel Sektör	5001 - 7500 TL (dahil)	Uygularım	Cam	2,00
35	ADANA	ÇUKUROVA	Bekar	3	Ön Lisans / Lisans	Özel Sektör	7501 TL ve Üstü	Uygularım	Kağıt	2,00
28	ADANA	ÇUKUROVA	Bekar	5	Lisans Üstü	Özel Sektör	7501 TL ve Üstü	Uygularım	Tıbbi Atık	2,00
24	ADANA	SEYHAN	Bekar	4	Lisans Üstü	Çalışmıyor (Öğrenci)	0 - 2500 (dahil)	Uygularım	Organik Atık	1,00
65	ADANA	ÇUKUROVA	Evli	3	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygularım	Plastik	2,00
41	ADANA	ÇUKUROVA	Evli	4	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygularım	Cam	2,50
36	ADANA	ÇUKUROVA	Evli	3	Ön Lisans / Lisans	Özel Sektör	5001 - 7500 TL (dahil)	Uygularım	Kağıt	1,00
24	ADANA	ÇUKUROVA	Bekar	4	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygularım	Organik Atık	2,00
59	ADANA	ÇUKUROVA	Evli	3	Ön Lisans / Lisans	Çalışmıyor	0 - 2500 (dahil)	Uygularım	elektrik/elektronik ürün	1,50
30	ADANA	YÜREĞİR	Evli	4	Ön Lisans / Lisans	Özel Sektör	2501 - 5000 TL (dahil)	Uygularım	Plastik	3,00

Figure 3.1.3.1. Transfering survey data to Excel file

Secondly, all the independent and dependent variables will be defined in SPSS program as Figure3.1.3.2. In type section, it can be defined according to data as date, currency or numeric. In width section, how many characters a value can hold, will be defined. Most

important sections are label and measure. For the label section, the name and the label of your variables in SPSS Program serve the same basic purpose, they are descriptors that identify the variable. The difference is that the name is the short identifier and the label is the long one. You need one of each because some output formats work fine with a long identifier and other formats need the short form. In the measure section, there is a measurement level in all statistical anaylsis. It is also valid in SPSS program. There are three options in the SPSS program which are nominal, ordinal and scale. For the nominal, a variable can be treated as nominal when its values represent categories with no intrinsic ranking. For example, the department of the company in which an employee works. Examples of nominal variables include region, zip code, or gender of individual or religious affiliation. For the ordinal, A variable can be treated as ordinal when its values represent categories with some intrinsic ranking. For example, levels of service satisfaction from highly dissatisfied to highly satisfied. Examples of ordinal variables include a degree of satisfaction among the consumers, preference degree from very high to very low, and degree of concern towards the certain issue. Generally, it is preferable to assign numeric codes to represent the degree of something among respondents. For example, 1=highly satisfied, 2=satisfied, 3= neutral, 4= dissatisfied, 5= highly dissatisfied. For the scale, A variable can be treated as scale when its values represent ordered categories with a meaningful metric, so that distance comparisons between values are appropriate. Examples of scale variables include age in years, and income in thousands of liras, or score of a student in exam.

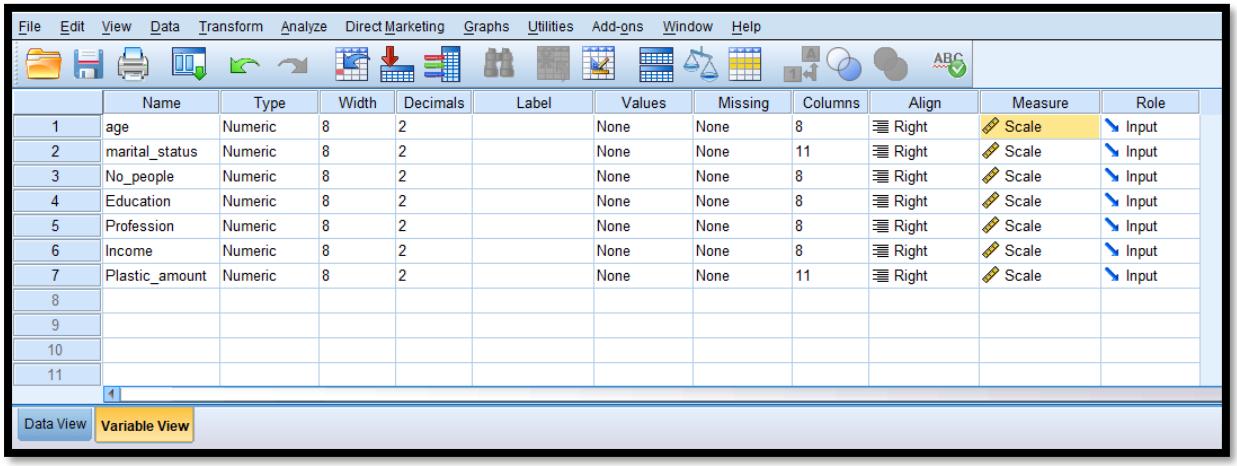


Figure 3.1.3.2. SPSS Variable View

Thirdly, data can be transferred to SPSS via file section. From value-label section, it can be seen as value or label at Figure 3.1.3.3.

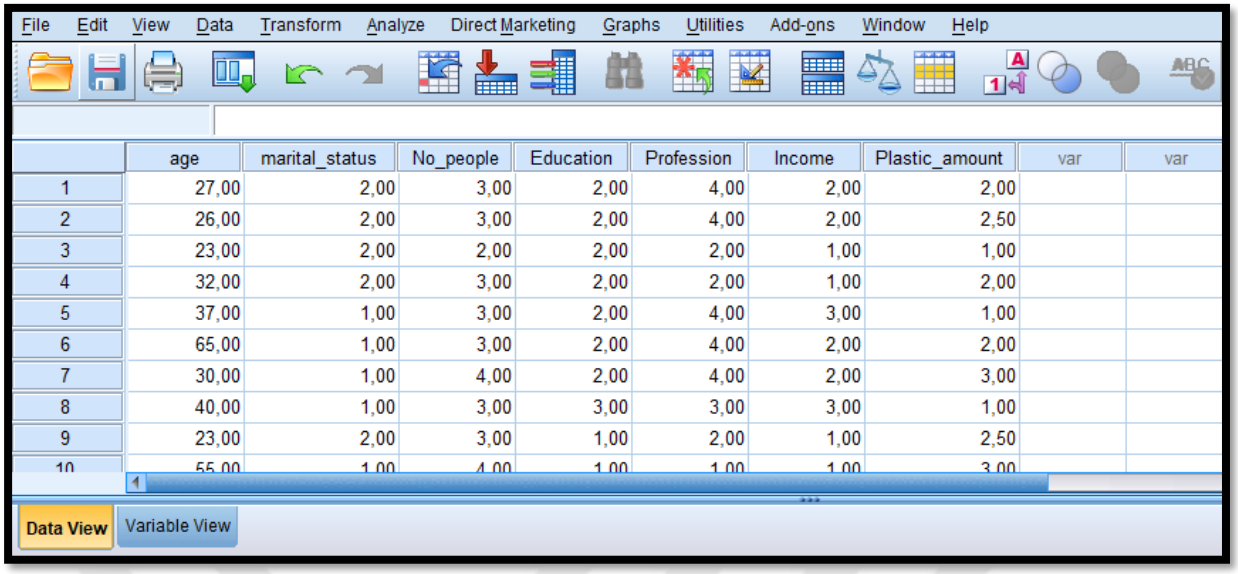


Figure 3.1.3.3. SPSS Data View

Additionaly, if the variables are categorical, it is must that dummy variables will be added into data. For this issue, below steps can be followed. In the transform section which is in the headline, recode into different variables section will be selected.

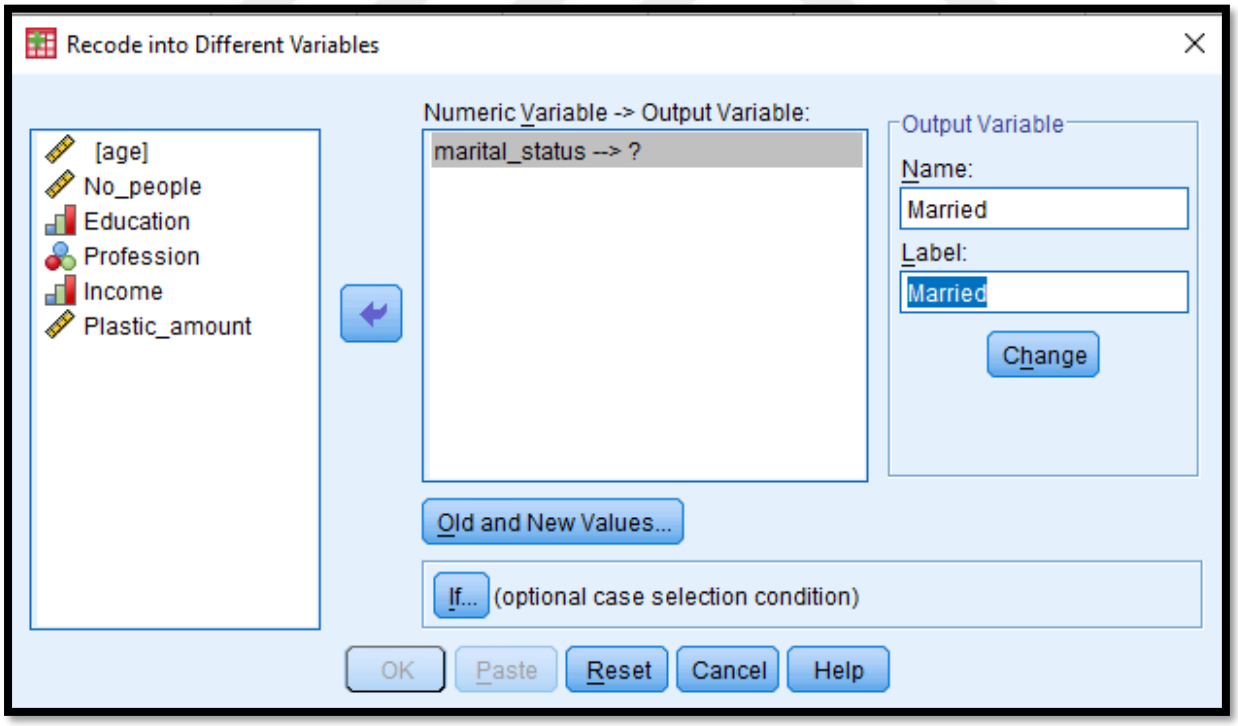


Figure 3.1.3.4. Dummy Variable Labeling

When the labeling is done, according to first labeling coding, new dummy coding can be arranged as it can be seen in Figure 3.1.3.5.

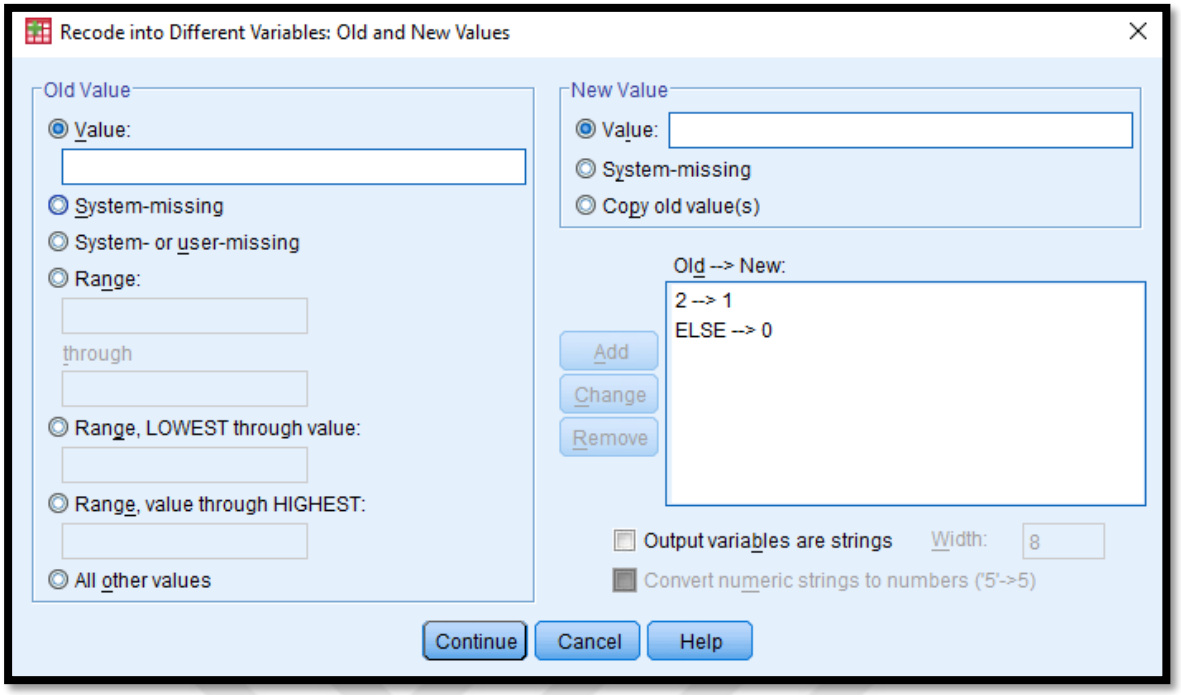


Figure 3.1.3.5. Dummy Variable Coding

All the dummy coding will be appeared in the data view page as their coding number. As it can be seen Figure 3.1.3.6, each categorical variable will have a dummy variable. In theoretical model, it is said that n-1 dummy can be used but there is no mathematical problem to create each dummy for each categorical variable but in the analysis section n-1 number of them will be used according to reference point.

age	marital_status	No_people	Education	Profession	Income	Plastic_amount	Married	Single	High_school	Bachelor
27,00	2,00	3,00	2,00	4,00	2,00	2,00	,0	1,00	,0	1,00
26,00	2,00	3,00	2,00	4,00	2,00	2,50	,0	1,00	,0	1,00
23,00	2,00	2,00	2,00	2,00	1,00	1,00	,0	1,00	,0	1,00
32,00	2,00	3,00	2,00	2,00	1,00	2,00	,0	1,00	,0	1,00
37,00	1,00	3,00	2,00	4,00	3,00	1,00	1,00	,0	,0	1,00
65,00	1,00	3,00	2,00	4,00	2,00	2,00	1,00	,0	,0	1,00
30,00	1,00	4,00	2,00	4,00	2,00	3,00	1,00	,0	,0	1,00
40,00	1,00	3,00	3,00	3,00	3,00	1,00	1,00	,0	,0	,0
23,00	2,00	3,00	1,00	2,00	1,00	2,50	,0	1,00	1,00	,0
55,00	1,00	4,00	1,00	1,00	1,00	3,00	1,00	,0	1,00	,0
39,00	1,00	3,00	2,00	4,00	2,00	1,00	1,00	,0	,0	1,00
41,00	1,00	4,00	1,00	4,00	2,00	1,50	1,00	,0	1,00	,0
25,00	2,00	1,00	3,00	4,00	3,00	1,00	,0	1,00	,0	,0
24,00	2,00	4,00	2,00	4,00	2,00	1,00	,0	1,00	,0	1,00
32,00	2,00	1,00	2,00	3,00	3,00	1,00	,0	1,00	,0	1,00
33,00	1,00	2,00	2,00	4,00	3,00	1,00	1,00	,0	,0	1,00
28,00	2,00	3,00	2,00	4,00	3,00	2,50	,0	1,00	,0	1,00
27,00	2,00	2,00	2,00	4,00	2,00	1,00	,0	1,00	,0	1,00
20,00	2,00	2,00	1,00	2,00	1,00	1,00	,0	1,00	1,00	,0

Figure 3.1.3.6. Dummy Variables

In the SPSS program, Multi-Linear Regression Analysis can be done via below steps. It can also be seen in the Figure 3.1.3.7.

- Analyze
- Regression
- Linear Regression

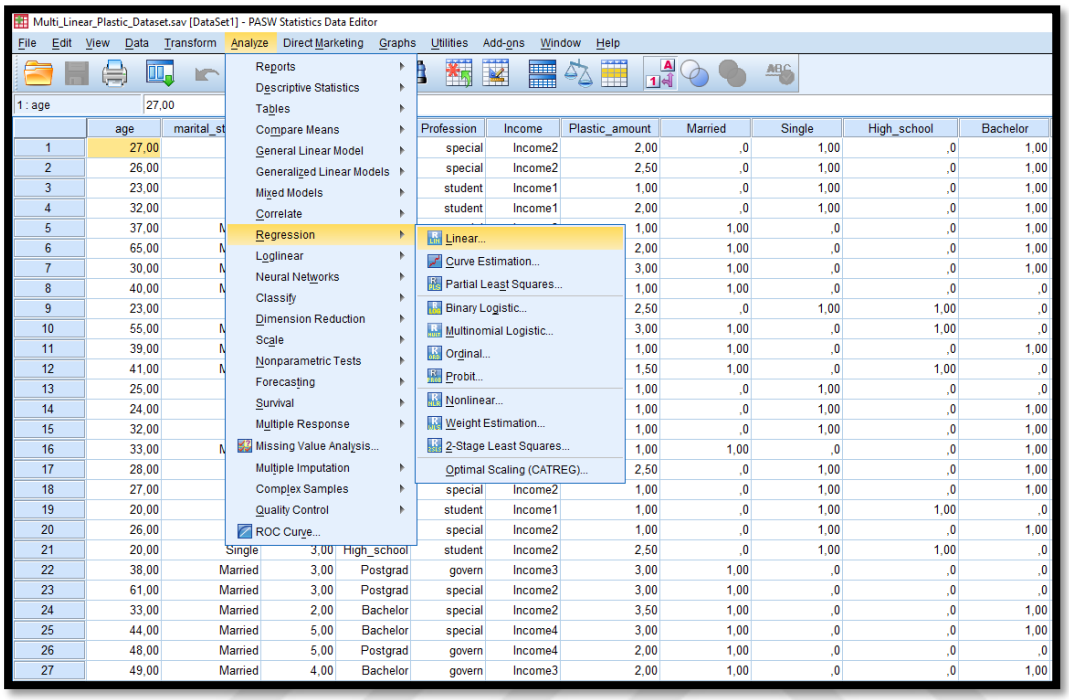


Figure 3.1.3.7. Multi-Linear Regression

After the enterence of multi-linear regression page, it is so important to arrange variables as dependent and independent. As it is mentioned in the previous statements, creating dummy variables is so curicial at this point of analysis. Otherwise, correlation in the model will be provided as miss or wrong information. After the arrangement of dummy variables for each categorical variable, as it can be seen in Figure 3.1.3.8, firstly, dependent variable will be selected. After that according to reference category, each dummy variable will be selected as independent variable. In here, most important thing is that defining reference category. Reason for this, there will be usage of n-1 dummy variables for each category. It is also important that measurement of each dummy variable must be arranged before the analysis as nominal, ordinal or scale.

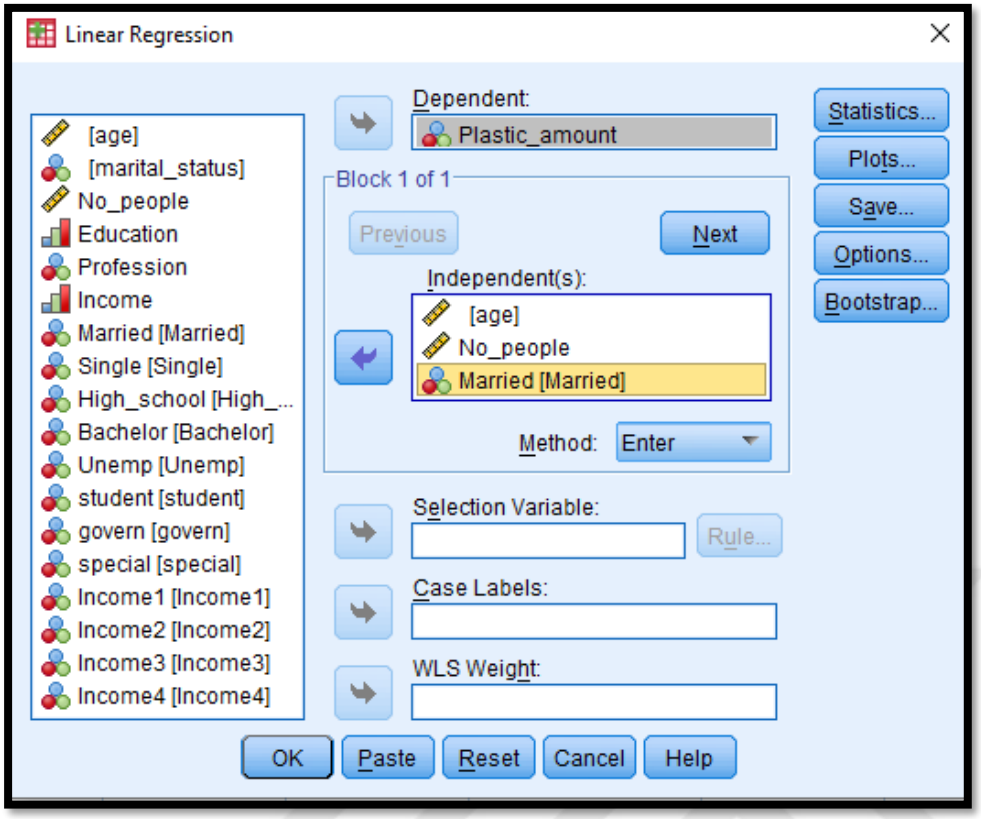


Figure 3.1.3.8. Multi-Linear Regression Variable

For the logistic regression below steps can be followed. From Analyze section, regression segment and binary logistic can be selected.

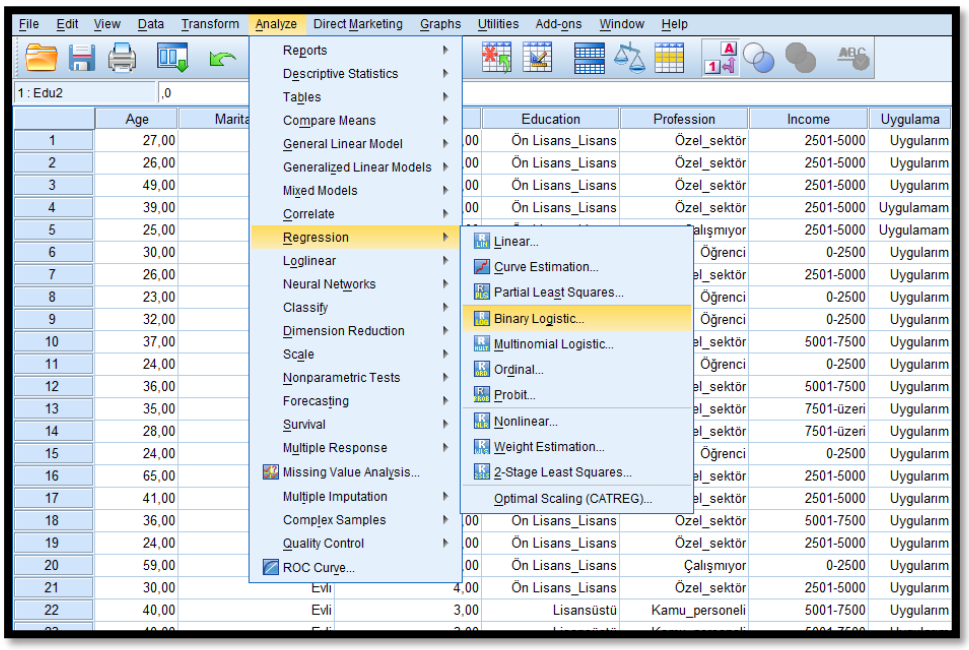


Figure 3.1.3.9. Logistic Regression

According to study data, dependent and independent variables are selected. There is no need to create dummy variable because of there is an option to select categorical variables as it can be seen from Figure 3.1.3.10 and Figure 3.1.3.11

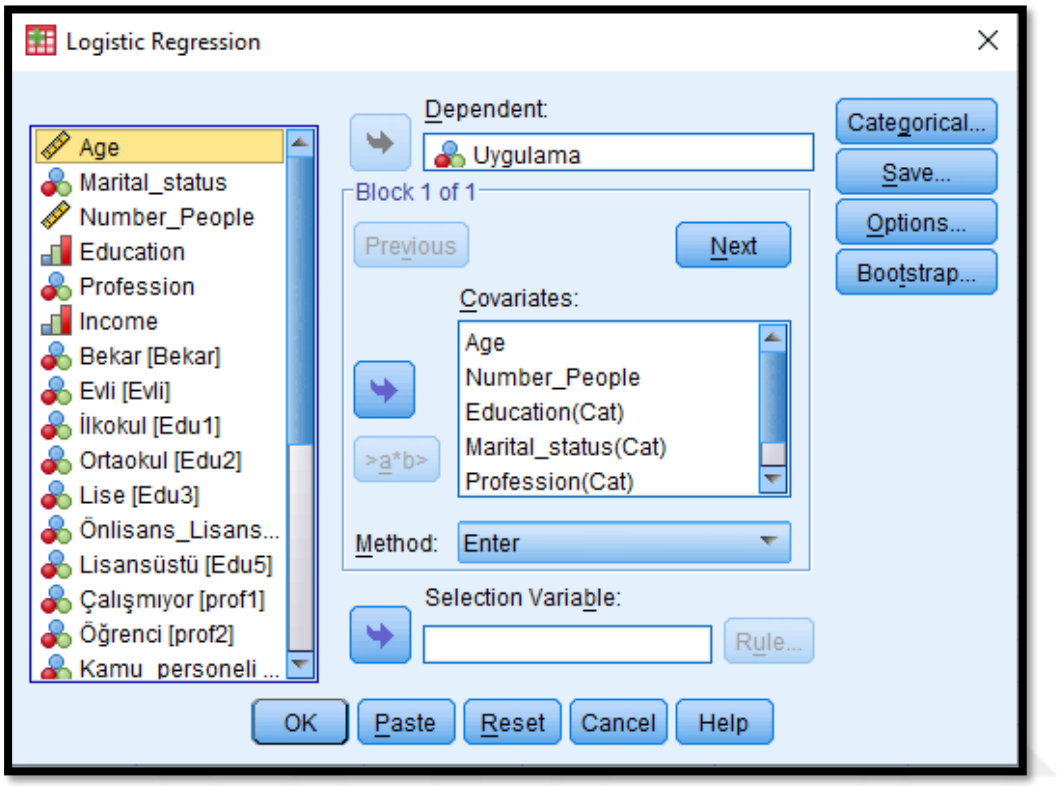


Figure 3.1.3.10. Variable Section

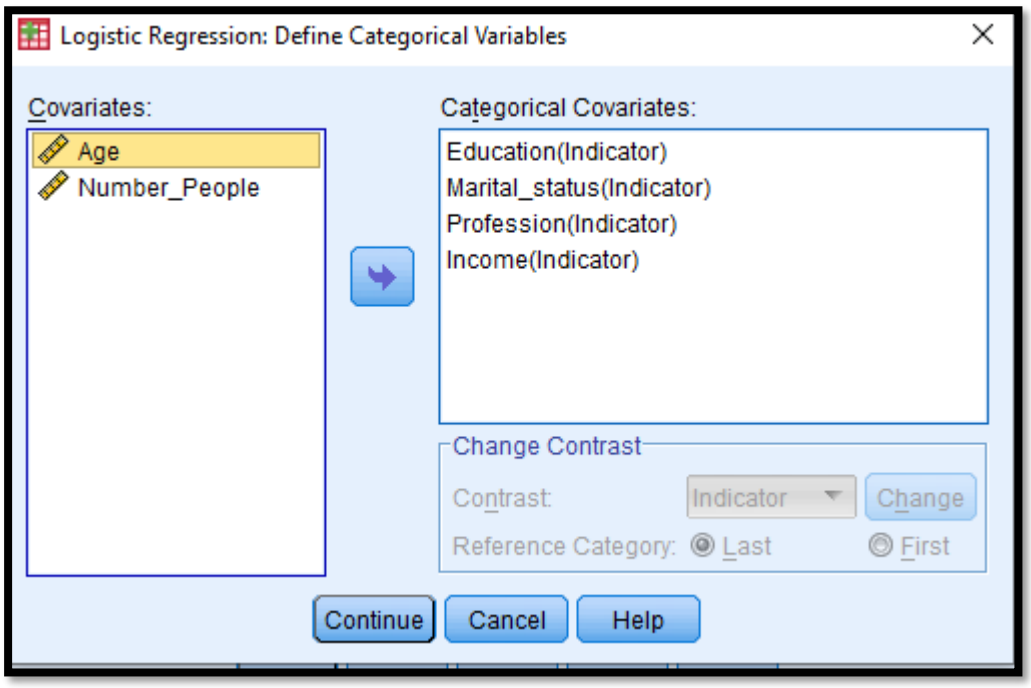


Figure 3.1.3.11. Categorical Variable Section

4. RESULTS AND DISCUSSIONS

In this research, aim is the finding out relation between the demographic variaties and the most common produced household waste type. For this aim, it is expected to see that there is a relation between age, marital status, profession, number of people in the same household, education level and income level.

Table 4.1. Demographic Frequencies and Ratios of Participants

Age Range	19-30	118	27.06%
	31-40	154	35.32%
	41-50	115	26.38%
	51-60	38	8.72%
	61-71	11	2.52%
Marital Status	Single	161	36.93%
	Married	275	63.07%
Profession Type	Civil Servant	222	50.92%
	Private Sector	134	30.73%
	Student	44	10.09%
	Unemployed	36	8.26%
Number of People	1	35	8.03%
	2	62	14.22%
	3	125	28.67%
	4	144	33.03%
	5	53	12.16%
	6	12	2.75%
	7	2	0.46%
	8	1	0.23%
	9	2	0.46%
Education Level	Primary School	12	2.75%
	Secondary School	10	2.29%
	High School	55	12.61%
	Bachelor Degree	280	64.22%
	Postgraduate Degree	79	18.12%
Income Level	0 - 2500 TL	78	17.89%
	2501 - 5000 TL	155	35.55%
	5001 - 7500 TL	150	34.40%
	7501 TL and upper	53	12.16%

According to Table 4.1, age distribution can be seen very similar between interval 19-30 and interval 41-50, additionally, it can be seen that highest participation from age interval is 31-40 and the lowest participation from age interval is 61-71. It can be outcome as the elderly people has less options to reach technological devices. Survey is based on online participation because of circumtances of applied time and there is a low frequency of elderly people. However, highest participation from civil servant is not surprising outcome because of the starting point of the survey but there is an enough participation from other professions. It can be seen that married people has approximately doubled ratio than single participants, it is because of the common culture in Turkey that is young age marriage. There is enough participation from each number of people in the same house hold but 3 and 4 people in the same household is the common type in Turkey again because of common culture. However, highest participation from bachelor degree can be connected with the starting point of the survey and it can be seen that income level has similar participation between for the interval 2501 TL – 5000 TL and 5001 TL – 7500 TL.

4.1. Multi-Linear Regression Analysis

According to survey study, it is asked that most common waste type which is produced in household. In the multi-linear regression analysis, for each type, there will be a separate analysis.

4.1.1 Waste Type - Plastic

For this analysis, dependent variable is defined as amount of waste type and independent variables are defined as number of people in the same household, education and lastly profession. As stated in the previous sections, there are some categorical variables and these must have dummy variables to provide solid solution. For the plastic amount as it is dependent variable, dummy variables are defined as below. There is no need to define dummy variable for the number of people in the same household because of it is scale.

- Education – Dummy 1, Dummy 2 – Reference is High School
- Profession – Dummy 1, Dummy 2, Dummy 3 – Reference is Uneployment

According to Table 4.1.1.1, correlations that is what the multiple regression is basically based upon and it is a correlation matrix so it is correlations amongst all the variables but most importantly correlations with the dependent variable. It can be seen that number of people in the same household has the largest positive correlation with plastic amount with the 0.343 and next one is the profession type which is civil servant. It can be also seen that there are positive inter-correlations amongst the independent variables or predictors, and that is why multiple regression analysis is usefull analysis that it decompeses the unique contributions of each variable as a predictor of plastic amount which is hard to do normally. As ıt can be seen that there is no "0" valued inter-correlations amongst the predictors but if there was, benefit of multiple regression cannot be got because each correlation represents the unique capacity.

Table 4.1.1.1. Correlation Between Variables Plastic

	Plastic Amount	**No. Of People**	**Bachelor**	**Postgrad**	**Student**	**Civil Servant**	**Private Sector**
Plastic Amount	1.000	.343	-.106	.085	.016	.305	-.250
No. Of People	.343	1.000	.101	-.031	-.046	.159	-.085
Bachelor	-.106	.101	1.000	-.610	-.265	-.014	.307
Postgrad	.085	-.031	-.610	1.000	-.191	.243	-.105
Student	.016	-.046	-.265	-.191	1.000	-.344	-.264
Civil Servant	.305	.159	-.014	.243	-.344	1.000	-.636
Private Sector	-.250	-.085	.307	-.105	-.264	-.636	1.000

According to Table 4.1.1.2, which gives R, R^2, Adjusted R^2 and Std. Error of Estimate. This summary shows that there is 21% variability in plastic amount and it is expected to get lower adjusted R^2 because it takes into account sample size to provide accurate representation.

Table 4.1.1.2. Model Summary Plastic

R	**R^2**	**Adjusted R^2**	**Std. Error of Estimate**
0.459	0.211	0.128	0.89111

According to Table 4.1.1.3, ANOVA is testing the statistical significance of model at each and there is a p-value less than 0.05 so it tells those independent variables have been included in the model with the F-value 2.535 with 6 degrees of freedom.

Table 4.1.1.3. ANOVA Plastic

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	12.078	6	2.013	2.535	.030
Residual	45.262	57	.794		
Total	57.340	63			

According to Table 4.1.14, it can be seen that there are unstandardized Beta weights and Std. Errors which associates with those but generally in economic or finance, standardized Beta weights are used more common. These values show unique contribution of each predictor of dependent variable. From this point, it can be said that number of people in the same household and profession type civil servant are more confortable to contributes in equation with the higher Beta weights. Additionaly, all these significance values can be seen in the table. According to results, number of people in the same household is the only one that is statistically significance because its value is less than 0.05 but other predictors have greater value so that these are not statistically significance. However, tolerance values can be seen on the table. These values are unique variance which associated with independent variables. Number of people in the same household has 96% variance which means in this percentage, it is not counted by other independent variables.

Table 4.1.1.4. Coefficients of Models Plastic

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
No. Of People	.231	.089	.312	2.603	.012	.962	1.039
Bachelor	-.311	.354	-.161	-.880	.383	.411	2.433
Postgrad	-.140	.412	-.060	-.341	.734	.452	2.213
Student	.350	.490	.122	-.713	.479	.472	2.119
Civil Servant	.688	.425	.362	1.620	.111	.278	3.604
Private Sector	.166	.443	.082	.374	.710	.287	3.484

Acc ording to Figure 4.1.1.1, there is a nice and normal distribution which shows the associates with the plastic amount. Additionaly, Figure 4.1.1.2 shows that there must be hugging of values on the line of least squares. It can be said that line has nearly greates fit.

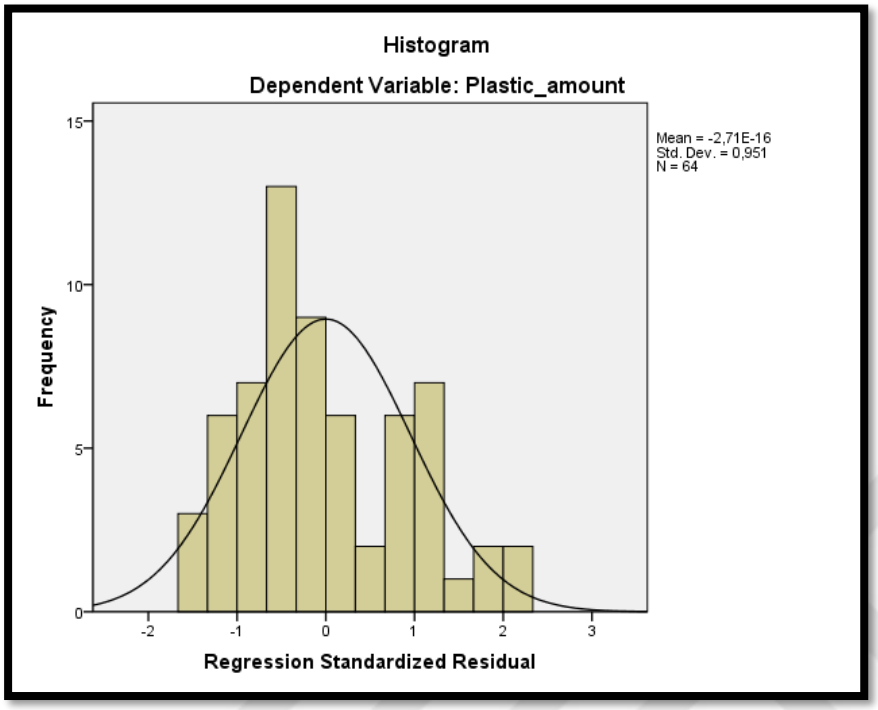


Figure 4.1.1.1 Histogram of the Residual Plastic

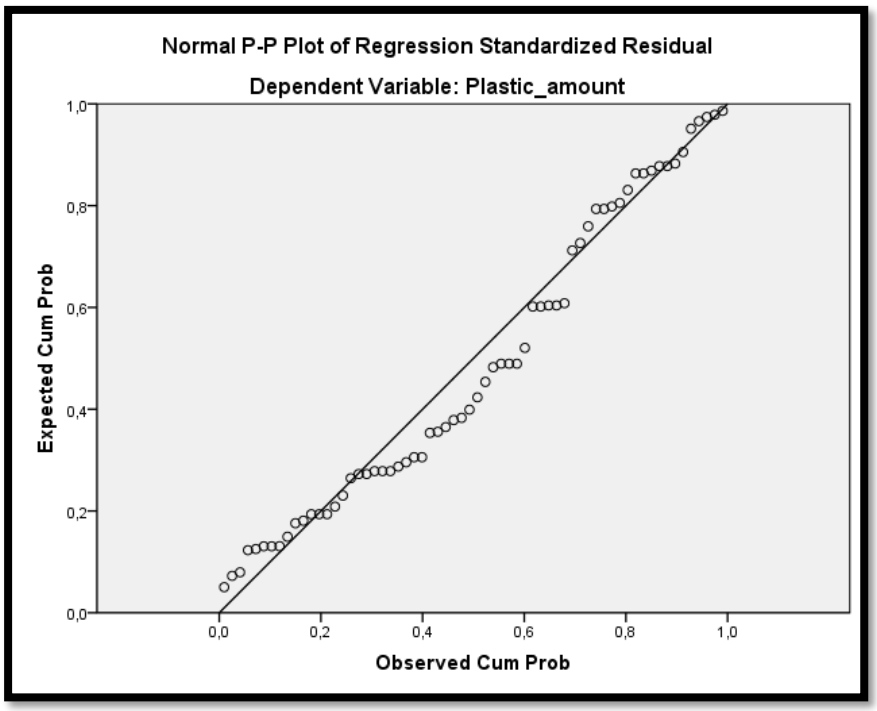


Figure 4.1.1.2 Normal P-P Plot Plastic

According to Figure 4.1.1.3, which is more informative than other figures, regression standardized predicted value is established on the X-axis and regression standardized residual is established on the Y-axis. It is expected to see bird's nets in these figures and below figure provides it. This figure helps to understand homoscedasticity and there is no tighter area and it can be said that there is no problem about the homoscedasticity. If the homoscedasticity is available in data, there is a confidence in standard errors associated with Beta weights.

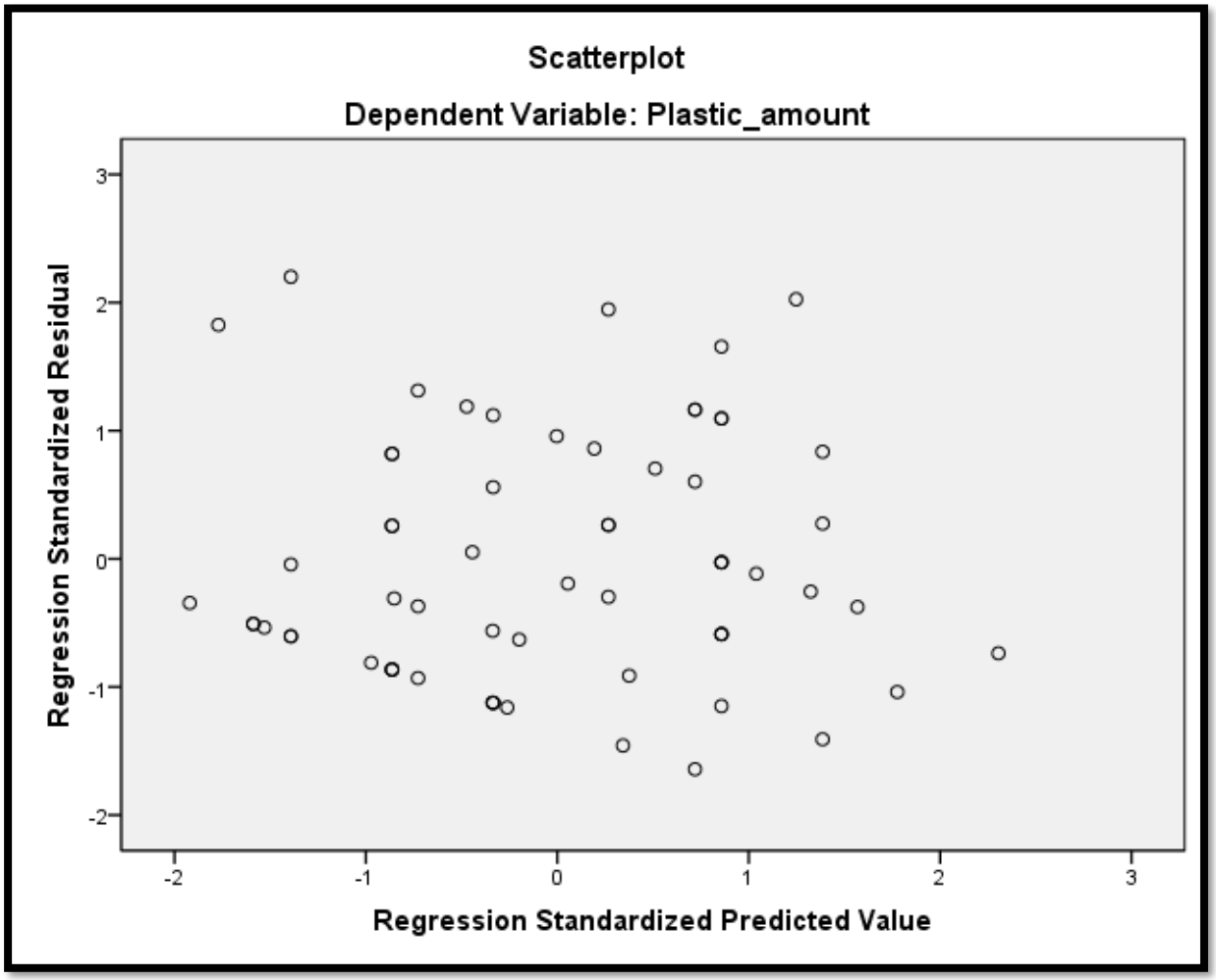


Figure 4.1.1.3 Plot of Regression Standardized Plastic

4.1.2 Waste Type - Paper

For this analysis, dependent variable is defined as amount of waste type and independent variables are defined as age and income level. As stated in the previous sections, there are some categorical variables and these must have dummy variables to provide solid solution. For the paper amount as it is dependent variable, dummy variables are defined as below. There is no need to define dummy variable for the age because of it is scale.

- Income Level – Dummy 1, Dummy 2, Dummy 3 – Reference is 0-2500 TL

According to Table 4.1.2.1, correlations that is what the multiple regression is basically based upon and it is a correlation matrix so it is correlations amongst all the variables but most importantly correlations with the dependent variable. It can be seen that income level 5001-7500 TL has the largest positive correlation with paper amount with the 0.85. It can be also seen that there are positive inter-correlations amongst the independent variables or predictors, and that is why multiple regression analysis is usefull analysis that it decompeses the unique contributions of each variable as a predictor of paper amount which is hard to do normally. As ıt can be seen that there is no "0" valued inter-correlations amongst the predictors but if there was, benefit of multiple regression cannot be got because each correlation represents the unique capacity.

Table 4.1.2.1. Correlation Between Variables

	Paper Amount	**Age**	**7501 and upper**	**5001-7500**	**2501-5000**
Paper Amount	1,000	-,379	-,157	,085	-,264
Age	-,379	1,000	,014	,312	-,253
7501 and upper	-,157	,014	1,000	-,435	-,187
5001-7500	,085	,312	-,435	1,000	-,516
2501-5000	-,264	-,253	-,187	-,516	1,000

According to Table 4.1.2.2, which gives R, R^2, Adjusted R^2 and Std. Error of Estimate. This summary shows that there is 35% variability in paper amount and it is expected to get lower adjusted R^2 because it takes into account sample size to provide accurate representation.

Table 4.1.2.2. Model Summary

R	**R^2**	**Adjusted R^2**	**Std. Error of Estimate**
0.592	0.351	0.198	1.61824

According to Table 4.1.2.3, ANOVA is testing the statistical significance of model at each and there is a p-value higher than 0.05 so it tells those independent variables have not been included in the model with the F-value 2.298 with 4 degrees of freedom.

Table 4.1.2.3. ANOVA

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	24.073	4	6.018	2.298	.101
Residual	44.518	17	2.619		
Total	68.591	21			

According to Table 4.1.2.4, it can be seen that there are unstandardized Beta weights and Std. Errors which associates with those but generally in economic or finance, standardized Beta weights are used more common. These values show unique contribution of each predictor of dependent variable. From this point, it can be said that 7501 and upper TL and 2501-5000 TL are more confortable to contributes in equation with the higher Beta weights. Additionaly, all these significance values can be seen in the table. According to results, age is the only one that is statistically significance because its value is less than 0.05 but other predictors have greater value so that these are not statistically significance. However, tolerance values can be seen on the table. These values are unique variance which associated with independent variables. Age has 87% variance which means in this percentage, it is not counted by other independent variables.

Table 4.1.2.4. Coefficients of Models

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
Age	-.090	.042	-.447	-2.141	.047	.874	1.144
7501 and upper	-1.775	1.334	-.345	-1.330	.201	.568	1.760
5001-7500	-.745	1.080	-.210	-.690	.500	.412	2.430
2501-5000	-2.519	1.236	-.550	-2.037	.057	.524	1.910

According to Figure 4.1.2.1, there is a nice and normal distribution which shows the associates with the paper amount. Additionaly, Figure 4.1.2.2 shows that there must be hugging of values on the line of least squares. It can be said that line has nearly greates fit.

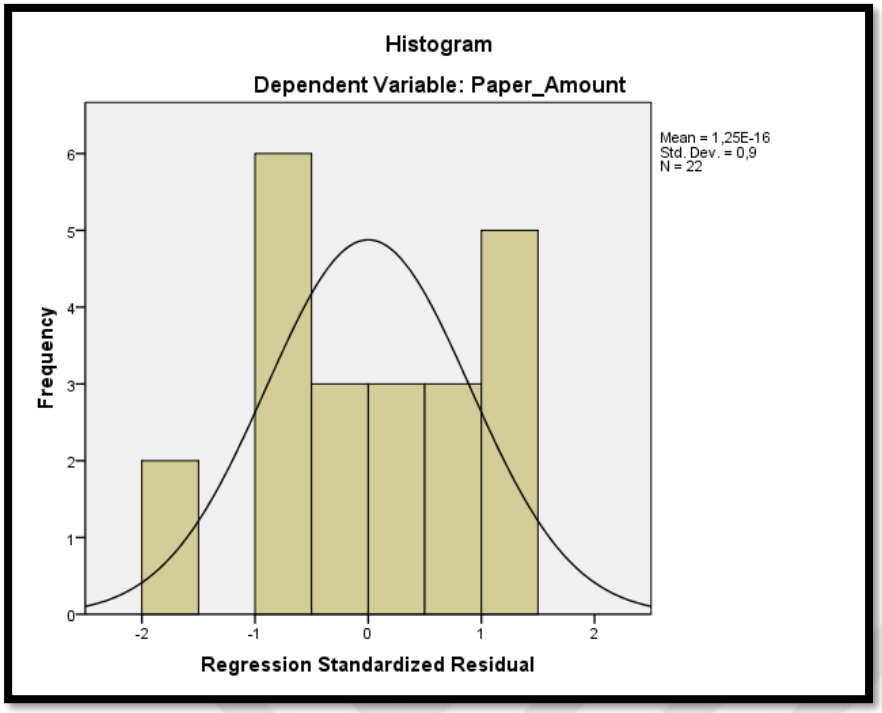


Figure 4.1.2.1 Histogram of the Residual

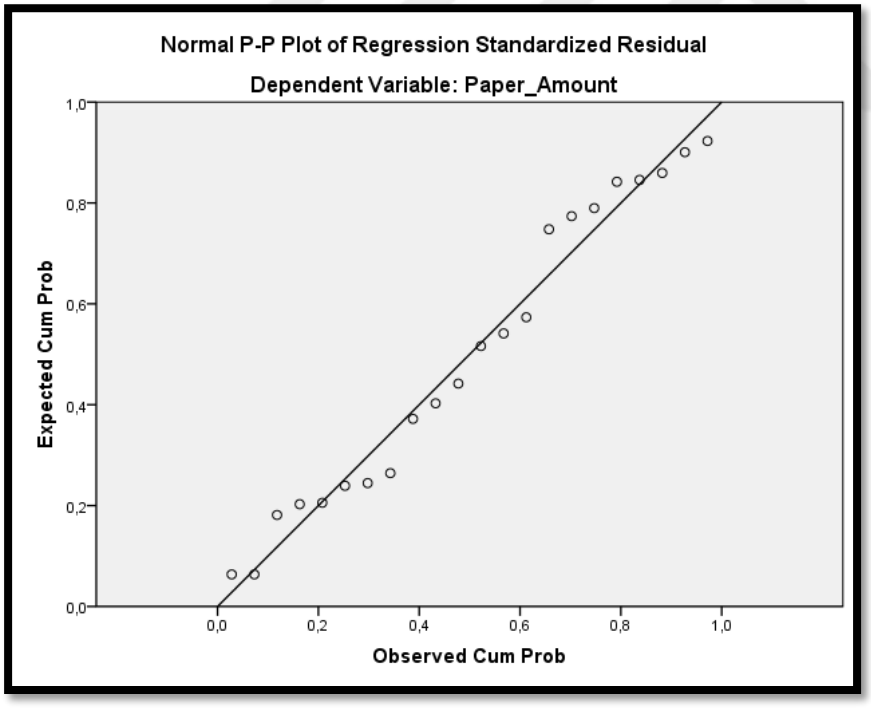


Figure 4.1.2.2 Normal P-P Plot

According to Figure 4.1.2.3, which is more informative than other figures, regression standardized predicted value is established on the X-axis and regression standardized residual is established on the Y-axis. It is expected to see bird's nets in these figures and below figure

cannot provides it. This figure helps to understand heteroscedasticity and there are tighter areas and this problem can be figured out with the increasing number of participant or data.

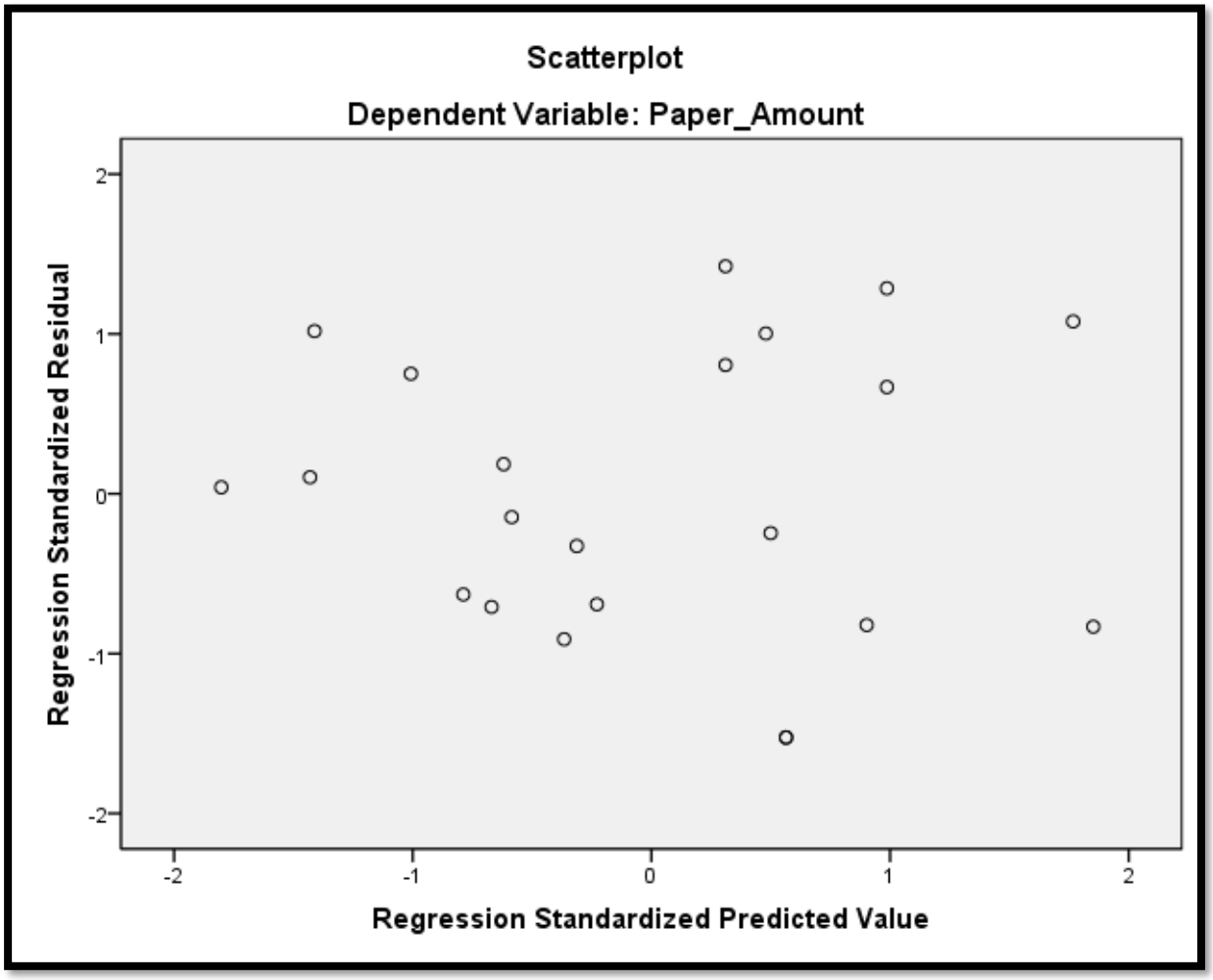


Figure 4.1.2.3 Plot of Regression Standardized

4.1.3 Waste Type - Glass

For this analysis, dependent variable is defined as amount of waste type and independent variables are defined as number of people in the same household, marital status and lastly profession. As stated in the previous sections, there are some categorical variables and these must have dummy variables to provide solid solution. For the glass amount as it is dependent variable, dummy variables are defined as below. There is no need to define dummy variable for the number of people in the same household because of it is scale.

- Profession – Dummy 1, Dummy 2, Dummy 3 – Reference is Civil Servant
- Marital Status – Dummy 1 – Reference is Married

According to Table 4.1.3.1, correlations that is what the multiple regression is basically based upon and it is a correlation matrix so it is correlations amongst all the variables but most importantly correlations with the dependent variable. It can be seen that unemployment has the largest positive correlation with glass amount with the 0.181 and next one is the marital status which is single. It can be also seen that there are positive inter-correlations amongst the independent variables or predictors, and that is why multiple regression analysis is usefull analysis that it decompeses the unique contributions of each variable as a predictor of glass amount which is hard to do normally. As ıt can be seen that there is no "0" valued inter-correlations amongst the predictors but if there was, benefit of multiple regression cannot be got because each correlation represents the unique capacity.

Table 4.1.3.1. Correlation Between Variables

	Glass Amount	**Number People**	**Single**	**Unemp**	**Student**	**Private Sector**
Glass_Amount	1,000	-,088	,131	,181	-,494	,042
Number_People	-,088	1,000	-,397	-,030	,297	-,181
Single	,131	-,397	1,000	,055	,285	,020
Unemp	,181	-,030	,055	1,000	-,115	-,246
Student	-,494	,297	,285	-,115	1,000	-,246
Private Sector	,042	-,181	,020	-,246	-,246	1,000

According to Table 4.1.3.2, which gives R, R^2, Adjusted R^2 and Std. Error of Estimate. This summary shows that there is 40% variability in glass amount and it is expected to get lower adjusted R^2 because it takes into account sample size to provide accurate representation.

Table 4.2.3.2. Model Summary

R	**R^2**	**Adjusted R^2**	**Std. Error of Estimate**
0.630	0.397	0.266	0.95146

According to Table 4.1.3.3, ANOVA is testing the statistical significance of model at each and there is a p-value less than 0.05 so it tells those independent variables have been included in the model with the F-value 2.743 with 5 degrees of freedom.

Table 4.1.3.3. ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	13.713	5	2.743	3.030	.030
Residual	20.821	23	.905		
Total	34.534	28			

According to Table 4.1.3.4, it can be seen that there are unstandardized Beta weights and Std. Errors which associates with those but generally in economic or finance, standardized Beta weights are used more common. These values show unique contribution of each predictor of dependent variable. From this point, it can be said that number of people in the same household and single marital status are more comfortable to contributes in equation with the higher Beta weights. Additionaly, all these significance values can be seen in the table. According to results, marital status single and profession type student are the ones that are statistically significance because its value is less than 0.05 but other predictors have greater value so that these are not statistically significance. However, tolerance values can be seen on the table. These values are unique variance which associated with independent variables. Profession type unemployment has 89% variance which means in this percentage, it is not counted by other independent variables.

Table 4.1.3.4. Coefficients of Models

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
No. Of People	,308	,210	,293	1,465	,157	,654	1,529
Single	,999	,445	,451	2,247	,035	,651	1,535
Unemp	,224	,615	,063	,364	,719	,890	1,123
Student	-2,584	,715	-,721	-3,613	,001	,658	1,520
Private Sector	-,175	,404	-,076	-,432	,670	,845	1,183

According to Figure 4.1.3.1, there is a nice and normal distribution which shows the associates with the glass amount. Additionaly, Figure 4.1.3.2 shows that there must be hugging of values on the line of least squares. It can be said that line has nearly greates fit.

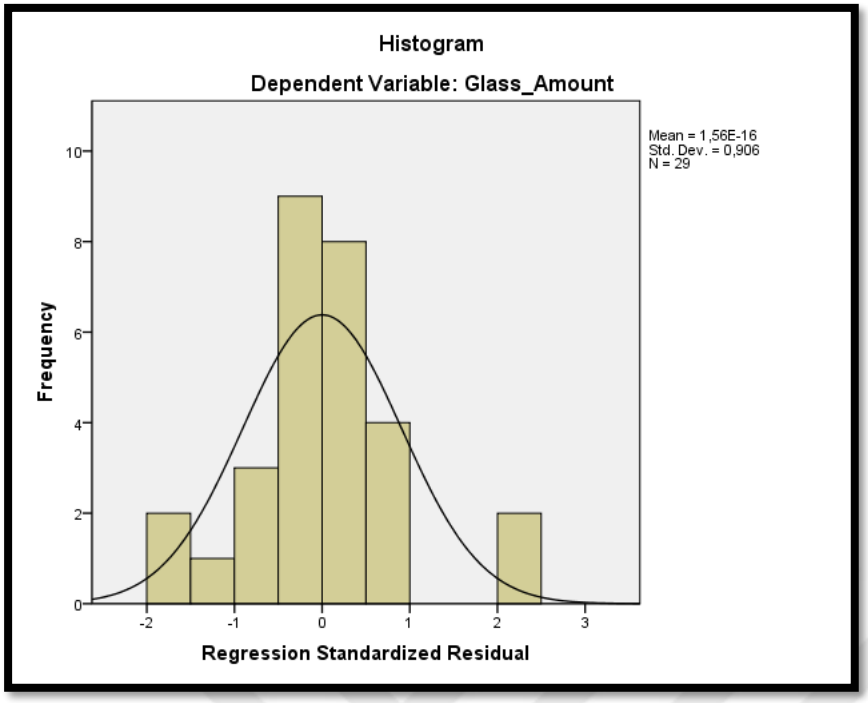


Figure 4.1.3.1 Histogram of the Residual

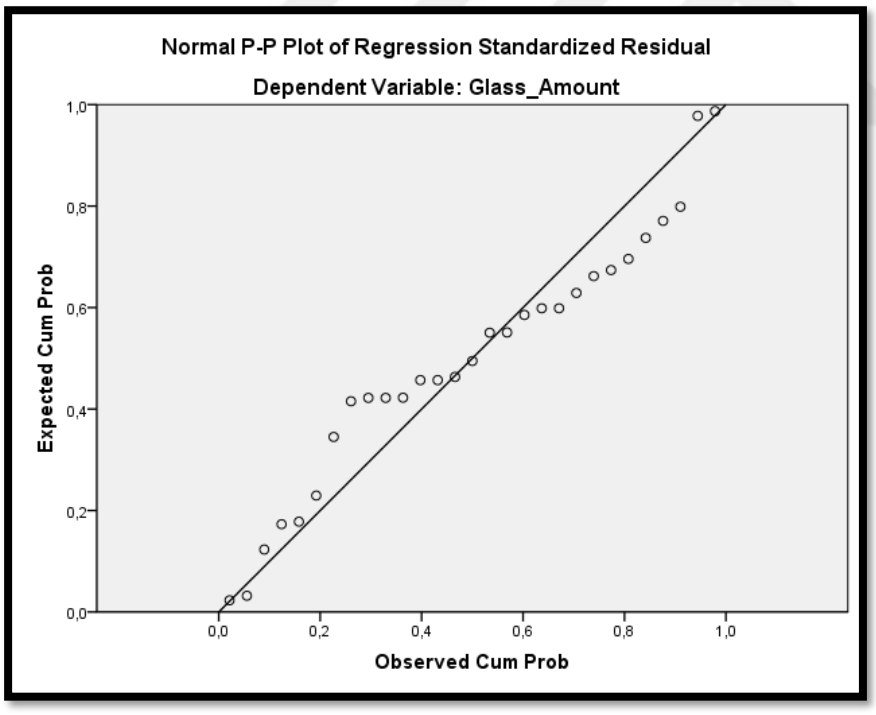


Figure 4.1.3.2 Normal P-P Plot

According to Figure 4.1.3.3, which is more informative than other figures, regression standardized predicted value is established on the X-axis and regression standardized residual is established on the Y-axis. It is expected to see bird's nets in these figures and below figure provides it. This figure helps to understand homoscedasticity and there is no tighter area and it

can be said that there is no problem about the homoscedasticity. If the homoscedasticity is available in data, there is a confidence in standard errors associated with Beta weights.

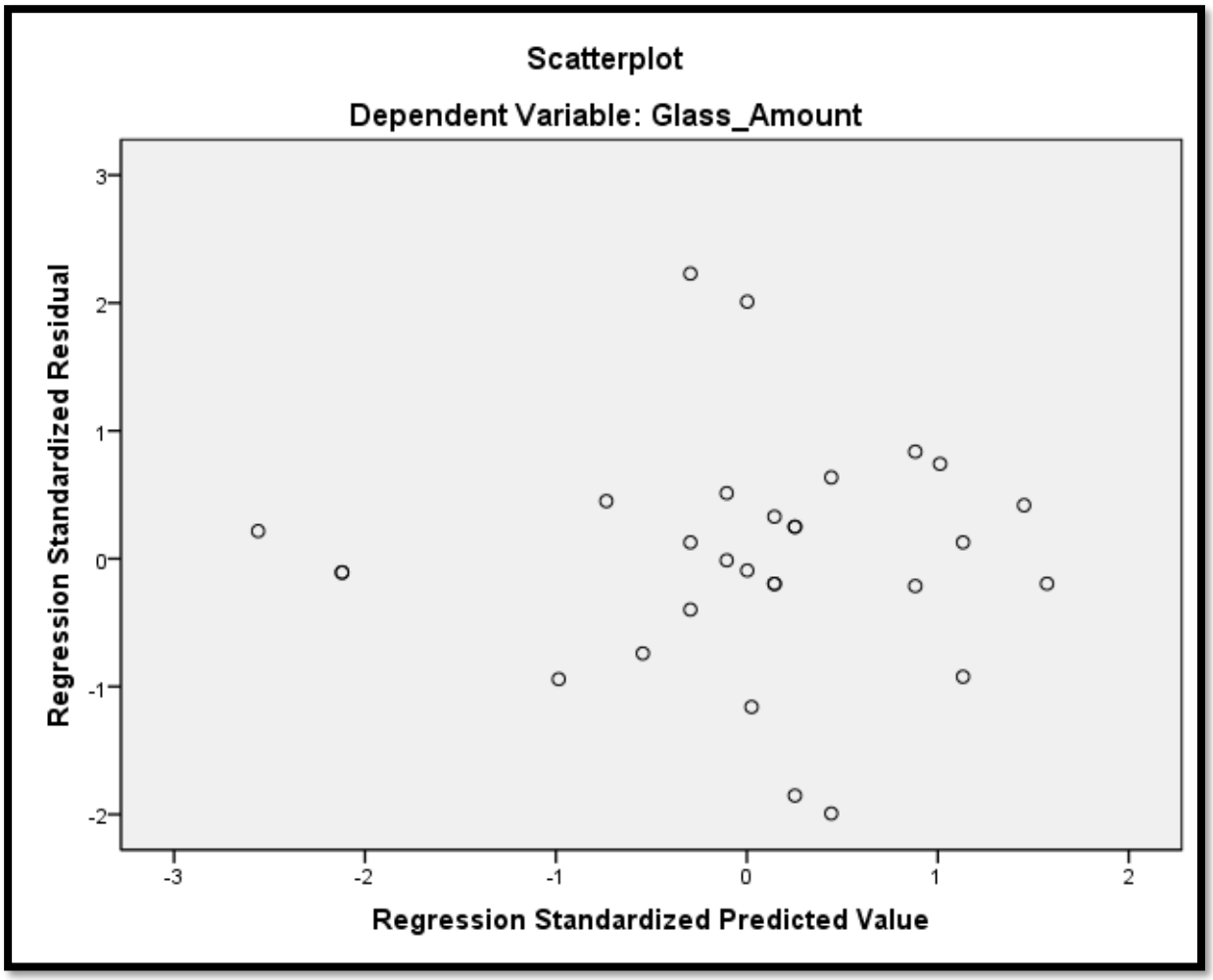


Figure 4.1.3.3 Plot of Regression Standardized

4.1.4 Waste Type – Electronic

For this analysis, dependent variable is defined as amount of waste type and independent variables are defined as age and marital status. As stated in the previous sections, there are some categorical variables and these must have dummy variables to provide solid solution. For the electronic amount as it is dependent variable, dummy variables are defined as below. There is no need to define dummy variable for the age because of it is scale.

- Marital Status – Dummy 1- Reference is Married

According to Table 4.1.4.1, correlations that is what the multiple regression is basically based upon and it is a correlation matrix so it is correlations amongst all the variables but most

importantly correlations with the dependent variable. It can be seen that marital status single has the largest positive correlation with plastic amount with the 0.646. It can be also seen that there are positive inter-correlations amongst the independent variables or predictors, and that is why multiple regression analysis is usefull analysis that it decompeses the unique contributions of each variable as a predictor of electronic amount which is hard to do normally. As ıt can be seen that there is no "0" valued inter-correlations amongst the predictors but if there was, benefit of multiple regression cannot be got because each correlation represents the unique capacity.

Table 4.1.4.1. Correlation Between Variables

	Electronic_Amount	**Age**	**Single**
Electronic_Amount	1,000	-,252	,646
Age	-,252	1,000	-,629
Single	,646	-,629	1,000

According to Table 4.1.4.2, which gives R, R^2, Adjusted R^2 and Std. Error of Estimate. This summary shows that there is 46% variability in electronic amount and it is expected to get lower adjusted R^2 because it takes into account sample size to provide accurate representation.

Table 4.1.4.2. Model Summary

R	**R^2**	**Adjusted R^2**	**Std. Error of Estimate**
0.676	0.457	0.349	1.06756

According to Table 4.1.4.3, ANOVA is testing the statistical significance of model at each and there is a p-value less than 0.05 so it tells those independent variables have been included in the model with the F-value 4.213 with 2 degrees of freedom.

Table 4.1.4.3. ANOVA

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	9,603	2	4,802	4,213	,047
Residual	11,397	10	1,140		
Total	21.000	12			

According to Table 4.1.4.4, it can be seen that there are unstandardized Beta weights and Std. Errors which associates with those but generally in economic or finance, standardized Beta weights are used more common. These values show unique contribution of each predictor of dependent variable. From this point, it can be said that marital status single is more confortable to contributes in equation with the higher Beta weights. Additionaly, all these significance values can be seen in the table. According to results, marital status single is the only one that is statistically significance because its value is less than 0.05 but other predictor has greater value so that this is not statistically significance. However, tolerance values can be seen on the table. These values are unique variance which associated with independent variables. Marital status single has 60% variance which means in this percentage, it is not counted by other independent variables.

Table 4.1.4.4. Coefficients of Models

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
Age	,028	,033	,255	,852	,414	,605	1,654
Single	2,435	,904	,807	2,694	,023	,605	1,654

According to Figure 4.1.4.1, there is a nice and normal distribution which shows the associates with the electronic amount. Additionaly, Figure 4.1.4.2 shows that there must be hugging of values on the line of least squares. It can be said that line has nearly greates fit.

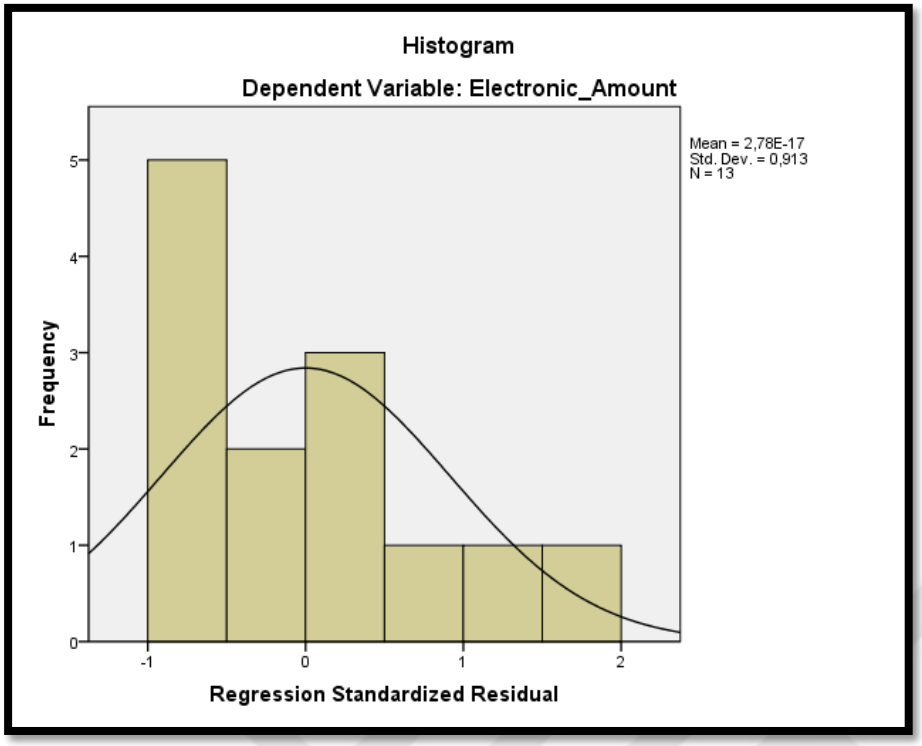


Figure 4.1.4.1 Histogram of the Residual

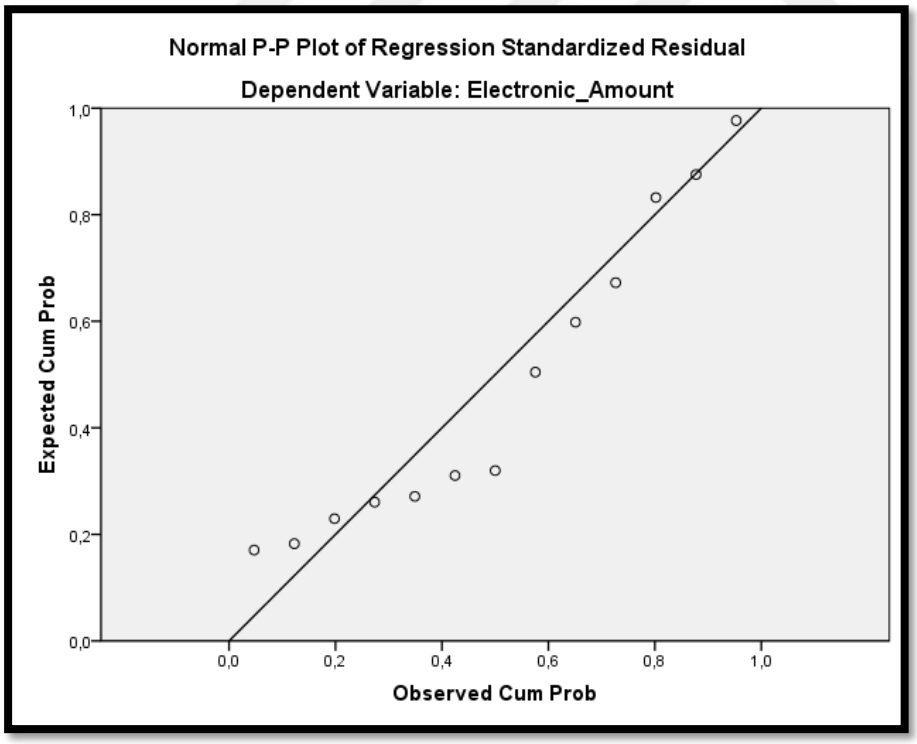


Figure 4.1.4.2 Normal P-P Plot

According to Figure 4.1.4.3, which is more informative than other figures, regression standardized predicted value is established on the X-axis and regression standardized residual

is established on the Y-axis. It is expected to see bird's nets in these figures and below figure provides it. This figure helps to understand homoscedasticity and there is no tighter area and it can be said that there is no problem about the homoscedasticity. If the homoscedasticity is available in data, there is a confidence in standard errors associated with Beta weights.

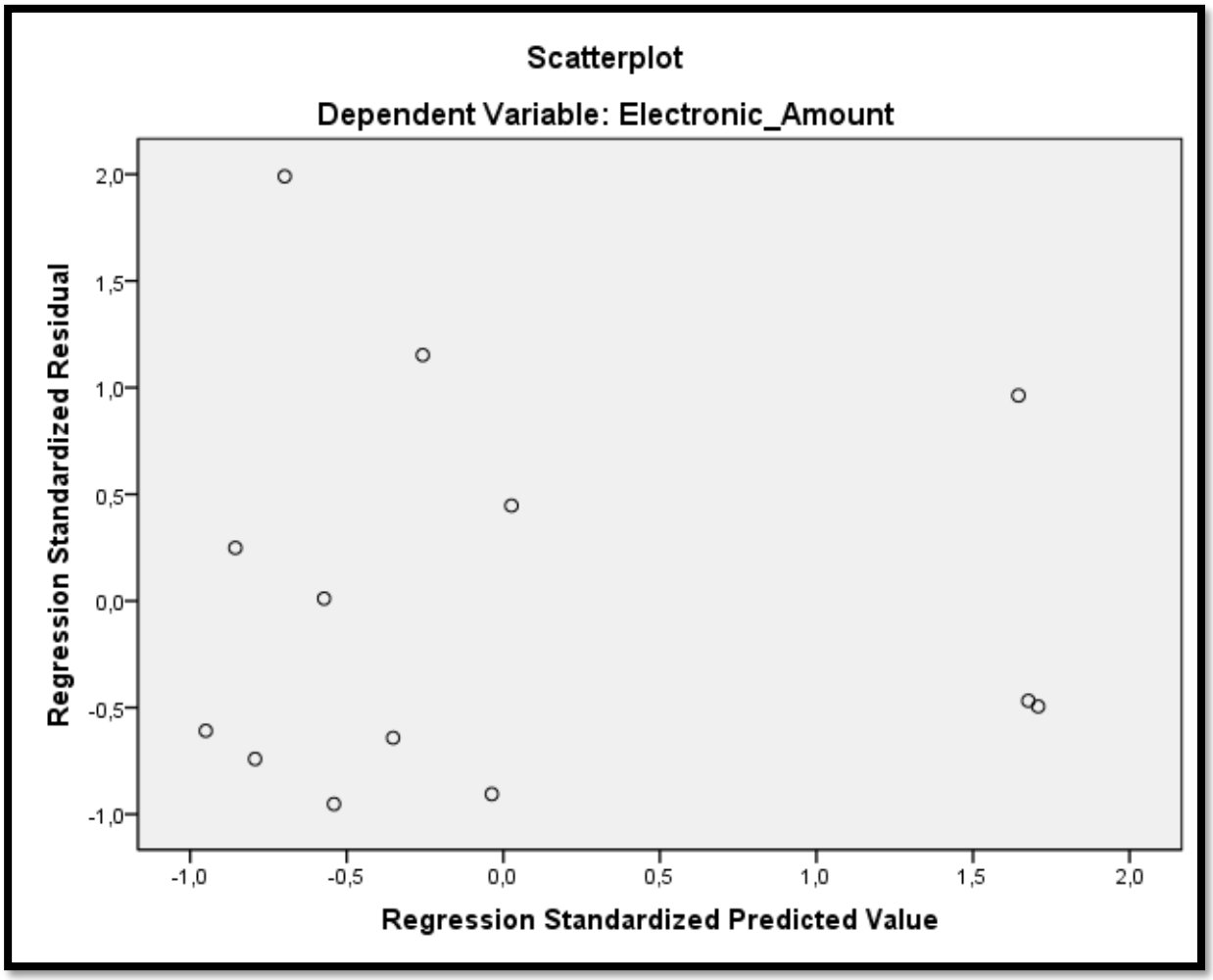


Figure 4.1.4.3 Plot of Regression Standardized

4.1.5 Waste Type – Metal

For this analysis, dependent variable is defined as amount of waste type and independent variables are defined as age and education. As stated in the previous sections, there are some categorical variables and these must have dummy variables to provide solid solution. For the metal amount as it is dependent variable, dummy variables are defined as below. There is no need to define dummy variable for the age because of it is scale.

- Education – Dummy 1, Dummy 2, Dummy3 – Reference is Highschool

According to Table 4.1.5.1, correlations that is what the multiple regression is basically based upon and it is a correlation matrix so it is correlations amongst all the variables but most importantly correlations with the dependent variable. It can be seen that education level postgraduation has the largest positive correlation with metal amount with the 0.073. It can be also seen that there are positive inter-correlations amongst the independent variables or predictors, and that is why multiple regression analysis is usefull analysis that it decompeses the unique contributions of each variable as a predictor of metal amount which is hard to do normally. As ıt can be seen that there is no "0" valued inter-correlations amongst the predictors but if there was, benefit of multiple regression cannot be got because each correlation represents the unique capacity.

Table 4.1.5.1. Correlation Between Variables

	Metal_Amount	**Highschool**	**Bachelor**	**Postgrad**	**Age**
Metal_Amount	1,000	-,049	-,146	,073	-,324
Highschool	-,049	1,000	-,478	-,158	-,246
Bachelor	-,146	-,478	1,000	-,661	,230
Postgrad	,073	-,158	-,661	1,000	-,058
Age	-,324	-,246	,230	-,058	1,000

According to Table 4.1.5.2, which gives R, R^2, Adjusted R^2 and Std. Error of Estimate. This summary shows that there is 18% variability in plastic amount and it is expected to get lower adjusted R^2 because it takes into account sample size to provide accurate representation.

Table 4.1.5.2. Model Summary

R	**R^2**	**Adjusted R^2**	**Std. Error of Estimate**
0.420	0.176	0.079	1.38662

According to Table 4.1.5.3, ANOVA is testing the statistical significance of model at each and there is a p-value less than 0.05 so it tells those independent variables have been included in the model with the F-value 1.819 with 4 degrees of freedom.

Table 4.1.5.3. ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	13,986	4	3,497	1,819	,148
Residual	65,373	34	1,923		
Total	79,359	38			

According to Table 4.1.5.4, it can be seen that there are unstandardized Beta weights and Std. Errors which associates with those but generally in economic or finance, standardized Beta weights are used more common. These values show unique contribution of each predictor of dependent variable. From this point, it can be said that education level highschool and bachelor are more confortable to contributes in equation with the higher Beta weights. Additionaly, all these significance values can be seen in the table. According to results, age is the only one that is statistically significance because its value is less than 0.05 but other predictors have greater value so that these are not statistically significance. However, tolerance values can be seen on the table. These values are unique variance which associated with independent variables. Age has 92% variance which means in this percentage, it is not counted by other independent variables.

Table 4.1.5.4. Coefficients of Models

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
Highschool	-1,987	1,206	-,423	-1,647	,109	,368	2,717
Bachelor	-1,506	1,022	-,498	-1,475	,150	,213	4,704
Postgrad	-1,272	1,112	-,342	-1,143	,261	,271	3,694
Age	-,050	,024	-,333	-2,056	,047	,923	1,084

According to Figure 4.1.5.1, there is a nice and normal distribution which shows the associates with the metal amount. Additionaly, Figure 4.1.5.2 shows that there must be hugging of values on the line of least squares. It can be said that line has nearly greates fit.

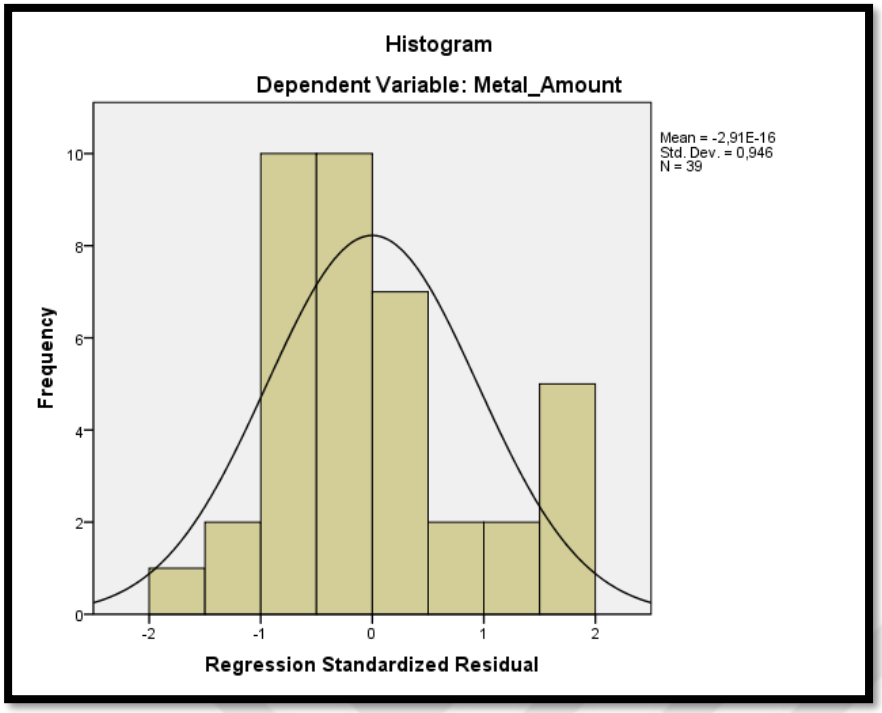


Figure 4.1.5.1 Histogram of the Residual

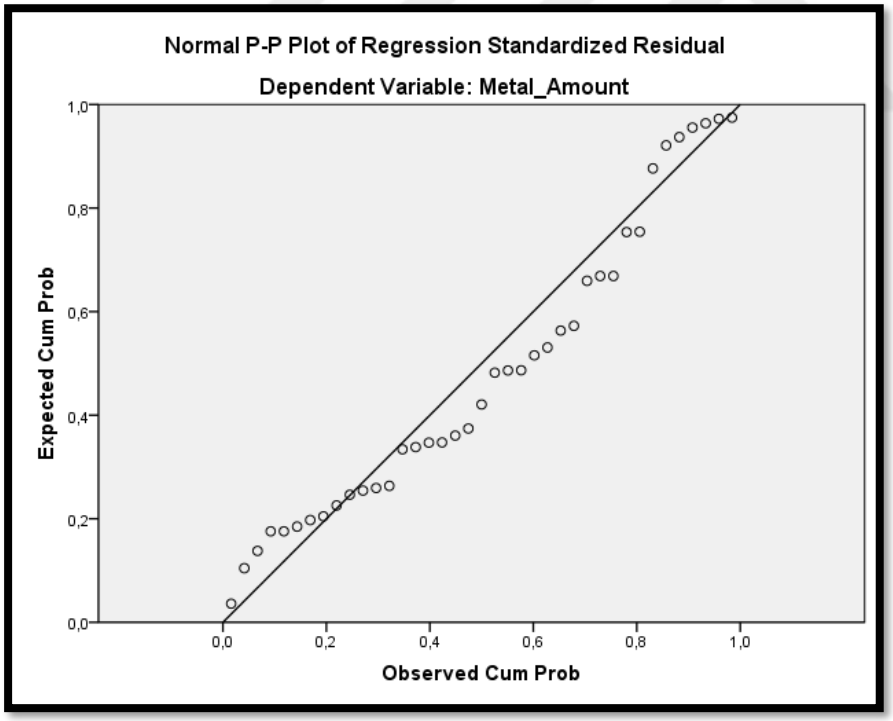


Figure 4.1.5.2 Normal P-P Plot

According to Figure 4.1.5.3, which is more informative than other figures, regression standardized predicted value is established on the X-axis and regression standardized residual is established on the Y-axis. It is expected to see bird's nets in these figures and below figure

cannot provides it. This figure helps to understand heteroscedasticity and there are tighter areas and this problem can be figured out with the increasing number of participant or data.

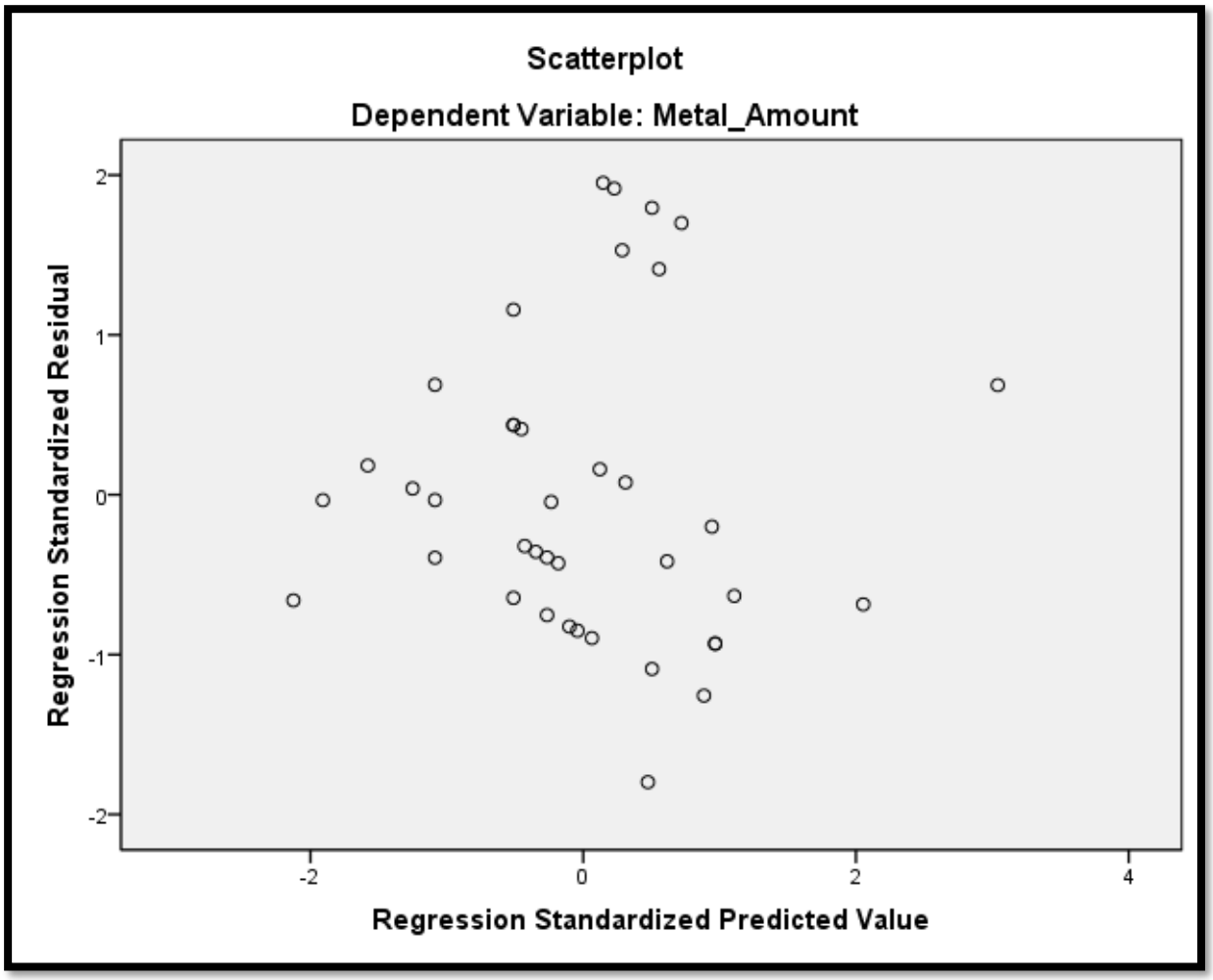


Figure 4.1.5.3 Plot of Regression Standardized

4.1.6 Waste Type – Organic

For this analysis, dependent variable is defined as amount of waste type and independent variables are defined as age, number of people in the same household, profession, income and lastly marital status. As stated in the previous sections, there are some categorical variables and these must have dummy variables to provide solid solution. For the organic amount as it is dependent variable, dummy variables are defined as below. There is no need to define dummy variable for the age and number of people in the same household because of it is scale.

- Marital Status – Dummy 1 – Reference is Single

- Profession – Dummy 1, Dummy 2, Dummy 3 – Reference is Unemployment
- Income - Dummy 1, Dummy 2, Dummy 3 – Reference is 0-2500 TL

According to Table 4.1.6.1, correlations that is what the multiple regression is basically based upon and it is a correlation matrix so it is correlations amongst all the variables but most importantly correlations with the dependent variable. It can be seen that income level 5001-7500 has the largest positive correlation with organic amount with the 0.080 and next one is the number of people. It can be also seen that there are positive inter-correlations amongst the independent variables or predictors, and that is why multiple regression analysis is usefull analysis that it decompeses the unique contributions of each variable as a predictor of organic amount which is hard to do normally. As ıt can be seen that there is no "0" valued inter-correlations amongst the predictors but if there was, benefit of multiple regression cannot be got because each correlation represents the unique capacity.

Table 4.1.6.1. Correlation Between Variables

	Organic Amount	Age	Number People	Student	Civil Servant	Private Sector	2501 -5000	5001 -7500	7501 -üzeri	Mar.
Organic Amount	1,000	-,036	,078	-,060	-,060	,074	-,048	,080	,049	,075
Age	-,036	1,000	-,080	-,503	,364	-,100	-,027	,229	,074	,447
Number People	,078	-,080	1,000	,068	,022	,080	-,088	,029	,053	,068
Student	-,060	-,503	,068	1,000	-,383	-,224	-,155	-,248	-,037	-,462
Civil Servant	-,060	,364	,022	-,383	1,000	-,636	,050	,454	-,183	,429
Private Sector	,074	-,100	,080	-,224	-,636	1,000	,101	-,180	,142	-,098
2501 -5000	-,048	-,027	-,088	-,155	,050	,101	1,000	-,542	-,243	,096
5001 -7500	,080	,229	,029	-,248	,454	-,180	-,542	1,000	-,252	,214
7501- üzeri	,049	,074	,053	-,037	-,183	,142	-,243	-,252	1,000	,048
Married	,075	,447	,068	-,462	,429	-,098	,096	,214	,048	1,000

According to Table 4.1.6.2, which gives R, R^2, Adjusted R^2 and Std. Error of Estimate. This summary shows that there is 6% variability in plastic amount and it is expected to get lower adjusted R^2 because it takes into account sample size to provide accurate representation.

Table 4.1.6.2. Model Summary

R	R^2	Adjusted R^2	Std. Error of Estimate
0.234	0.055	0.017	2.50405

According to Table 4.1.6.3, ANOVA is testing the statistical significance of model at each and there is a p-value higher than 0.05 so it tells those independent variables have not been included in the model with the F-value 1.266 with 5 degrees of freedom.

Table 4.1.6.3. ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	81,930	9	9,103	1,452	,167
Residual	1417,082	226	6,270		
Total	1499,012	235			

According to Table 4.1.6.4, it can be seen that there are unstandardized Beta weights and Std. Errors which associates with those but generally in economic or finance, standardized Beta weights are used more common. These values show unique contribution of each predictor of dependent variable. From this point, it can be said that income level 2501-5000 is more confortable to contributes in equation with the higher Beta weight. Additionaly, all these significance values can be seen in the table. According to results, only being student and income level 2501-500 are the statistically significance and all other predictors have greater value than 0.05 so that these are not statistically significance. However, tolerance values can be seen on the table. These values are unique variance which associated with independent variables. Age has 90% variance which means in this percentage, it is not counted by other independent variables.

Table 4.1.6.4. Coefficients of Models

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Organic Amount	-,027	,020	-,109	-1,351	,178	,644	1,552
Age	,176	,135	,089	1,306	,193	,903	1,108
Number People	-1,147	,824	-,147	-1,393	,165	,374	2,670
Student	-1,610	,719	-,319	-2,240	,026	,206	4,850
Civil Servant	-,851	,690	-,150	-1,234	,218	,282	3,540
Private Sector	,586	,580	,110	1,010	,313	,351	2,852
2501 -5000	1,287	,627	,245	2,053	,041	,293	3,409
5001 -7500	,778	,684	,093	1,138	,256	,622	1,607
7501 -üzeri	,551	,422	,105	1,306	,193	,648	1,543
Married	-,027	,020	-,109	-1,351	,178	,644	1,552

According to Figure 4.1.6.1, there is a nice and normal distribution which shows the associates with the organic amount. Additionaly, Figure 4.1.1.2 shows that there must be hugging of values on the line of least squares. It can be said that line has nearly greates fit.

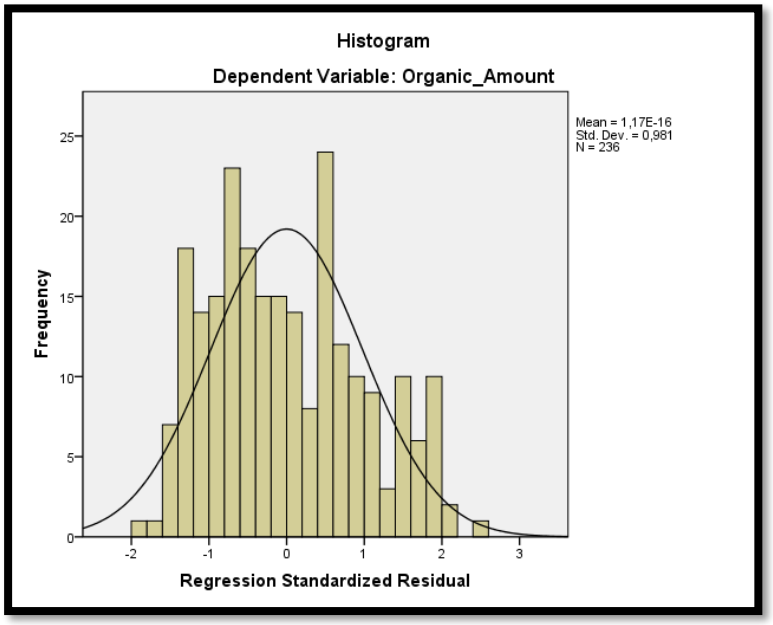


Figure 4.1.6.1 Histogram of the Residual

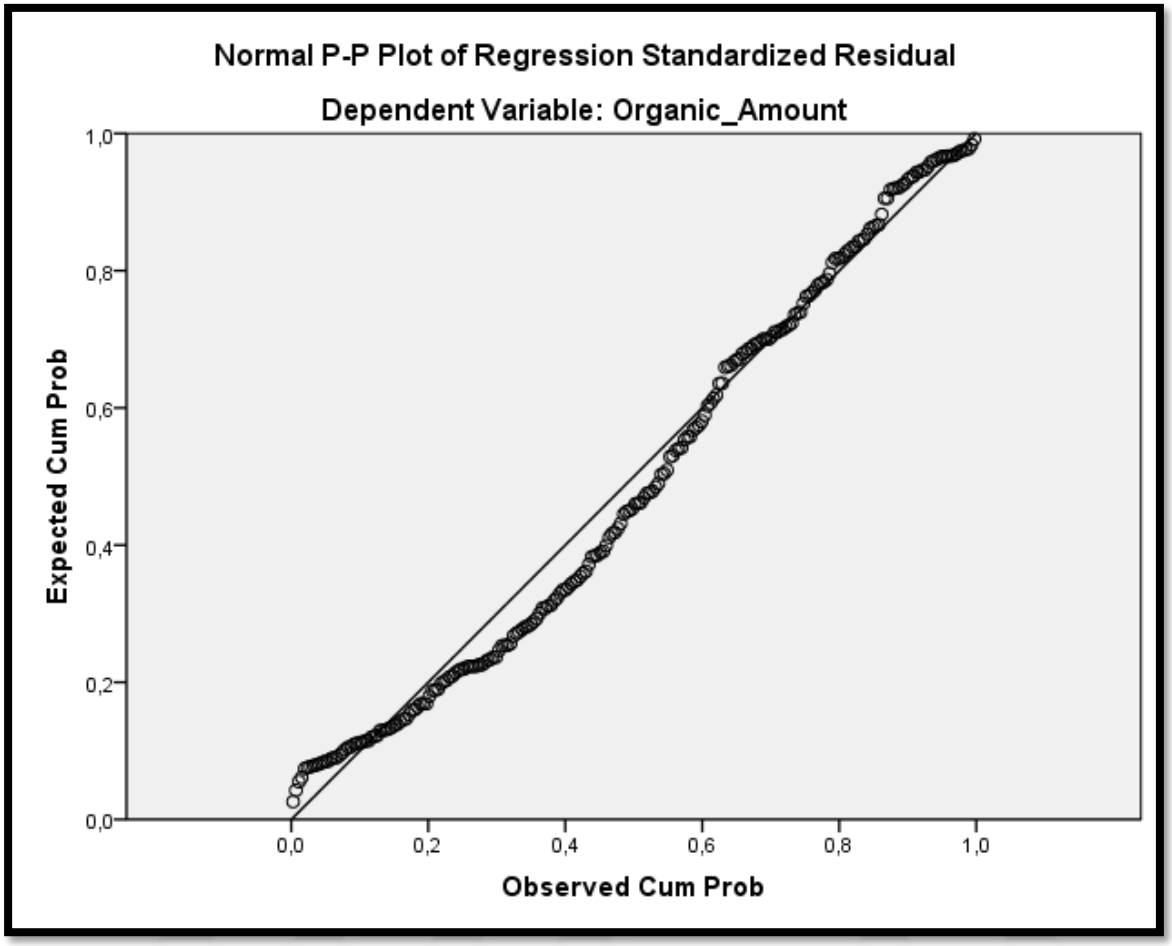


Figure 4.1.6.2 Normal P-P Plot

According to Figure 4.1.1.3, which is more informative than other figures, regression standardized predicted value is established on the X-axis and regression standardized residual is established on the Y-axis. It is expected to see bird's nets in these figures and below figure provides it. This figure helps to understand homoscedasticity and there is no tighter area and it can be said that there is no problem about the homoscedasticity. If the homoscedasticity is available in data, there is a confidence in standard errors associated with Beta weights.

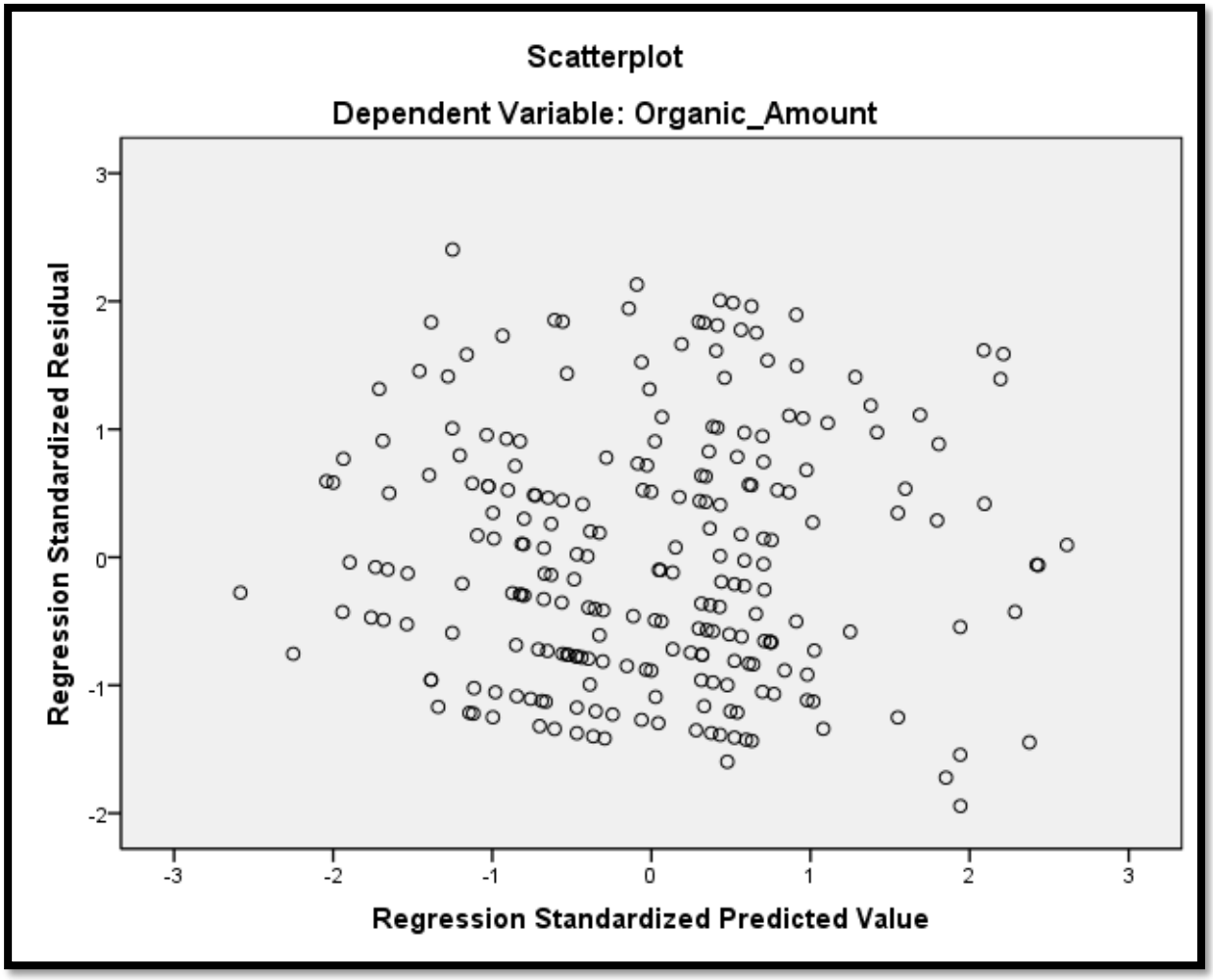


Figure 4.1.6.3 Plot of Regression Standardized

4.1.7 Waste Type – Medical

For this analysis, dependent variable is defined as amount of waste type and independent variables are defined as education level and marital status. As stated in the previous sections, there are some categorical variables and these must have dummy variables to provide solid solution. For the medical amount as it is dependent variable, dummy variables are defined as below.

- Education – Dummy 1, Dummy 2 – Reference is Secondary School
- Marital Status – Dummy 1 – Reference is Single

According to Table 4.1.7.1, correlations that is what the multiple regression is basically based upon and it is a correlation matrix so it is correlations amongst all the variables but most

importantly correlations with the dependent variable. It can be seen that marital status married has the largest positive correlation with medical amount with the 0.307 and next one is the education level highschool. It can be also seen that there are positive inter-correlations amongst the independent variables or predictors, and that is why multiple regression analysis is usefull analysis that it decompeses the unique contributions of each variable as a predictor of medical amount which is hard to do normally. As ıt can be seen that there is no "0" valued inter-correlations amongst the predictors but if there was, benefit of multiple regression cannot be got because each correlation represents the unique capacity.

Table 4.1.7.1. Correlation Between Variables

	Organic_Amount	**High School**	**Bachelor**	**Married**
Organic_Amount	1,000	,184	-,063	,307
High School	,184	1,000	-,872	,083
Bachelor	-,063	-,872	1,000	,087
Married	,307	,083	,087	1,000

According to Table 4.1.7.2, which gives R, R^2, Adjusted R^2 and Std. Error of Estimate. This summary shows that there is 13% variability in medical amount and it is expected to get lower adjusted R^2 because it takes into account sample size to provide accurate representation.

Table 4.1.7.2. Model Summary

R	**R^2**	**Adjusted R^2**	**Std. Error of Estimate**
0.36	0.132	0.042	2.56172

According to Table 4.1.6.3, ANOVA is testing the statistical significance of model at each and there is a p-value higher than 0.05 so it tells those independent variables have not been included in the model with the F-value 1.467 with 3 degrees of freedom.

Table 4.1.7.3. ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	28,871	3	9,624	1,467	,244
Residual	190,310	29	6,562		
Total	219,182	32			

According to Table 4.1.7.4, it can be seen that there are unstandardized Beta weights and Std. Errors which associates with those but generally in economic or finance, standardized Beta weights are used more common. These values show unique contribution of each predictor of dependent variable. From this point, it can be said that education level highschool is more confortable to contributes in equation with the higher Beta weights. Additionaly, all these significance values can be seen in the table. According to results, all predictors have greater value than 0.05 so that these are not statistically significance. However, tolerance values can be seen on the table. These values are unique variance which associated with independent variables. Education level highschool has 20% variance which means in this percentage, it is not counted by other independent variables.

Table 4.1.7.4. Coefficients of Models

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
High School	1,995	2,006	,372	,994	,328	1,995	2,006
Bachelor	1,345	2,101	,240	,640	,527	1,345	2,101
Married	1,365	,985	,255	1,386	,176	1,365	,985

According to Figure 4.1.7.1, there is a nice and normal distribution which shows the associates with the medical amount. Additionaly, Figure 4.1.7.2 shows that there must be hugging of values on the line of least squares. It can be said that line has nearly greates fit.

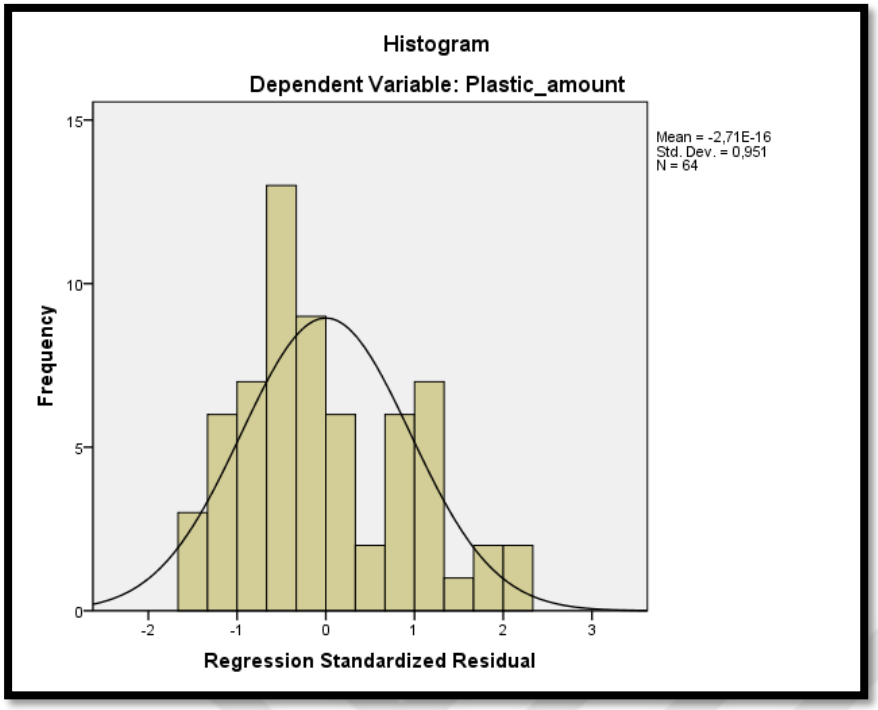


Figure 4.1.7.1 Histogram of the Residual

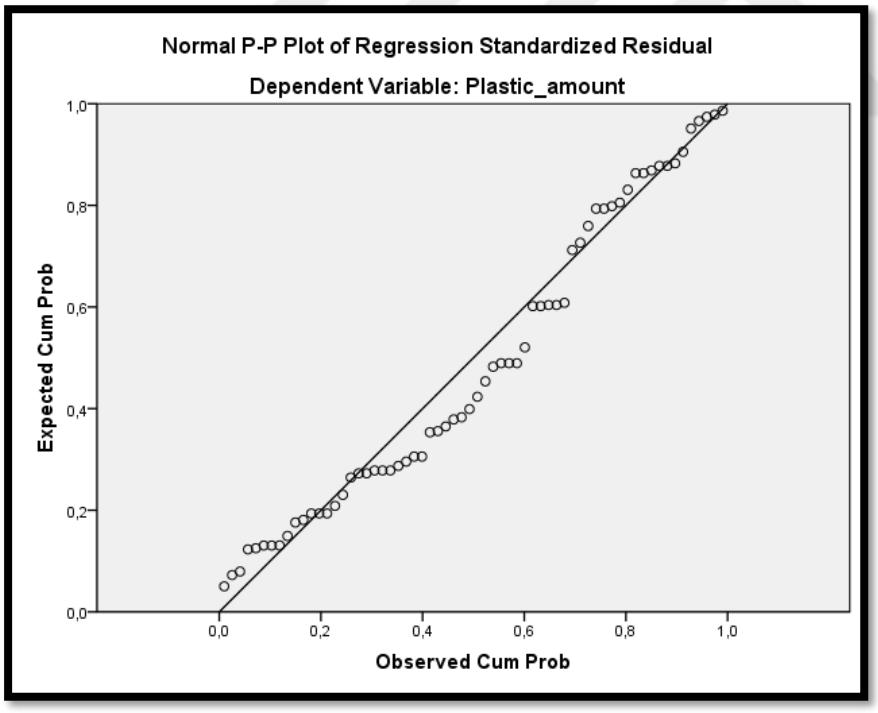


Figure 4.1.7.2 Normal P-P Plot

According to Figure 4.1.7.3, which is more informative than other figures, regression standardized predicted value is established on the X-axis and regression standardized residual is established on the Y-axis. It is expected to see bird's nets in these figures and below figure provides it. This figure helps to understand homoscedasticity and there is no tighter area and it

can be said that there is no problem about the homoscedasticity. If the homoscedasticity is available in data, there is a confidence in standard errors associated with Beta weights.

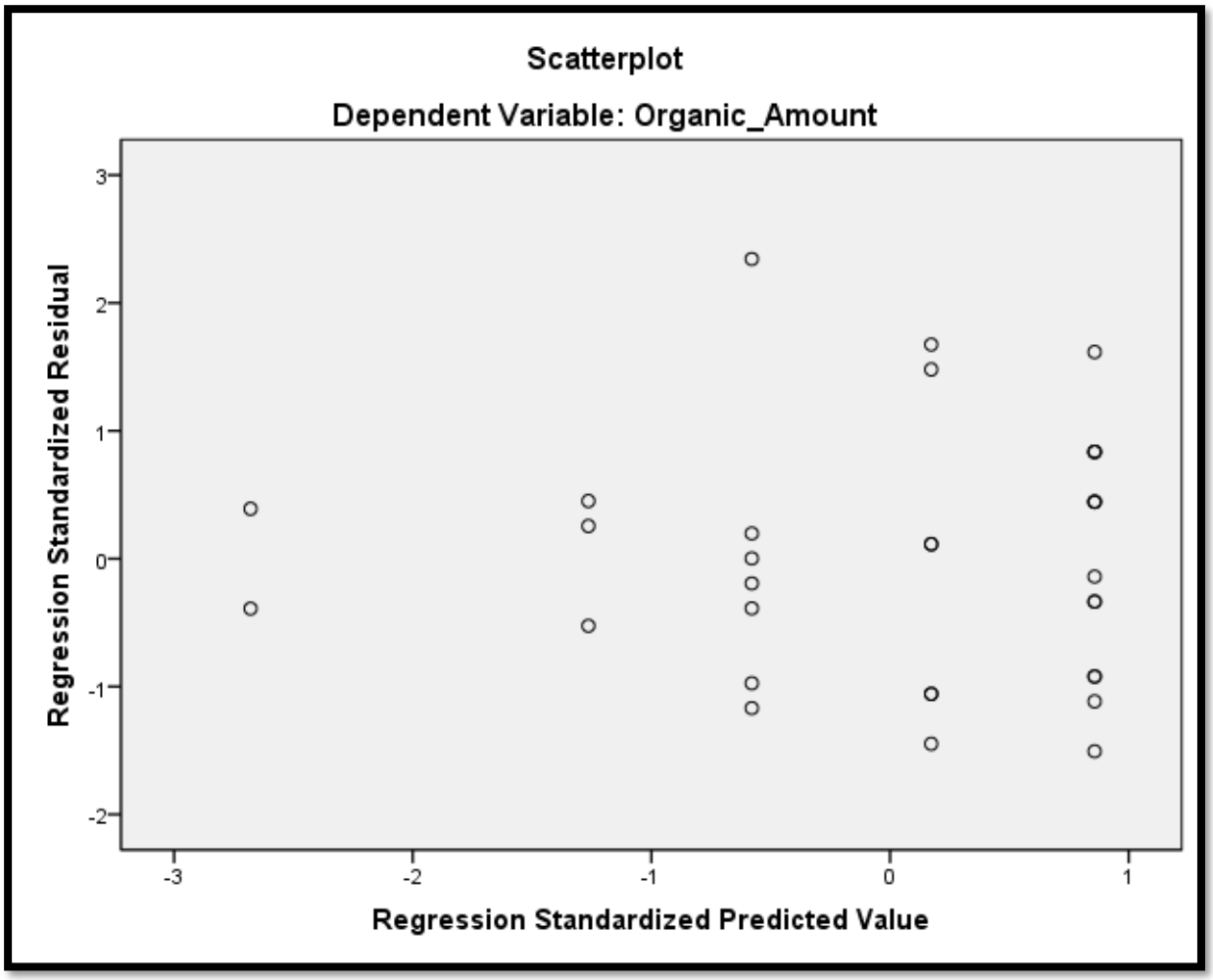


Figure 4.1.7.3 Plot of Regression Standardized

4.2. Logistic Regression Analysis

In the logistic regression analysis, SPSS program is used to understand participation on recycling or waste management system if it is established according to region based.

Table 4.2.1. Case Summary

Included in Analysis	436	100,0
Missing Cases	0	,0
Total	436	100,0

It can be seen from Table 4.2.1, there is no missing data and also it can be seen that reference category is defined “yes” for participation according to Table 4.2.2.

Table 4.2.2. Encoding

Original Value	Internal Value
Yes	0
No	1

According to Table 4.2.3, if there are no predictors in the model and it is just intercept only model which means a null model, there will be an 87% accuracy if it is predicted non-default. 378 people are doing not default and 58 people are doing default with assuming.

Table 4.2.3. Classification Table

Observed		Predicted		
		Participation		Percentage Correct
		Yes	No	
Participation	Yes	378	0	100,0
	No	58	0	,0
Overall Percentage				86,7

According to Table 4.2.4, it is testing the hypothesis and frequency of 58 people and 378 people are statistically different from each other with the lower significance number, it shows that there is an equal number of people within sampling variability. Odds ratio which is Exp(B) is calculated with number of people “no” divided by number of people “yes”.

Table 4.2.4. Variables in the Equation Testing

B	S.E.	Wald	df	Sig.	Exp(B)
-1,874	,141	176,678	1	,000	,153

According to Table 4.2.5, predictive capacity of model can be seen. Negative log likelihood is more accurate than Chi-square in logistic regression studies. Cox and Snell R square is very similar to R^2 value in multiple linear regression but only difference is that this is

not based on least square. But most important one is the Nagelkerke R square which is scale from zero to one because Cox and Snell have maximum 0.75 value. It can be said that 9% variability in the dependent variable is accounted by independent variables.

Table 4.2.5. Model Summary

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
320,805	,047	,087

Accoridng to Table 4.2.6, high school education and income level 0-2500 TL are the only one's variables that are statistically significant. On the other hand, high school education has highest weight of equation which one unit increase 19% increase the pariticipation.

Table 4.2.6. Variables in the Equation

	B	Sig.
Age	-,028	,150
Number_People	,021	,862
Primary	Reference	,110
Secondary	-18,852	,999
High	2,199	,013
Bachelor	,062	,928
Postgrad	,417	,327
Marital Status	,705	,069
Unemp	Reference	,444
Student	-,323	,654
Civil Servant	,048	,943
Private Sector	-,581	,107
0-2500	Reference	,048
2501-5000	-,066	,920
5001-7500	-,172	,754
7501-upper	,822	,121

5. CONCLUSIONS

Household wastes have great impact on public health and in the parallel of it, have effects on economic issues. After the review of different countries related to their development level, it is understood that household waste management is global problem and must be handled globally. However, there are quite differences between countries regarding to their development level. For instance, non-developed countries have no solution and instead of it, developed countries are focusing on improvements. From this point of view, developing countries are playing inevitable role to arrange and control global waste management. This study is focusing on household waste management in Turkey which is considered as one of the developing countries. In Turkey, it is discovered that household waste management is varied between each region and it is not effective because of the lack of participation. To be able to establish a well-developed system, it is crucial that feedbacks from users must be used. Without this information, well-planned system will not have satisfied input. In this study, it is assumed that characteristics of the wastes depends on demographic information and for each country there must be a specific waste management. For this aim, household waste types are analyzed with considering demographic information with the help of survey study. Survey study is taking place between 436 participants. Questions are defined according to current problems of waste management in Turkey. From this point of view, age, education level, income level, number of people in same household, profession and marital status are asked with the most common produced household waste type by its quantity which is defined by EU commission. According to study outcomes, it is found out that different demographic information is effective on different types of wastes. Additionally, it is recognized that number of people in the same household has great impact on plastic waste, besides from it, age and lower income level have significant impact on paper waste type. Marital status married and being a student has great impact on glass waste type. Marital status single is changing ratio of electronic type and age is not effective on it. Additionally, age is effective on metal waste type and there is no relation with education level. Lastly, it is found out that organic waste has relation with mid income level and being student and medical waste types have no relation with the demographic information statistically according to study outcomes. For the participation, it can be seen that with high value of B, when the education level is high school and people have income level in interval 0-2500 TL, have more intent to participate waste management system. There is no big relation between the

participation and other demographic information according to significance values. In the contrary, age has high value significance with the waste management participation. To be able to provide more precise solution, it can be recommended that increasing amount of data of study could provide more precise solutions. According to these descriptions, it is suggested that managers and responsible who are in waste management systems must take actions with the support of briefings and informative sessions to collect each waste type in high volume. Each identified session must be related with the demographic information to be able to get high efficiency.

.

REFERENCES

Alam, M., & Siwar, C. (2015). Waste recycling in Malaysia: Transition from developing to developed country. Jereme, IA, Alam, MM, and Siwar, C, 1-14.

Amasuomo, E., & Baird, J. (2016). The concept of waste and waste Management. J. Mgmt. & Sustainability, 6, 88.

Arzu, A. R. I., & Onder, H. (2013). Farkli veri yapilarinda kullanilabilecek regresyon yöntemleri. Anadolu Tarım Bilimleri Dergisi, 28(3), 168-174.

Balibeyoğlu, J. (1989). Çok Değişkenli Varyans Analizi ve Yazlık Mercimek Kalitesi Üzerine Uygulaması.

Bano, M., & Zowghi, D. (2015). A systematic review on the relationship between user involvement and system success. Information and Software Technology, 58, 148-169.

Bano, M., Zowghi, D., & da Rimini, F. (2017). User satisfaction and system success: an empirical exploration of user involvement in software development. Empirical Software Engineering, 22(5), 2339-2372.

Barles, S. (2014). History of waste management and the social and cultural representations of waste. In The basic environmental history (pp. 199-226). Springer, Cham.

Barnes, T. J. (1998). A history of regression: actors, networks, machines, and numbers. Environment and Planning A, 30(2), 203-223.

Bassi, S. A., Christensen, T. H., & Damgaard, A. (2017). Environmental performance of household waste management in Europe-An example of 7 countries. Waste Management, 69, 545-557.

BEKMEZCİ, H. D., & ÇETİN, H. Kentsel Katı Atıklar ve Geri Kazanımlarının Faydaları; Eskişehir Örneği. Bitlis Eren Üniversitesi Fen Bilimleri Dergisi, 9(3), 1415-1424.

Begum, R. A., Siwar, C., Pereira, J. J., & Jaafar, A. (2006). A Logistic regression analysis of the contractor's awareness regarding waste management. Journal of Applied Sciences, 6(9), 1904-1908.

Berkun, M., Aras, E., & Anılan, T. (2011). Solid waste management practices in Turkey. Journal of Material Cycles and Waste Management, 13(4), 305-313.

Bokhari, R. H. (2005). The relationship between system usage and user satisfaction: a meta-analysis. Journal of Enterprise Information Management.

Chatterjee, S., & Hadi, A. S. (2012). Regression analysis by example. John Wiley & Sons.

Choe, C., & Fraser, I. (1998). The economics of household waste management: a review. Australian Journal of Agricultural and Resource Economics, 42(3), 269-302.

Cramer, J. S. (2002). The origins of logistic regression.

Darban Astane, A. R., & Hajilo, M. (2017). Factors affecting the rural domestic waste generation. Global Journal of Environmental Science and Management, 3(4), 417-426.

Darlington, R. B., & Hayes, A. F. (2016). Regression analysis and linear models: Concepts, applications, and implementation. Guilford Publications.

Durmuş, K. A. Y. A., Eyidoğan, M., Polat, R., & KILIÇ, F. Ç. (2012). The feasibility analysis of household solid waste recycling and an energy production facility installation in technical and economic point of view. Tarım Makinaları Bilimi Dergisi, 8(3), 321-326.

Ertek, T. (1996). Ekonometriye Giriş, Beta Yayınları, 2. Baskı, Istanbul Yayınları.

Fiorillo, D. (2013). Household waste recycling: national survey evidence from Italy. Journal of Environmental Planning and Management, 56(8), 1125-1151.

Ezeudu, O. B., Ozoegwu, C. G., & Madu, C. N. (2019). A statistical regression method for characterization of household solid waste: a case study of Awka municipality in Nigeria. Recycling, 4(1), 1.

Fahrmeir, L., Kneib, T., Lang, S., & Marx, B. (2013). Regression models. In Regression (pp. 21-72). Springer, Berlin, Heidelberg.

Ghaljaie, F., Naderifar, M., & Goli, H. (2017). Snowball sampling: A purposeful method of sampling in qualitative research. Strides in Development of Medical Education, 14(3).

Godfrey, L., & Oelofse, S. (2017). Historical review of waste management and recycling in South Africa. Resources, 6(4), 57.

Gogtay, N. J., Deshpande, S. P., & Thatte, U. M. (2017). Principles of regression analysis. Journal of the Association of Physicians of India, 65(48), 48-52.

Gündüzalp, A. A., & Güven, S. (2016). Atık, çeşitleri, atık yönetimi, geri dönüşüm ve tüketici: Çankaya belediyesi ve semt tüketicileri örneği. Hacettepe Üniversitesi Sosyolojik Araştırmalar E-Dergisi, 9.

Gordon, R. A. (2015). Regression analysis for the social sciences. Routledge.

Grasso, A. C., Olthof, M. R., Boevé, A. J., van Dooren, C., Lähteenmäki, L., & Brouwer, I. A. (2019). Socio-demographic predictors of food waste behavior in Denmark and Spain. Sustainability, 11(12), 3244.

Han, Z., Dan, Z., Shi, G., Shen, L., Xu, W., & Xie, Y. (2015). Characteristics and management of domestic waste in a rural area of the Tibetan Plateau. Journal of the Air & Waste Management Association, 65(11), 1365-1375.

Handayani, D., Gitaharie, B. Y., Yussac, R. N., & Rahmani, R. S. (2018). How does household characteristics influence their waste management? In E3S Web of Conferences (Vol. 74, p. 06005). EDP Sciences.

Japanese ministry of the environment, office of Sound Material-Cycle Society 2014, History and current state of waste management in Japan, viewed 15 October 2017.

Jereme, I., Begum, R., Talib, B., Siwar, C., & Alam, M. (2015). Assessing problems and prospects of solid waste management in Malaysia. Jereme, IA, Siwar, C., Begum, RA, Talib, BA, and Alam, MM, 70-87.

Julius, M., Charles, N., & Mufandaedza, S. (2017). Determinants of willingness to pay for solid waste management in Gweru city, Zimbabwe. Alanya Akademik Bakış, 1(3), 15-21.

Karim, R., & Nawshin, N. Characteristics of Household Solid Waste and its Management Options in the Urban Areas, Jessore, Bangladesh. International Journal of Science and Research (IJSR) Volume, 3, 1519-24.

Kemirtlek, A. (2005). Entegre katı atık yönetimi. İstaç AŞ, İstanbul.

KŘUPKA, J., KNÍŽKOVÁ, I., & KAŠPAROVÁ, M. (2012). Data Analysis of Municipal Solid Waste Models.

Lerner, J., & Lomi, A. (2018). Knowledge categorization affects popularity and quality of Wikipedia articles. PloS one, 13(1), e0190674.

Louis, G. E. AHistorical CONTEXT FOR MUNICIPAL SOLID WASTE MANAGEMENT IN THE UNITED STATES (1850-1980).

Noor, Z. Z. (2016). Towards Sustainable Household Waste Management in Urban Areas: Determinants That Hindered the Recycling Activities in The City of Johor Bahru, Malaysia. Malaysia Sustainable Cities Program, Working Paper Series, 1-20.

Noufal, M., Yuanyuan, L., Maalla, Z., & Adipah, S. (2020). Determinants of Household Solid Waste Generation and Composition in Homs City, Syria. Journal of environmental and public health, 2020.

Metin, M. (2015). Nicel veri toplama araçları. Eğitimde Bilimsel Araştırma Yöntemleri, 2, 161-214.

Olive, D. J. (2017). Multiple linear regression. In Linear regression (pp. 17-83). Springer, Cham.

Roback, P., & Legler, J. (2021). Beyond multiple linear regression: Applied generalized linear models and multilevel models in R. CRC Press.

Rybova, K. (2019). Do sociodemographic characteristics in waste management matter? Case study of recyclable generation in the Czech Republic. Sustainability, 11(7), 2030.

Shams, S., & Ibrahimu, C. (2003). Household waste recovery and recycling: a case study of Kigoma-Ujiji, Tanzania. International Journal of Environment and Sustainable Development, 2(4), 412-424.

Shahzad, U. (2015). Global warming: Causes, effects and solutions. Durreesamin Journal, 1(4), 1-7.

Singh, J., Laurenti, R., Sinha, R., & Frostell, B. (2014). Progress and challenges to the global waste management system. Waste Management & Research, 32(9), 800-812.

Smol, M., Duda, J., Czaplicka-Kotas, A., & Szołdrowska, D. (2020). Transformation towards Circular Economy (CE) in Municipal Waste Management System: Model Solutions for Poland. Sustainability, 12(11), 4561.

Solano Meza, J. K., Rodrigo-Ilarri, J., Romero Hernández, C. P., & Rodrigo-Clavero, M. (2020). Analytical methodology for the identification of critical zones on the generation of solid

waste in large urban areas. International journal of environmental research and public health, 17(4), 1196.

Strydom, W. F. (2018). Barriers to household waste recycling: Empirical evidence from South Africa. Recycling, 3(3), 41.

Szumilas, M. (2010). Explaining odds ratios. Journal of the Canadian academy of child and adolescent psychiatry, 19(3), 227.

Tan, Ş., (2009). Öğretimde Ölçme Değerlendirme KPSS El Kitabı, Pegema Yayıncılık, Ankara.

Tonini, D., Albizzati, P. F., & Astrup, T. F. (2018). Environmental impacts of food waste: Learnings and challenges from a case study on UK. Waste Management, 76, 744-766.

Vergne, J. P., & Wry, T. (2014). Categorizing categorization research: Review, integration, and future directions. Journal of Management Studies, 51(1), 56-94.

Verma, A., Kumar, A., & Singh, N. B. (2019). Application of Multi Linear Model for Forecasting Municipal Solid Waste Generation in Lucknow City: A Case Study. Current World Environment, 14(3), 421.

Wong, E. Y., & Tate, G. (1994). A study of user participation in information systems development. Journal of Information Technology, 9(1), 51-60.

Yilmaz, A., & Bozkurt, Y. (2010). TÜRKİYE'DE KENTSEL KATIATIK YÖNETİMİ UYGULAMALARI VE KÜTAHYA KATIATIK BİRLİGİ (KÜKAB) ÖRNEĞİ. Suleyman Demirel University Journal of Faculty of Economics & Administrative Sciences, 15(1).

Yoada, R. M., Chirawurah, D., & Adongo, P. B. (2014). Domestic waste disposal practice and perceptions of private sector waste management in urban Accra. BMC public health, 14(1), 1-10.

Yu, C. (2010). A Study on Students' Categorizing Abilities and the Implications for Vocabulary Teaching in a Private Training School in China.

Zakariya, N. I., & Kahn, M. T. E. (2014). Benefits and biological effects of ionizing radiation. Sch. Acad. J. Biosci, 2(9), 583-591.

CURRICULUM VITAE

Education

Adana Science and Technology University/Turkey
Business Administration/M.BA
GPA: 3.44

Middle East Technical University/Turkey
Mechanical Engineering/B.SC
Date of Graduation: June 2017
Graduation Project: Soil Quality Mapping Robot for graduation project which is supported by CNH Industrial with 4000 TL+VAT. Aim of this project was reporting soil quality (Moisture, temperature, PH) autonomously with the GPS connection to defined driver computer.
GPA: 2.20

Work Experience

TEMSA Ulaşım Araçları Ticaret ve Sanayi A.Ş
Adana/Turkey
Procurement Engineer
January 2019 – Current

MAN Türkiye A.Ş
Ankara/Turkey
Purchasing Engineer
July 2017 – October 2018