DOKUZ EYLÜL UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

INVENTORY OF INDUSTRIAL PACKAGING WASTES IN IZMIR CITY

by

Fatma Esra GENÇ

March, 2011

İZMİR

INVENTORY OF INDUSTRIAL PACKAGING WASTES IN IZMIR CITY

A Thesis Submitted to the
Graduate School of Natural and Applied Sciences of Dokuz Eylül University
In Partial Fulfillment of the Requirements for The Degree of Master of Science
in Environmental Engineering, Applied Environmental Program

by

Fatma Esra GENÇ

March, 2011
İZMİR

M.Sc THESIS EXAMINATION RESULT FORM

We have read the thesis entitled **"INVENTORY OF INDUSTRIAL PACKAGING WASTES IN İZMİR CITY"** completed by **FATMA ESRA GENÇ** under supervision of **ASIST. PROF. DR. GÖRKEM AKINCI** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

Asist. Prof. Dr. Görkem AKINCI
Supervisor

Prof. Dr. Davut ÖZDAĞLAR
(Jury Member)

Prof. Dr. Turgay Onaygil
(Jury Member)

Prof.Dr. Mustafa SABUNCU
Director
Graduate School of Natural and Applied Sciences

ACKNOWLEDGMENTS

I would like to express my sincere appreciation to my supervisor Asist. Prof. Dr. Görkem AKINCI, for her patience, guidance, encouragement, and invaluable suggestions. I am particularly grateful for her understanding during this study.

I would also like to sincerely thank Mr. Alp Ertunga ARDENİZ, General Manager in ATKASAN A.Ş. for sharing his precious knowledge with me, assistance, advices and supports whenever I needed.

I am grateful to Mr. Ali MANCAR who is the General Manager of KASTAŞ A.Ş. and İZGEP for his supports and motivation during my study. And, I would like to thank İZGEP as well.

I am greatly thankful to my family, without their support, encourament and endless understanding, this work could not have been produced. My deepest appeciation goes to my valuable parents Mrs. and Mr. GENÇ for their sacrifices which help me to continue and improve my life.

Environmental Engineer
Fatma Esra GENÇ

INVENTORY OF INDUSTRIAL PACKAGING WASTES IN İZMİR CITY

ABSTRACT

Significant legislative acts have been passed involving environmental issues in particular within the process of Turkey's candidation for EU, one of which is packaging waste control and management. For the purpose concerned, studies have been accelerated involving methods and bases established within the context of Regulation of Packaging Waste Control issued by The Ministry Environment and Forestry. The biggest problem is that there is not any sufficient inventory concerning packaging waste control.

The study has examined Waste Management Action Plan in 2008-2012 prepared by The Ministry of Environment and Forestry as well as regulations on packaging waste control in Europe and Turkey. Waste Management Action Plan is of great importance in determining the present status covering the waste management in Turkey, considering which a prediction has been made on inventory of packaging waste likely to appear in province of Izmir. In doing so, annual amounts and types of packaging waste produced and sales on output of industries in different sectors have been taken into account.

The study has managed to achieve annual packaging waste amounts likely to be caused by 81 industries in nine different sectors in Izmir Metropolitan Area and their percentile break downs based on data obtained.

Keywords : Recovery, Packaking Wastes caused by sectoral industies, Izmir Metropolitan Area, Waste management action plan.

İZMİR KENTİ ENDÜSTRİYEL AMBALAJ ATIĞI ENVANTERİ

ÖZ

Avrupa Birliği uyum sürecinde, Türkiye'de özellikle çevre konularında önemli yasal düzenlemeler yapılmıştır. Ambalaj atıklarının kontrolü ve yönetimi bu yasal düzenlemelerden biridir. Bu amaçla, Çevre ve Orman Bakanlığı tarafından yayınlanan Ambalaj Atıklarının Kontrolü Yönetmeliği çerçevesinde belirlenen usul ve esaslara gore yapılan çalışmalar Türkiye genelinde hızla devam etmektedir. Ambalaj atıklarının kontrolündeki en büyük sıkıntı yeterli envanterin olmamasıdır.

Bu çalışmada, Ambalaj Atıklarınınn Kontrolü'ne ilişkin Avrupa'da ve Türkiye'de yayınlanan ve uygulanan mevzuatlar ile Çevre ve Orman Bakanlığı tarafından hazırlanan 2008-2012 yıllarını kapsayan Atık Yönetim Eylem Planı incelenmiştir. Atik Yönetim Eylem Planı, Türkiye'deki atık yönetimine ilişkin mevcut durumun belirlenmesi açısından önem taşımaktadır. Bu bilgilerden yararlanılarak, İzmir ilinde oluşabilecek sanayi kaynaklı ambalaj atık envanteri için öngörü yapılmıştır. Öngörü yapılırken, farklı sektörlerdeki sanayi kuruluşlarının yıllık ürettikleri ambalaj atık miktarı ve türleri ile yıllık üretimden satış miktarları dikkate alınmıştır.

Bu çalışmayla, elde edilen bulgular çerçevesinde İzmir Metropol Alan içerinde yer alan dokuz farklı sektördeki 81 sanayi kuruluşlarından kaynaklanabilecek yıllık muhtemel ambalaj atığı miktarı ve bu atıkların cinslerine gore yüzdelik dağılımına ulaşılmıştır.

Anahtar sözcükler: Geri kazanım, Sanayi kaynaklı ambalaj atığı, İzmir Metropolitan Alan, Atık yönetim eylem planı.

CONTENTS

Page

THESIS EXAMINATION RESULT FORM ii
ACKNOWLEDGEMENTS iii
ABSTRACT iv
ÖZ v

CHAPTER ONE – INTRODUCTION 1

CHAPTER TWO – LEGISLATION CORRESPONDS WITH THE SOLID WASTES 4
2.1 Legislation on Wastes 4
2.2 Waste Management Policy in EU 4
2.2.1 Directive 94/62/EC on Packaging and Packaging Waste 7
2.3 Waste Management Policy in Turkey 8
2.3.1 Regulation on Control of Packaking Waste 9
2.3.1.1 The Purpose of Regulation 12
2.3.1.2 Responsible Parties 12
2.3.1.3 Packaging Waste Management Plan 18
2.3.1.4 Targets of Recycling 18
2.3.1.5 Demand for Finance 20
2.3.1.6 Data Recording System 21
2.3.1.7 The Patway to Achive the Established Targets 24

CHAPTER THREE - MATERIAL AND METHOD 25

CHAPTER FOUR – RESULT AND DISCUSSION 29
4.1 Glass & Ceramics Industries 29
4.2 Food Processing Industries 33
4.3 Vegatable Oil Industries 39

4.4 Beverages Industries..... 43
4.5 Chemistry and Chemicals Production Industries 48
4.6 Petroleum Industries..... 52
4.7 Iron & Steel Industries 57
4.8 Automotive Industries 62
4.9 Tobacco Industries 66
4.10 Total Potantial Amount of Packaging Waste Produced by the the Indusries in Izmir 71

CHAPTER FIVE – CONCLUSION 74

REFERENCES..... 75

CHAPTER ONE
INTRODUCTION

Over consumption of raw material, power, water and food stuffs caused by uncontrollable growth of human population, accelarated industries and increased human activities have accounted for undesirable production of wastes, with uncontrolable piles of wastes severely affecting the environment. On the other hand, although natural sources suffice for mankind, they are by no means endless. Studies have constantly been made concerning waste management to create sustainable environmental conditions.

Within the context of waste management in Turkey, significant steps have been taken for the matter involved. Management of solid wastes is the whole series of processes involving most efficient use of natural sources such as power and raw material and collection, transportation, recycling and elimination of wastes without disturbing natural echo system and urban living, which is an important field of activity closely intertwined with technical, economic and social disciplines in which individuals and private/public institutions should be given numerous resposibilities.

In Turkey, twelve regulations and four bulletins have been prepared within the frame of the Law of Environment and accordingly five basic headings of wastes such as domestic, specific, hazardous, undangerous and packaging processes have been decided to manage, follow and control. Of such wastes, domestic and medical processes and their related requirements are managed by municipalities, where as group of wastes such as packaging items, discarded oils, batteries and accumulators, as well as end of lifes vehicles is to collected, recycled and disposed of under the principle of consumers responsibility.

Studies and reports concerning regulations of wastes in Turkey have significantly been completed and adopted as a fundamental principle for the process of adjustment of Turkey to the membership of EU, according to which the present situation related to waste regulation for the matter involved is as follows in Table 1.1 (Erdem, 2009).

Table 1.1 Regulation on wastes in EU & Turkey

Regulation in EU	Regulation in Turkey
Directive 75/442/EC on Waste (Waste Framework Direvtive)	05.07.2008 Regulation on General Priciples for Waste Management
Directive 2000/532 The Commission of the Europan Communities	
Directive 91/689/EEC on Hazardous Waste	14.03.2005 Regulation on Control of Hazardous Waste
Directive 94/62/EC on Packaging and Packaging Waste	25.06.2007 Regulation on Control of Packaging Waste
Directive 2000/76/EC on the Incineration of Waste	06.10.2010 Regulation on Incineration Waste
Directive 99/31/EC on Landfill of Waste	26.03.2010 Regulation on Landfill of Waste
Directive 75/439/EEC & Directive 87/101/EEC on the Disposal Waste Oils	30.07.2008 Regulation on Conrtol of Oil Waste
Directive 96/59/EC on the Disposal PCB and PCT Waste	27.12.2009 Regulation on Control of PCB and PCT Wastes
Directive 93/86/EC ve 98/101/EC ve 91/157/EEC on Batteries and Accumulators Containing Certain Dangerous Substances	31.08.2004 Regulation on Control of on Batteries and Accumulators
Regulation 259/93/EECon the Supervision and Conrol of Shipments of Waste	Planned to be issued in the years to come
Directive 2000/53/EC on End of Life Vehicles	30.12.2009 Regulation on Control of End of Life Vehicles
Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment	30.05.2008 Regulation on the restriction of the use of certain hazardous substances in electrical and electronic equipment
Directive 2002/96/EC on Waste Electrical and Electronic Equipment	Regulation on Control of Waste Electrical and Electronic Equipment
Directive 98/98/EC on Waste	Planned to be adjusted in 2014.

Thanks to experiences gained in the collecting and recycling packaging waste, 30 July 2004 dated and 25538 numbered Regulation of Packaging and Related Wastes Control has been issued for the first time and therefore a new period started on the management of packaging waste to create a sound collecting and recycling system with in the frame of adjustment to packaging directives for EU.

The regulation was operated for about 2.5 years. Problems and troubles were experienced on the matters of separate collection of wastes in origin, sharing responsibilities, marking packaging items, formats and codes of information on packaging quantities and filling them licence criteria management plans for packaging wastes and etc. In addition, it was found that, 94/62/EC Numbered

Packaging and Packaging Wastes Directive contrasted with the concerned regulation in terms of some parameters which failed to be adjustable to the process of EU member ship and they should be made adjustable. Therefore, the Regulation on Packaging Waste Control was reissued in the 26562 Numbered Official Gazzette on 24 June 2007 and introduced.

A sound and sustainable management system requires recyclable wastes to be collected in origin without being mixed with other wastes and recycled in an organised structure. Therefore, reduction of wastes likely to be transported to the landfill and recycling of wastes into raw material for the present economic structure can be realized. For this purpose, the regulation requires that packaging wastes should be separated in origin or prior to being processed into landfill which therefore enabled a system to be established for the purpose involved.

In this context, the collection and sorting of packaging waste in Izmir and Izmir Great Municipality for the coordination of the district municipalities, eight Collection Sorting Facilities in Izmir and the protocol was signed on November 30, 2007 between Çevko Foundation and the above (Packaging Waste Management Plan of The Great Municipality of Izmir, 2008). Izmir Metropolitan Municipality located within the boundaries defined by regulation to producers of packaging waste, packaging waste is collected separately from the source. One of the difficulties in implementing the Regulation on Packaging Waste Control of the lack of sufficient inventory data.

The aim of this study is to examine recycling processes made within İzmir Metropolitan Area in order to examplify developments in the management of packaging wastes caused by sectoral industrials in Turkey and inspect method to eliminate wastes therefrom within the frame of adaptive developments of Turkey to European Union.

CHAPTER TWO
LEGISLATION CONSISTENT WITH THE SOLID WASTES

2.1 Legislation on Wastes

Legislation plays a significant part to establish quality of life in any given community. Therefore, people have universally prepared a variety of laws and acts to radically or partially find solutions to the problem of increased solid wastes.

Developments in livelihood and thus social progresses on earth have inevitably brought about many problems such as overpopulation, decreased natural sources, increased consumption of fosil fuels and management of undesirably increased wastes as well as related environmental problems. Much of wastes is uncontrollably dumped into urban and natural surroundings such as rivers, sea and lakes without considering any radical measures involving quality and quantity of discharges.

Hierarchies and legislation concerning solid wastes management are usually established to define significant items / articles of such plans and procedures. The general waste-related legislation billed and passed by industrialised nations consists of the following:

- Reduction
- Reusing
- Recycling
- Recovery
- Disposal

2.2 Waste Management Policy of EU

As European society has grown wealthier it has created more and more rubbish. Each year the European Union alone throws away 3 billion tonnes of waste, some 90 million tonnes of which is hazardous. This amounts to about 6 tonnes of solid waste

for every man, woman and child, according to Eurostat statistics. It is clear that treating and disposing of all such material - without harming the environment - becomes a major headache (Europan Comission, 2010).

Between 1990 and 1995, the amount of waste generated in Europe increased by 10%, according to the Organisation for Economic Cooperation and Development (OECD). Most of what we throw away is either burnt in incinerators, or dumped into landfill sites (67%). But both these methods create environmental damage. Landfilling not only takes up more and more valuable land space also causes pollution of air, water and soil, discharging carbon dioxide (CO_2) and methane (CH_4) into the atmosphere and chemicals and pesticides into the earth and groundwater. This in turn is harmful to human health, as well as to plants and animals (Europan Comission, 2010).

By 2020, OECD estimates that we could be generating 45% more waste than we did in 1995. Obviously we must reverse this trend if we are to avoid being submerged in rubbish. But the picture is not all gloomy. The EU's Sixth Environment Action Programme identifies waste prevention and management as one of the four top priorities. Its primary objective is to decouple waste generation from economic activity so that EU growth will no longer lead to more and more rubbish, and there are signs that this is beginning to happen. In Germany and the Netherlands, for example, municipal waste generation fell during the 1990s (Europan Comission, (2010).

The EU is seeking a significant cut in the amount of rubbish generated, through new waste prevention initiatives, better use of resources, and encouraging a shift to more sustainable consumption patterns.

The European Union's approach to waste management is based on three principles:

- **Waste prevention**: This is a key factor in any waste management strategy. If we can reduce the amount of waste generated in the first place and reduce its hazardousness by reducing the presence of dangerous substances in products, then disposing of it will automatically become simpler. Waste prevention is closely associated with improving manufacturing methods and encouraging consumers to demand greener products and less packaging.

- **Recycling and reuse**: If waste cannot be prevented, as many of the materials as possible should be recovered, preferably by recycling. The European Commission has defined several specific 'waste streams' for priority attention, the aim being to reduce their overall environmental impact, which includes packaging waste, end-of-life vehicles, batteries, electrical and electronic waste. EU directives now require Member States to introduce legislation on waste collection, reuse, recycling and disposal of these waste streams. Several EU countries are already managing to recycle over 50% of packaging waste.

- **Improving final disposal and monitoring**: Where possible, waste that cannot be recycled or reused should safely be incinerated, with landfill being only used as the last resort. Both methods need close monitoring because of their potential for causing severe environmental damage. The EU has recently approved a directive setting strict guidelines for landfill management, banning certain types of waste, such as used tyres and setting targets for reducing quantities of biodegradable rubbish. Another recent directive lays down tough limits on emission levels from incinerators. The Union also wants to reduce emissions of dioxins and acid gases such as nitrogen oxides (NO_x), sulphur dioxides (SO_2), and hydrogen chlorides (HCL), which can be harmful to human health.

As part of a serial of measures to improve the sustainability of solid waste management, several directives are prepared to introduce requirements on EU member states. To achive this objective, directives have introduced targets for reducing the amount of solid waste disposed of to landfills.

Relevant direvtives for solid wastes in EU are as follows:

a. Directive 75/442/EEC on Waste (Waste Framework Direvtive)
b. Directive 94/62/EC on Packaging and Packaging Waste
c. Directive 2004/12/EC Amending Directive 94/62/EC on Packaging and Packaging Waste
d. Directive 2000/76/EC on The Incineration of Waste
e. Directive 1999/31/EC on the Landfill of Waste
f. Directive 91/157/EEC on Batteries and Accumulators Containing Certain Dangerous Substances
g. Directive 91/689/EEC on Hazardous Waste, as Amended by Directive 94/31/EC
h. Directive 2002/96/EC on Waste Electrical and Electronic Equipment

2.2.1 Directive 94/62/EC on Packaging and Packaging Waste

The EU first introduced measures on the management of packaging waste in the early 1980s. Directive 85/339/EEC covered the packaging of liquid beverage containers intended for human consumption only but it was too vague to bring about the effective harmonisation of national policies. As a consequence, diverging national legislation appeared in several Member States (Europan Comission, 2010).

Only some EU Member States introduced measures on packaging and packaging waste management with a view to reducing their environmental impacts. Serious Internal Market problems arose when cheap secondary materials from countries with recycling schemes that provided funding for collection and recycling appeared on the markets of other Member States where no such schemes were in place. Collection and recycling activities that relied on cost of recovery through the sale of secondary raw material were threatened by collapse (Europan Comission, 2010).

For such reasons, economic operators and Member States approached the Commission to introduce comprehensive legislation on packaging. In 1992, the Commission came forward with a Proposal for a Council Directive on Packaging and

Packaging Waste. Following a prolonged discussion in the European Parliament and the Council of Ministers, Directive 94/62/EC was adopted.

This Directive aims to harmonise national measures in order to prevent or reduce the impact of packaging and packaging waste on the environment and ensure the functioning of the Internal Market. It contains provisions on the prevention of packaging waste, the re-use of packaging and on the recovery and recycling of packaging waste.

In 2004, the Directive was reviewed to provide criteria clarifying the definition of the term 'packaging' and increase the targets for recovery and recycling of packaging waste. In 2005, the Directive was revised again to allow new Member States to have transitional periods for attaining the recovery and recycling targets.

2.3 Waste Management in Turkey

Turkey began addresing environmental concerns during the 1970s. In 1978 the Prime Ministry Undersecretariat for Environmental was founded as an extension of a state ministry responsible for the coordination of all national and international activities concerning the environment. The Undersecretariat was the institution expected to set Environmental policy, coordinate and prepare regulations, and cooperate with other ministries.

Relevant directives for solid wastes in Turkey are as follows:

a. Law on Environment, Numbered 2872
   (Offical Gazzette on 11 August 1983)
b. Law on Great Municipalities, Numbered 5216
   (Offical Gazzette on 10 July 2004)
c. Law on Municipalities, Numbered 5393
   (Official Gazzette on 3 July 2005)
d. Regulation on General Principles for Waste Management
   (Offical Gazzette on 05 July 2008)

e. Regulation on Control of Solid Waste
   (Official Gazzette on 14 March 1991)
f. Regulation on Control of Packaging and Packaging Waste
   (Official Gazzette on 30 July 2004)
   Regulation on Control of Packaging Waste (Official Gazzette on 24 June 2007)
g. Regulation on Control of Hazardous Waste
   (Offical Gazzette on 14 March 2005)
h. Regulation on Control of Medical Waste
   (Offical Gazzette on 22 July 2005)
i. Regulation on the Control of Spent Batteries and Acculmulators
   (Offical Gazzette on 31 August 2004)
j. Regulation on Construction and Demolotion Waste
   (Offical Gazzette on 18 March 2004)
k. Regulation on Control of Wasted Oil
   (Offical Gazzette on 30 July 2008)
l. Regulation on Conrtol of Vegetable Oil Waste
   (Offical Gazzette on 19 April 2005)

2.3.1 Regulation on Control of Packaking Waste

Table 2.1 presents historical order of the laws and regulations involving power, authority and responsibilities on management of packaging wastes in Turkey. Law of Environment, numbered 2872, put into force in 1983 and its amendment in 2006 requires that wastes of packaging should be collected and processed separately from the sources of discharge. Article 11 of the related law establishes that it is essential for wastes to be recycled and separately collected where they have been discharged. Responsibilities for wastes to be collected are shared in the act of Great Municipality (2004) and that of Municipalities (2005), according to which it is municipalities that are in charge of collection and elimination of wastes. However, within the context of the regulation concerned, municipalities are assigned to collect wastes while great municipalities are supposed to dispose of them (Waste Management Action Plan 2008-2012).

Table 2.1 Regulation on management of packaging wastes

YEAR	LAW / REGULATION
1983	Law of Environment
2004	Law of Great Municipalities
2005	Law of Municipalities
1991	Regulation on Solid Waste Control
2004	Regulation on Packaging and Packaging Waste Control
2007	Regulation on Packaging Waste Control

Regulations issued in 1991, 2004, and 2007 by the Ministry of Environment and Forestry considered the matter of management of packaging wastes. The Regulation of Solid Waste Control for the first time dealt with packaging wastes in 1991. Packaging wastes were excluded from Regulation of Solid Waste Control and included in Regulation on Packaging and Packaging Waste Control in 2004, thus being again revised into what it is now in 2007.

Table 2.2 illustrates the studies and attempts made and assessed according to the regulation involved. Figure 2.1 shows amounts of packaging waste introduced, what is to be collected and what is to be recycled from disposals as well as their variations of quantities in packaging wastes according to years. Therefore, 128483 tonnes of packaging was introduced into market in 1992, from which 60634 tonnes was recycled. From 1992 to 2004 packaging wastes of 1220228 tonnes was collected and recyled (Waste Management Action Plan, 2008-2012).

Table 2.2 Quantities of recycled packaging wastes from 1992 to 2007

Years	Amount of Packaging Waste Introduced (ton)	Target (ton)	Amount of Packaging Waste Recycled (ton)
1992	128.462	30.969	60.634
1993	143.192	47.628	72.704
1994	174.571	75.620	58.799
1995	187.654	80.846	55.818
1996	223.015	89.931	71.221
1997	251.444	92.777	98.525
1998	287.405	94.334	91.232
1999	328.070	106.136	92.409
2000	335.231	107.488	110.558
2001	347.382	100.061	117.943
2002	366.875	106.005	130.525
2003	401.646	123.284	123.740
2004	440.826	137.192	136.120
2005	1.496.316	198.804	718.392
2006	1.474.829	219.206	1.378.412
2007	1.712.585	532.776	2.472.325

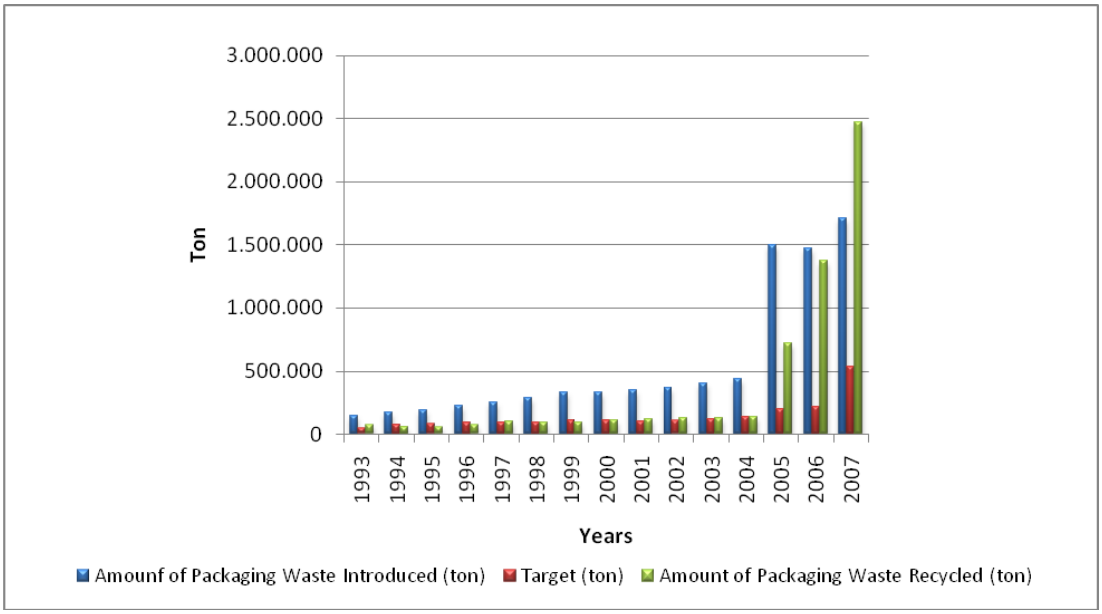

Figure 2.1 Quantities of packaging wastes introduced and recycled between 1992 and 2004

2.3.1.1 The Purpose of Regulation

Regulation of Packaging Waste Control establishes methods and bases concerning packaging waste management. The purpose of regulation is to determine legal administrative/managerial and technical parameters as well as principles, policies and programs necessary to establish technical and administrative standards on collecting separately, transporting and sorting packaging wastes according to a given system and reducing amounts of wastes to be disposed of through recycling and reusing discharges unlikely to be prevented, stopping potential damages of wastes to environment, formation and accumulation of disposals and producing specified packaging material for the matter involved.

2.3.1.2 Responsible Parties

As seen in Figure 2.2, there are ten share holders in the regulation. Their successive responsibilities to one another, which can be briefly stated as follows:

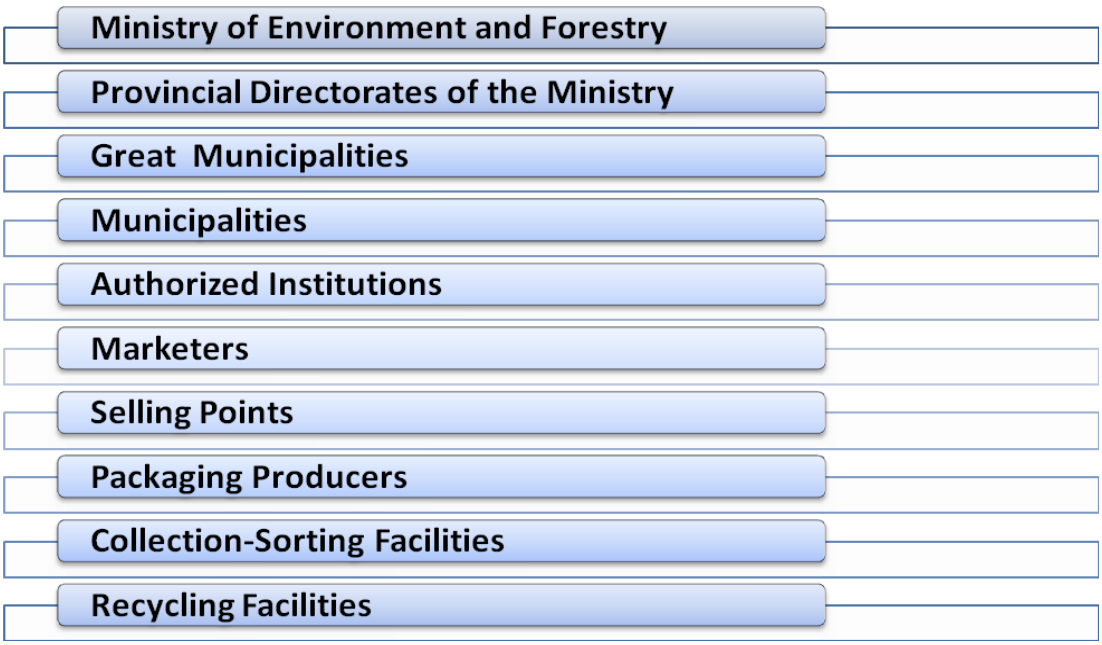

Figure 2.2 Responsible parties

a. Ministry

- To determine the program and policies with regard to the collection, reuse, recycling, recovery and disposal of package wastes; to ensure cooperation and coordination as regards the implementation of this Regulation; to take administrative precautions; to issue notifications, if needed; to carry out necessary audits.

- To determine recycling/recovery targets of package wastes in general and material terms.

- To define the principles as regards the authorization of institutions/organizations that will carry out the collection, reuse, recycling and recovery activities on behalf of the economic enterprises, which are held responsible in this regulation; to evaluate the applications to be made in this regard and to authorize if deemed appropriate; to audit the authorized institutions, to ensure application of necessary sanction in case of contradictions with the relevant regulations and to terminate the authorization, if necessary.

- To grant pre-licenses, temporary working permits and licenses and to renew the license to the recovery facilities; to audit their activities; to ensure application of necessary sanction in case of contradictions with the relevant regulations and if necessary, to terminate the pre-license, temporary working permit and license.

- To assign code numbers to be written on the packages marketed.

- To call the package commission to meet when necessary, to chair the commission and to carry out the secretariat procedures.

- To inspect documents to be submitted to the Ministry by the enterprises, which are responsible to do so within the scope of this regulation.

- To encourage the use of recycled products.

b. Provincial Directorates of the Ministry

- To coordinate between municipilaties, introducers and authorised institutions in order to collect packaging wastes from where they have just been dumped.

- To supervise if the collection works have been made according to packaging waste management plan or not where the wastes concerned are started to be collected as defined by the regulation and impose administrative sanctions where they are not done so or otherwise done.

- To certify and supervise those facilities and plants to collect, sort and recycle the related wastes.

c. Great Municipilaties

- To take necessary steps for packaging wastes not to be accepted into landfills.

- To coordinate works done by local municipilaties.

- To support activities and procedures conducted according to packaging waste management plan prepared by local municipilaties.

d. Municipilaties

- To collect packaging wastes or have them collected separately.

- To prepare packaging waste management plans in coordination with certified companies, marketers and or authorised institutions for packaging waste to be separately collected in origin and submit them to the related ministry.

- To take necessary measures lest packaging wastes be loaded into domestic waste collecting trucks.

- To supervise if the collection works have been made according to packaging waste management plan or not where the wastes concerned are started to be collected as defined by the regulation and impose administrative sanctions where they are not done so or otherwise done.

- To support activities of collection in origin conducted by contracted and authorised companies in such matters as provision of collecting devices, staff and equipment and similar admistrative and technical issues.

e. Packaging Producers

- To manifacture packaging materials to disturb environment and create wastes in the least way.

- To design, produce and introduce packaging material in a way to reuse, recover and recycle it.

- To organise training and education activities to inform consumers on the matter within the frame of packaging waste management plan.

f. Marketers

- To use packaging materials to create the least waste and to be most available for reutility and recycling.

- To be responsible for the related ministry to be informed on quantity and quality of packaging material introduced into market every year.

- To take code and password from the ministry for reports to be sent.

- To establish recycling targets stated in the regulation.

- To undersign contracts with municipalities and certified/authorised companies for packaging wastes introduced into market to separately collected in origin to achieve the targets.

- To conduct training and education activities to inform consumers and municipalities on such issues as separate collection in origin, recovery and recycling of packaging waste and meet expenditure for the matter involved under the packaging waste management plan prepared according to the signed contracts and submitted to the ministry by the related municipilaties.

g. Authorised Institutions

- To sign contracts with municipilaties and certified companies for packaging wastes to be separately collected in origin in the name of introducers they represent.

- To conduct training and education activities to inform consumers and municipalities on such issues as separate collection in origin, recovery and recycling of packaging waste and meet expenditure for the matter involved

under the packaging waste management plan prepared according to the signed contracts and submitted to the ministry by the related municipilaties.

h. Sale Points

- To establish waste collecting points for packaging waste to be separately collected from consumers on entrances of sale points.

- To deliver packaging waste to certified companies contracted by related municipilaties without demanding any fees.

i. Collection-Sorting Facilities

- To be certified and authorised to collect and sort packaging waste by the ministry.

- To establish criteria for collecting and sorting companies defined by the regulation.

- To conduct activities for packaging wastes to be appropriately collected and sorted and regularly report them to the related authorities under the packaging waste management plan.

j.Recycling Facilities

- To be certified and authorised to recycling packaging waste by the Ministry.

- To establish criteria for recycling companies defined by the regulation.

- To regularly report packaging waste that they have recovered to the related authorities.

2.3.1.3 Packaging Waste Management Plan

The regulation stipulates that packaging wastes be separately collected where they have been disposed of by municipalities which can perform on their own or have it done to the facilities certified by the related ministry for collection and separation of packaging waste. The undersigned contracts require that Packaging Waste Management Plan should be prepared and submitted to the ministry in order to separately collect and sort disposals where they have been discharged.

Units defined as packaging waste producers by the regulation such as apartment, settlement officials, schools, universities, hospitals, hotels, public institutions, restaurants, cafés, terminals, airports, railway stations, harbors/ports, health centers, sports centers, organised industrial areas, free zones, markets, sales points and outlets, factories, stadiums, business centers are expected to collect packaging wastes separately from other discharges and deliver them to municipal collection system without demanding any fees within the frame of the certified packaging waste collection plan (Offical Gazzette, 24.07.2010, Article 8).

2.3.1.4 Targets of Recycling

Since the regulation is based on the principle “Whoever pollutes will pay for it” , the whole cost of such processes is imposed on introducers of packaging wastes, that is trade mark owners. Introducer implies those who produce and introduce packaging items or public and private ones who carry the name or title of what has been produced and used as packaging material in the market or those domestic representatives of corps abroad which have manifactured and patented items defined as the above mentioned items.

Intoducers of packaging material or items are alleged to recollect a given amount of what have introduced into market, for which some targets have been established by the related laws and regulations. Those targets are presented in years according to the regulation in Table 2.3 (Offical Gazzette, 24.07.2010, Article 19).

Table 2.3 Regulatory target ratios for the recycling of packaging wastes

Recycling targest according to the material type (%)				
Years	**Glass**	**Plastics**	**Metal**	**Paper and Cardboard**
2005	32	32	30	20
2006	33	35	33	30
2007	35	35	35	35
2008	35	35	35	35
2009	36	36	36	36
2010	37	37	37	37
2011	38	38	38	38
2012	40	40	40	40
2013	42	42	42	42
2014	44	44	44	44
2015	48	48	48	48
2016	52	52	52	52
2017	54	54	54	54
2018	56	56	56	56
2019	58	58	58	58
2020	60	60	60	60

Trade mark owners are required to recollect, recycle packaging wastes caused by introduction into market based on the established targets above and pay for what is to be spent as costs. The expenses to be spent imply that packaging wastes produced by their introducers should be collected exactly where they have been discharged, consumers be informed on the procedures/systems performed and training be conducted, in other words the Packaging Wastes Management Plan thus be advocated. In order that this plan should be sustainably implemented, the triangle composed of municipality (whose subcontractor is the certified collecting and sorting company), introducers and consumers should be based on substantial parameters. Therefore, for the system defined to financially sustain itself, the introducer is obliged to pay for the price. The regulation requires that the introducers should be given some obligations and prepare a file of documents and send it to the ministry concerned every year which contains documents related to training activities for collection of waste in origin.

Considering the difficulty that the introducers might have a hard time individually perform the above – mentioned activities, the regulation regards the formation of an industrial institution such as occurs in many other nations. For the introducers should be able to meet their obligations appropriately, it also establishes that they should constitute a public structure not to aim any profits what so ever. Such an institution was also established in Turkey which are for example the present ÇEVKO (Charity of Environmental Protection and Packaging Waste Evaluation) and TÜÇEV (Charity of Turkish Environmental Protection) authorised by the ministry. In other words, these institutions are current representatives for introducers (Waste Management Action Plan, 2008-2012).

2.3.1.5 Demand for Finance

In the management of packaging waste, the process itself has been increasingly developing over the last six years in particular since 1991. Operation of companies has been turned from an amateur to professional mentality thanks to certification procedures in which environmental engineers have come to be employed, entrance-exit recorded, infrastructure a improved and collection-transportation equipment increased, with a new sector being born.

Although where collection-sorting facilities were and their capacities was not known until 2003, the number of such facilities rose from 15 in 2003 to 101 in 2007. However, considering amount of packaging waste accumulated and national population, the number is expected to be likely to further increase. Likewise, the number of recycling facilities increased from 13 in 2003 to 81 in 2007. Facilities appearing sufficient to process the present waste is predicted to be likely to be insufficient considering the national situation as a whole. Figure 2.3 illustrates number of collecting & sorting and recycling facilities in Turkey in 2007 (Waste Management Department, The Ministry of Environment and Foresty, 2009).

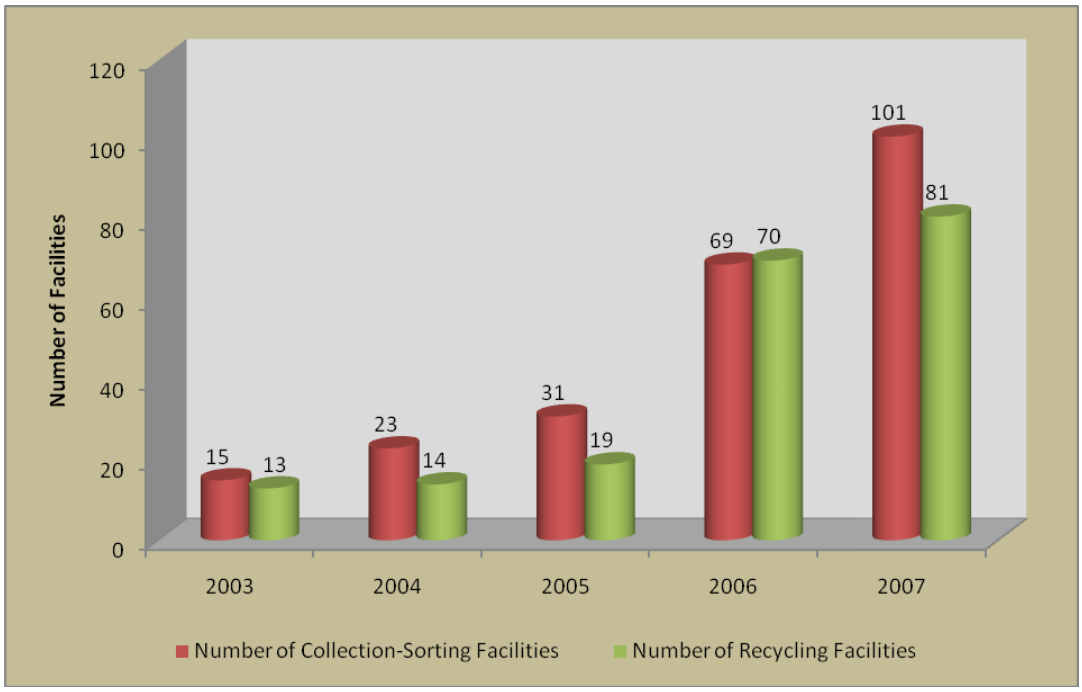

Figure 2.3 Number of facilities

In the light of the above – said assessment, it seems clear that remarkable investment in infrastructure would be needed to separately collect and recycle wastes in origin. The report on High Cost Projects of Investment in Environment states that the nation would require an investement in infrastructure of €41 million from 2008 on in order to collect wastes in origin, which is supposed to be provided by private sector, marketers and municipalities concerned (Waste Management Action Plan, 2008 - 2012).

2.3.1.6 Data Recording System

It is essential to establish a sound data recording system to create a sustainable management of packaging wastes, for which a web – based computer soft ware whose users are the ministry, marketers, packaging producers and licenced collection & sorting businesses. The program was introduced in 81 Provincial Directorates of the Ministry, with the performance being conducted more actively and faster and made to be more decentralized. In addition, those Provincial Directorates actively participated in the process.

Accordingly, packaging producers are required to define annual data base due to types of material related to quantity of packaging items produced, exported and imported and which companies they are sold. Marketers are stipulated to quantify annual data base according to types of material involving packaging items imported, exported and used during introduction to market. From 2005 onwards, all such data as amounts of sales and recycling and production of packaging items was started to be recorded having been received from packaging producers, marketers and licenced collection & sorting facilities.

The regulation defines packaging producers and marketers as economic businesses. Figure 2.4 presents quantitative increase of such businesses recorded by the ministry, according to which there were 926 economic businesses in 2005 whereas some 2500 in 2006, 3600 in 2007 and 3900 in 2008 with in the context of the Regulation Control of Packaging Wastes (Waste Management Department, The Ministry of Environment and Foresty, 2009).

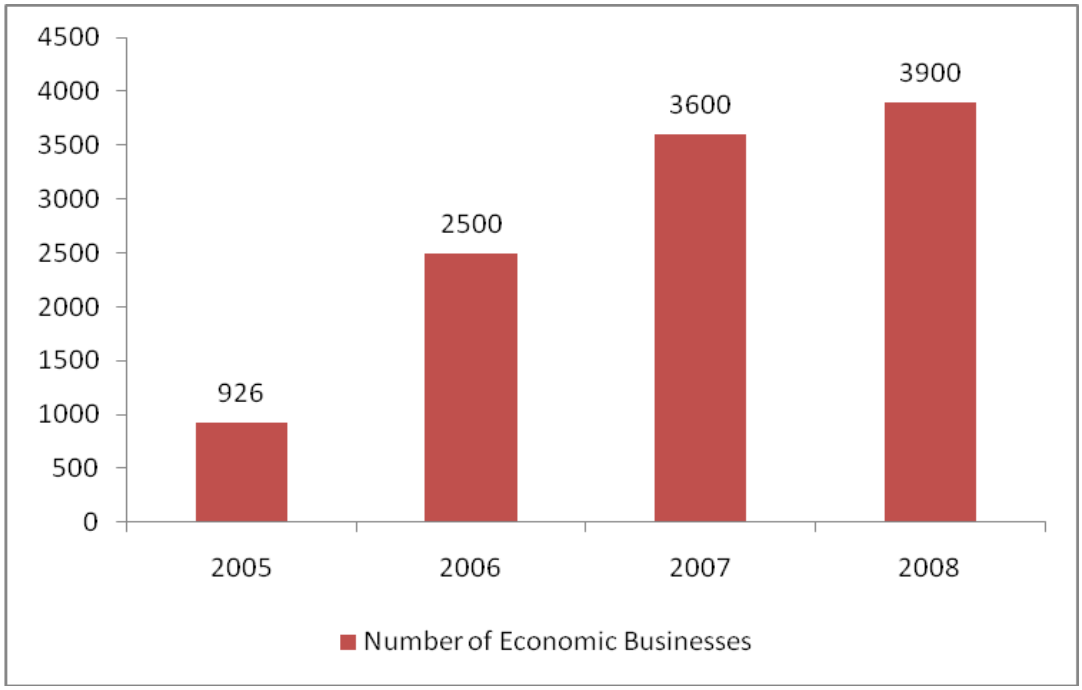

Figure 2.4 Number of economic businesses

Those involved in the programme were done in 2005 by the ministry itself. However, user code and password given by the ministry enabled packaging producers and marketers to be involved in the programme by themselves.

The other user of the program, licenced collection-sorting and recycling facilities regularly send monthly data of brought, sorted, processed and sold packaging wastes to the data recording system of the ministry.

Figure 2.5 shows data of packaging material and wastes produced, marketed and recycled between 2005 and 2007. The ministry was the first to conduct an implementation in 2008 related to the fact that data of packaging items and wastes would be published in annual bulletins by the Ministry following the sessions made by Turkey Statistics Institutions and itself (Waste Management Department, The Ministry of Environment and Foresty, 2009).

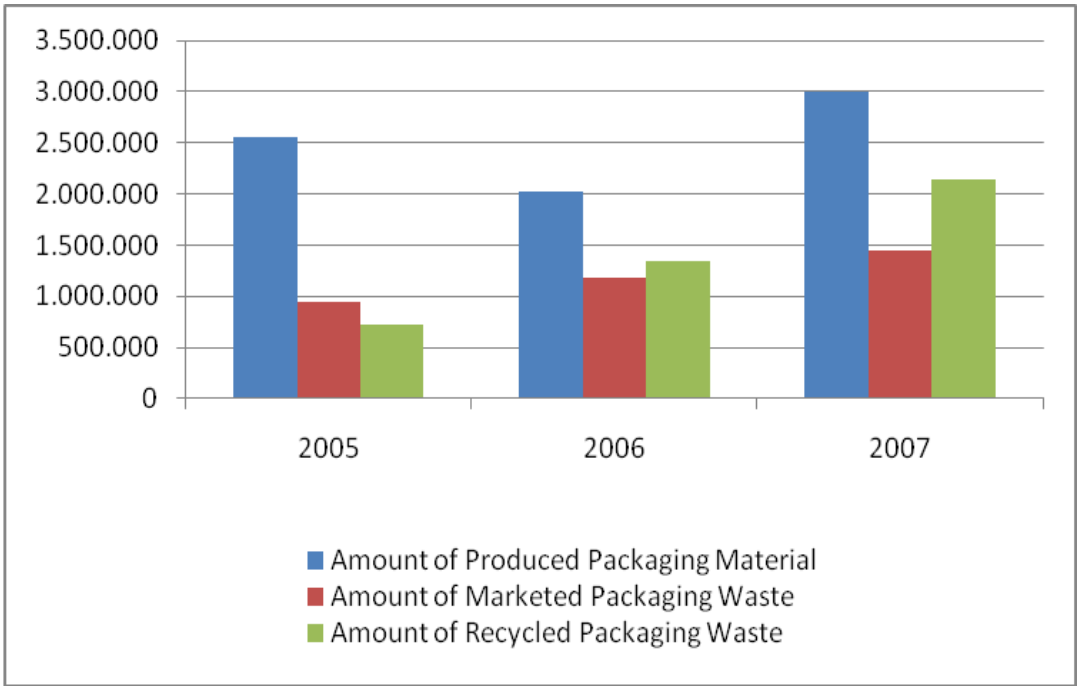

Figure 2.5.Amount of produced packaging material, marketed and recycled packaging waste

2.3.1.7 The Pathway to Achive the Established Targets

40-45 % of packaging wastes accumulated was estimated to be separately collected in origin by Great Municipalities. Amounts of packaging wastes induced by industries and households are not precisely known. However, the present data recording system is planned to be sophiticated in such a way to determine them in the years to come (Waste Management Action Plan, 2008-2012).

Such investments are to be made by the responsible parties to achieve targets determined on provincial basis.

Sales points have a great role in recording companies in that they produce and introduce a variety of items. Based on such great roles of their own, they are given some responsibilities by the regulation according to which they are assigned not to sale items of the those companies which have not registered and thus to be market - supervised to see if they have really met the responsibilities imposed by the regulation or not. This supervision aims to register all companies and businesses in charge of the process and therefore prevent any likely unfair competition among them.

CHAPTER THREE
MATERIAL AND METHODS

To determine inventory of packaging waste produced by different industrial sectors in İzmir City, quantities of packaging wastes declared to Ministry of Environment and Forestry by 37 industrial companies by means of their collecting & sorting facilities (2009) and their direct sale data obtained from Aegean Region Chamber of Industry were taken into account (Aegean Region Chamber of Industry [ARCI], 2008).

To form the inventory of packaging wastes firstly, the industrial companies were coded with a number each which specifies the sectors of food processing, beverages, vegetable oils, tobacco, automotive, chemistry, iron&steel, petroleum products, glass and ceramics. Table 3.1 shows code numbers of the chosen studied sectors and the number of companies studied in each of the sectors.

Table 3.1 Codes of the Industrial Sectors

Industrial Sector	**Classification Code**	**Number of Companies**
Glass and Ceramics Industies	A	4
Food Processing Industies	B	3
Vegatable Oil Industies	C	3
Beverage Industies	D	5
Chemistry and Chemicals Production Industries	E	5
Petroleum Industries	F	3
Iron & Steel Industries	G	5
Automotive Industries	H	6
Tobacco Industries	I	3
Total		**37**

Data bases were formed according to types and amounts of packaging waste produced and reported to the Ministry via collection & sorting facilities servicing to the companies included in each sector. For estimating the packaging waste amounts, production capacity of the studied sectors in Aegean Region a linear equation (Eq. 3.1) was assumed between the amount of packaging wastes produced by the companies and their direct sales declared on a yearly basis.

S = a *P + b **(Eq. 3.1)**

,where S is the annual direct sale of the company (direct sales on output), P the annual packaging waste produced by the company, finally a and b linear constants. As it is assumed, the amount of packaging waste produced increases with the increasing annual direct sale. Hence, annual direct sale is a function of annual packaging waste production. A linear equation between the sales and packaging waste production is constituted for each of the studied sectors using the obtained data. Since the declared amount of annual packaging waste amount of some companies were not proportional to their direct sales, their waste productions were corrected according to the minimum and maximum declarations of the companies in the sector. In other words, the waste declarations which are not applicable were not taken into the consideration when the linear correlations are constituted. Since the number companies in the sectors and their overall capacity in Aegean Region is not limited with the companies studied here, the other industrial companies on business are included to the study by using their declared annual direct sales, according to the studied sectors.The companies in the rank of first 250 according to their annual direct sale is taken into consideration in the content of the thesis, to limit the framework of the study. The linear equation obtained from the sales and packaging waste data is applied to the direct sales of the companies in first 250, and the Regional capacity of each sector was determined. By this way, the number companies considered is increased from 37 to 81. Table 3.2 presents amount of annual packaging wastes declared by the companies in the sectors and their annual direct sales on output.

Table 3.2 Annual amount of packaging waste and direct sales of the companies

Sector and Code	Amount of Packaging Wastes (tonnes/year)	Sales on Output (TL/year)
(A) Glass & Ceramics Industries		
A1	392.926	143090880
A2	35.730	38790161
A3	17.800	33554601
A4	69.600	48680110
(B) Food Processing Industries		
B1	108.240	76723913
B2	66.710	50300041
B3	32.010	28221817
(C) Vegatable Oil Industries		
C1	41.700	52225722
C2	2.540	17632141
C3	54.840	419397194
(D) Beverages Industries		
D1	46.350	23184543
D2	3.130	22147646
D3	1.230.850	51600649
D4	1.639.334	61400180
D5	3.282.230	100816756
(E) Chemistry and Chemicals Production Industries		
E1	14.550	156553465
E2	4.210	205178761
E3	51.730	241291744
E4	173.700	3476676148
E5	32.420	368914148
(F) Petroleum Industries		
F1	138.020	10657101156
F2	24.760	166449886
F3	27.412	102405449

Table 3.2 Annual amount of packaging waste and direct sales of the companies (continiuing)

Sector and Code	Amount of Packaging Wastes (tonnes/year)	Sales on Output (TL)
(G) Iron & Steel Industries		
G1	3.050	218685839
G2	5.008	1293751270
G3	12.170	541165338
G4	0	537005830
G5	5.983	633280515
(H) Automotive Industries		
H1	14.550	97650075
H2	4.210	67313349
H3	51.730	30927704
H4	173.700	288948025
H5	32.420	93701078
H6	300.335	681250108
(I) Tobacco Industries		
I1	31.660	40117455
I2	5.432.263	143811814
I3	0	27509466

CHAPTER FOUR
RESULT AND DISCUSSION

Here, the results obtained are presented according to the studied sectors and the findings are discussed.

4.1 Glass & Ceramics Industries

Sales on output and packaging waste data were obtained for this sector. Table 4.1 and Fig. 4.1 shows annual amount of packaging wastes and their percentage breakdowns declared by the companies from glass & ceramics industry, respectively.

Table 4.1 Annual amount of packaging wastes from glass & ceramics industries

Types of Packaging Waste	A1	A2	A3	A4	TOTAL (tones/year)
Paper (kg)	299426	28880	9780	38260	**376.346**
Cardboard (kg)	0	0	8020	15780	**23.800**
Plastics (kg)	64650	400	0	11900	**76.950**
Metal(kg)	0	0	0	0	**0**
Glass(kg)	0	0	0	0	**0**
PE(kg)	28850	6450	0	0	**35.300**
Wood (kg)	0	0	0	3660	**3.660**
TOTAL (tonnes)	**392.926**	**35.730**	**17.800**	**69.600**	**516.056**

It follows from Table 4.1 that the annual packaging waste production of the companies varies, in the same way as the variation of the amount of recyclables they produced. It seems like paper and cardboard are the major components of their packaging waste (Fig. 4.1).

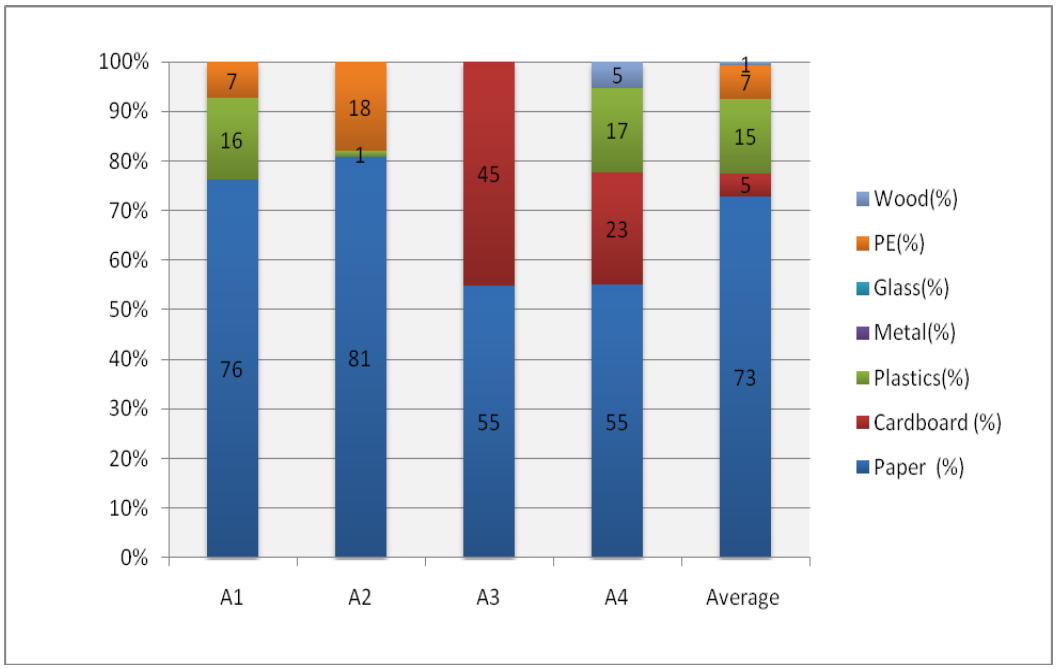

Figure 4.1 Percentage break downs of packaging wastes for glass & ceramics industries

Additionally, Table 4.2 and Figure 4.2 present monthly amounts of packaging wastes produced by the four companies concerned.

Table 4.2 Monthly amount of packaging wastes for glass & ceramics industries

Companies	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL (t/y)
A1	48030	24430	37370	12570	23780	45740	32290	40770	38840	33106	24850	31150	**392.926**
A2	4420	4320	1660	1920	980	3720	4300	1540	1440	7030	1750	2650	**35.730**
A3										9780	2620	5400	**17.800**
A4					8320	12800	11380	1660	8200	9140	8280	9820	**69.600**

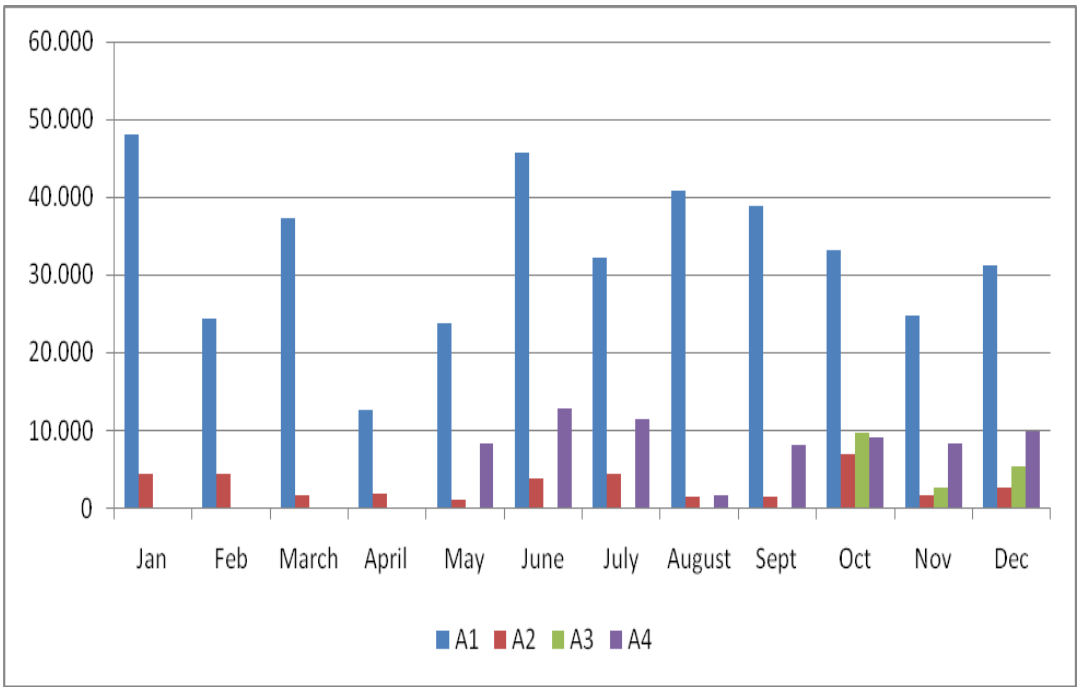

Figure 4.2 Monthly amount of packaging wastes for glass & ceramics industries

Figure 4.2 shows that Company A1 produced more packaging wastes than others. Breakdown of packaging wastes varies monthly.

Table 4.3 and Figure 4.3 show data of amounts of sales on output by the first 250 companies in this sector in 2008 according to Aegean Region Chamber of Industry.

Table 4.3 Sales on output for glass & ceramics industries

Companies	**Sales on Output (TL)**
A1	143090880
A2	38790161
A3	33554601
A4	48680110

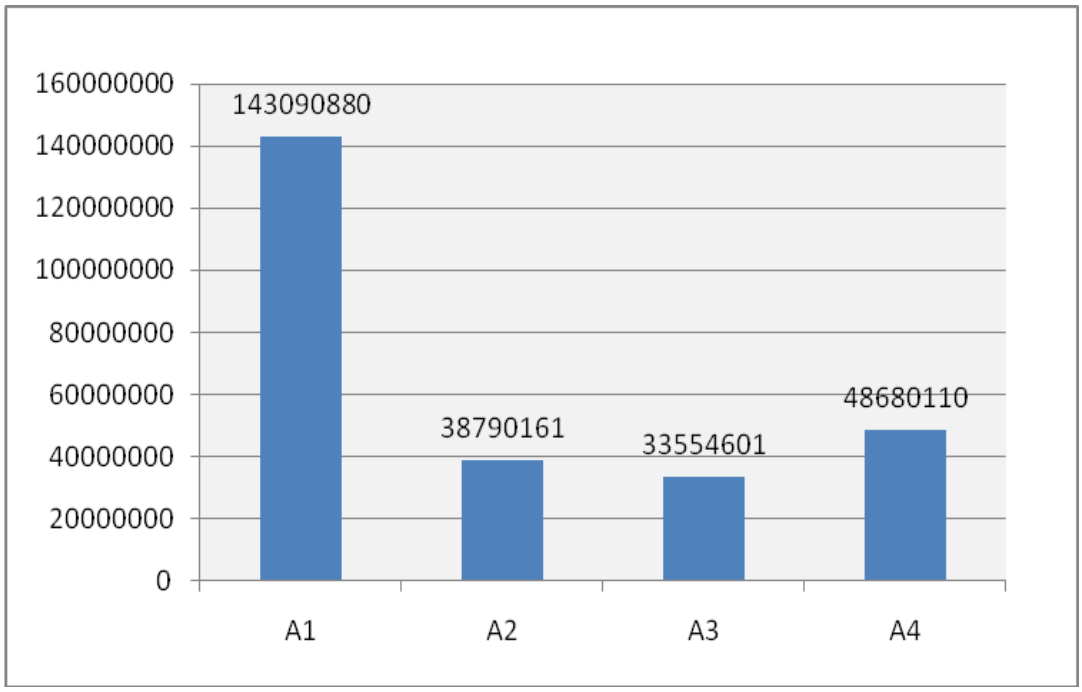

Figure 4.3 Sales on output for glass & ceramics industries

Table 4.4 shows information on amounts of sales on output and number of packaging waste produced by the four companies chosen from the sector.

Table 4.4 Data of amounts of sales on output and packaging wastes for glass-ceramic industries

Companies	**Amount of Packaging Wastes (kg/year)**	**Sales on Output (TL)**
A1	392926	143090880
A2	35730	38790161
A3	17800	33554601
A4	69600	48680110

Correlation has been established between amount of packaging waste and number of sales on output from the equation “S = 292.00 P + 28357027.80” in Figure 4.4, where (P) is amount of packaging waste produced and (S) number of sales on output.

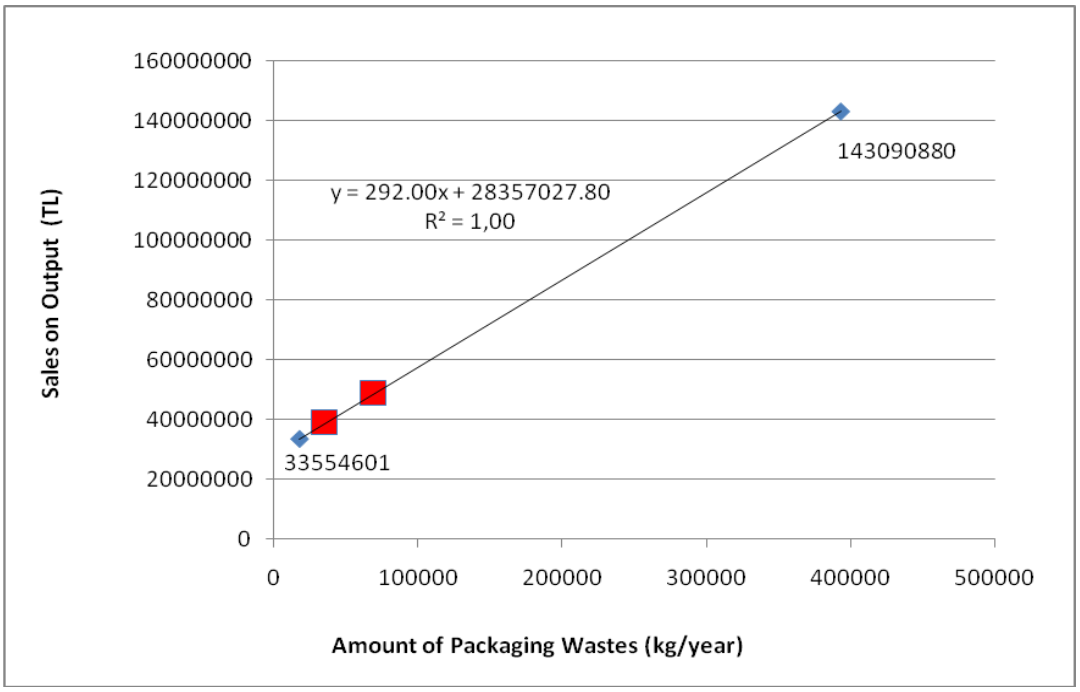

Figure 4.4 Correlation between amount of packaging wastes and number of sales on output for glass & ceramics industries

From the equation obtained, amount of packaging wastes which the other companies in the sector could produce can be calculated using number of sales on output for (y). However, because there are no other companies in the first 250 in province of Izmir, total amount of packaging wastes produced by the four companies has been regarded as inventory of packaging wastes for the glass & ceramics sector.

4.2 Food Processing Industries

The direct sales and packaging waste data obtained in this sector. Table 4.5 and Fig. 4.5 shows annual amount of packaging wastes and their percentage break downs declared by the companies from food processing industry, respectively.

It is clear from Figure 4.5 the major component of packaging waste in food processing sector is paper.

In addition, Table 4.6 and Figure 4.6 present monthly amounts of packaging wastes produced by the three companies concerned.

Table 4.5 Annual amount of packaging wastes for food processing industries

Types of Packaging Waste	B1	B2	B3	TOTAL (tones/year)
Paper (kg)	52620	24260	16270	**93.150**
Cardboard (kg)	2600	34070	0	**36.670**
Plastics(kg)	16280	650	5240	**22.170**
Metal(kg)	16480	470	0	**16.950**
Glass(kg)	0	0	0	**0**
PE(kg)	12280	7260	10500	**30.040**
Wood (kg)	7980	0	0	**7.980**
TOTAL(tonnes)	**108.240**	**66.710**	**32.010**	**206.960**

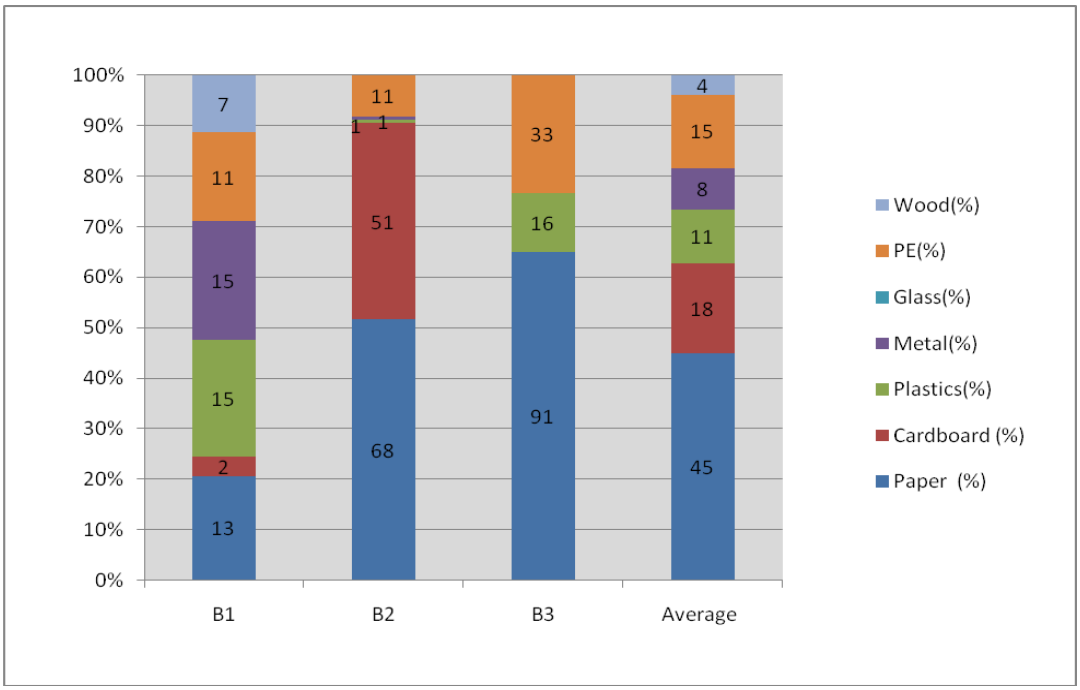

Figure 4.5 Percentage breakdowns of packaging wastes for food processing industries

Table 4.6 Monthly amount of packaging wastes for food processing industries

Companies	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL (tonnes)
B1	0	0	0	0	0	0	0	0	0	48180	18420	41640	**108.240**
B2	0	0	0	0	0	0	0	2360	17340	9690	11490	25830	**66.710**
B3	3910	0	2740	680	2640	5500	1800	2800	3940	2960	2460	2580	**32.010**

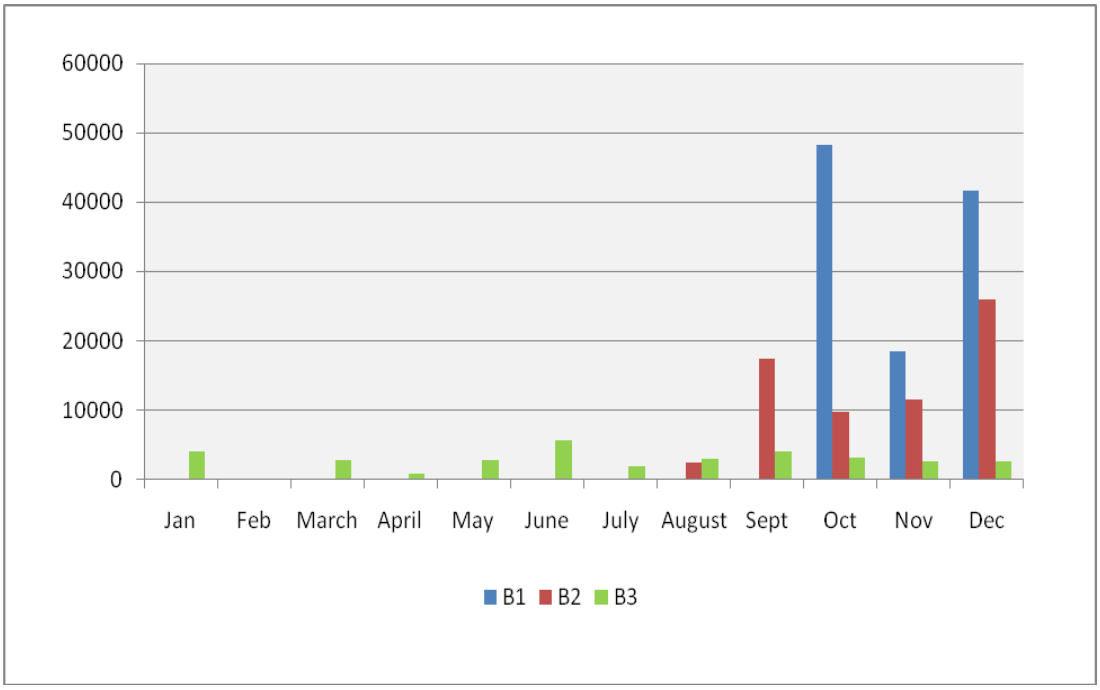

Figure 4.6 Monthly amount of packaging wastes for food processing industries

It follows from Figure 4.6 that packaging waste are produced during Fall months, especially in food processing sector, which is an understandable finding since the waste production period starts just after the harvesting term.

Table 4.7 and Figure 4.7 show data of amounts of sales on output by the first 250 companies in 2008 according to Aegean Region Chamber of Industry.

Table 4.7 Sales on output for food processing sector

Companies	**Sales on Output (TL)**
B1	76723913
B2	50300041
B3	28221817

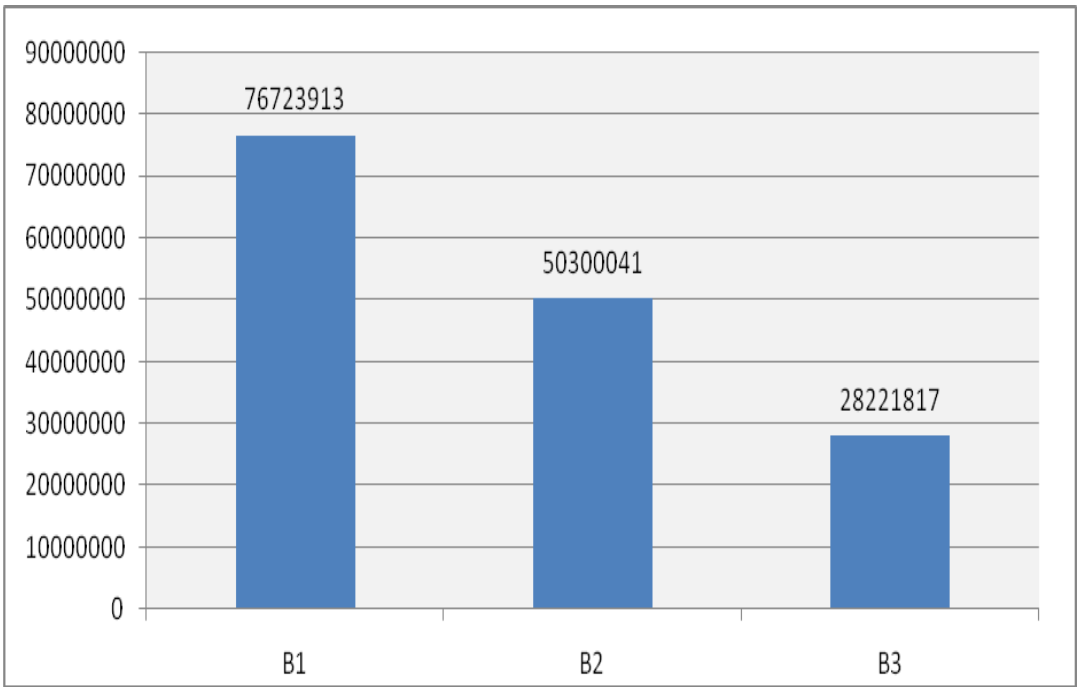

Figure 4.7 Sales on output for food processing sector

Table 4.8 shows information on amounts of sales on output and number of packaging waste produced by the three companies chosen from the sector.

Table 4.8 Data of amounts of sales on output and packaging wastes for food processing sector

Companies	**Amount of Packaging Waste (kg/year)**	**Sales on Output (TL)**
B1	108240	76723913
B2	66710	50300041
B3	32010	28221817

Correlation has been established between amount of packaging waste and number of sales on output from the equation “S = 636.26 P + 7855137.29” in Figure 4.8, where (P) is amount of packaging waste produced and (S) number of sales on output.

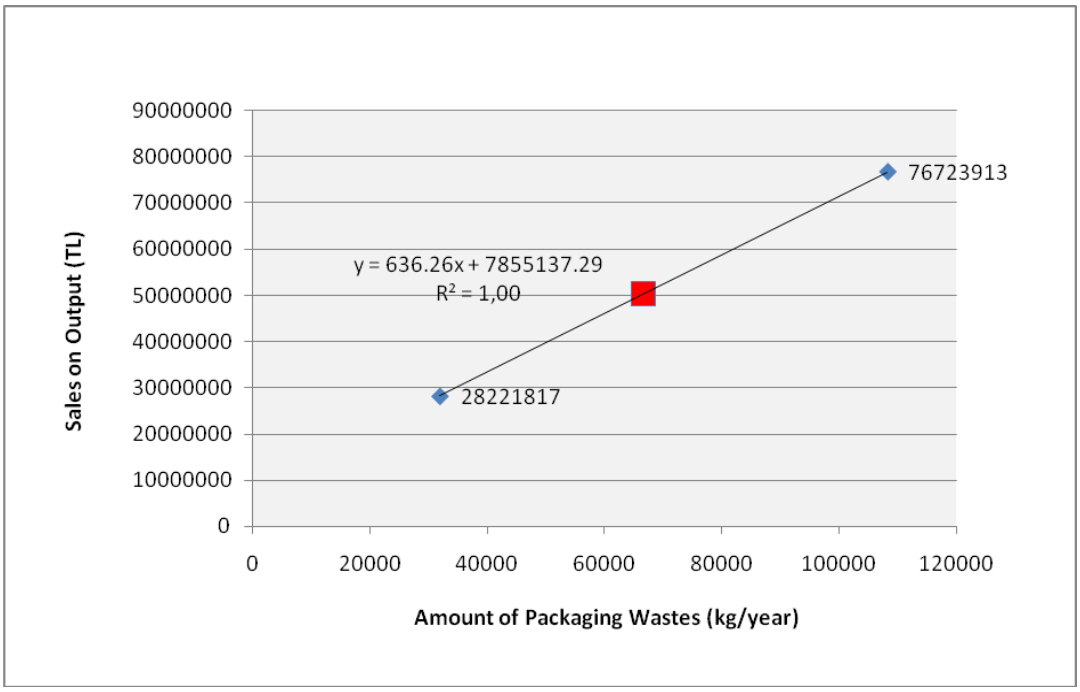

Figure 4.8 Correlation between amount of packaging wastes and number of sales on output for food processing sector

Similarly, packaging waste amounts to be produced by the 28 companies in the rank of first 250 according to their direct sales depending to the EBSO data included the determinations using the above equation where (S) is applied to yearly sales on output, according to which the inventory of packaging waste has been formed for the food processing sector. Potential amount of packaging waste to be produced by these companies is 2547.619 tonnes/year (Table 4.9).

Table 4.9 Inventory of packaging waste for food processing sector

Companies	Amount of Packaging Waste (kg/year)	Sales on Output (TL)
B1	**108240**	**76723913**
B2	**66710**	**50300041**
B3	**32010**	**28221817**
B4	717460	464346300
B5	469728	306724341
B6	132820	92363354
B7	128870	89849984
B8	107848	76474398
B9	82945	60629773
B10	69452	52044943
B11	62837	47835720
B12	60209	46163850
B13	55141	42939316
B14	45920	37072038
B15	41866	34492973
B16	40641	33713622
B17	37630	31797570
B18	36085	30814657
B19	33028	28869667
B20	30304	27136306
B21	28604	26055016
B22	28003	25672283
B23	26734	24865201
B24	25831	24290651
B25	22629	22252830
B26	22527	22187968
B27	17029	18690005
B28	16516	18363438
TOTAL (tones)	**2547.619**	**-**

4.3 Vegatable Oil Industries

Table 4.10 shows annual amount of packaging wastes and their percentage breakdowns declared by the three companies chosen from vegatable oil industries. Figure 4.9 includes percentage breakdowns according to types of packaging wastes produced (paper-cardboard, plastics, metals, glass, nylons, woods)

Table 4.10 Annual amount of packaging for vegetable oil industries

Types of Packaging Waste	C1	C2	C3	TOTAL (tones/year)
Paper (kg)	14960	2540	24940	**42.440**
Cardboard (kg)	0	0	0	**0**
Plastics(kg)	7380	0	7440	**14.820**
Metal(kg)	3280	0	0	**3.280**
Glass(kg)	12620	0	0	**12.620**
PE(kg)	3460	0	18700	**22.160**
Wood(kg)	0	0	3760	**3.760**
TOTAL(tonnes)	**41.700**	**2.540**	**54.840**	**99.080**

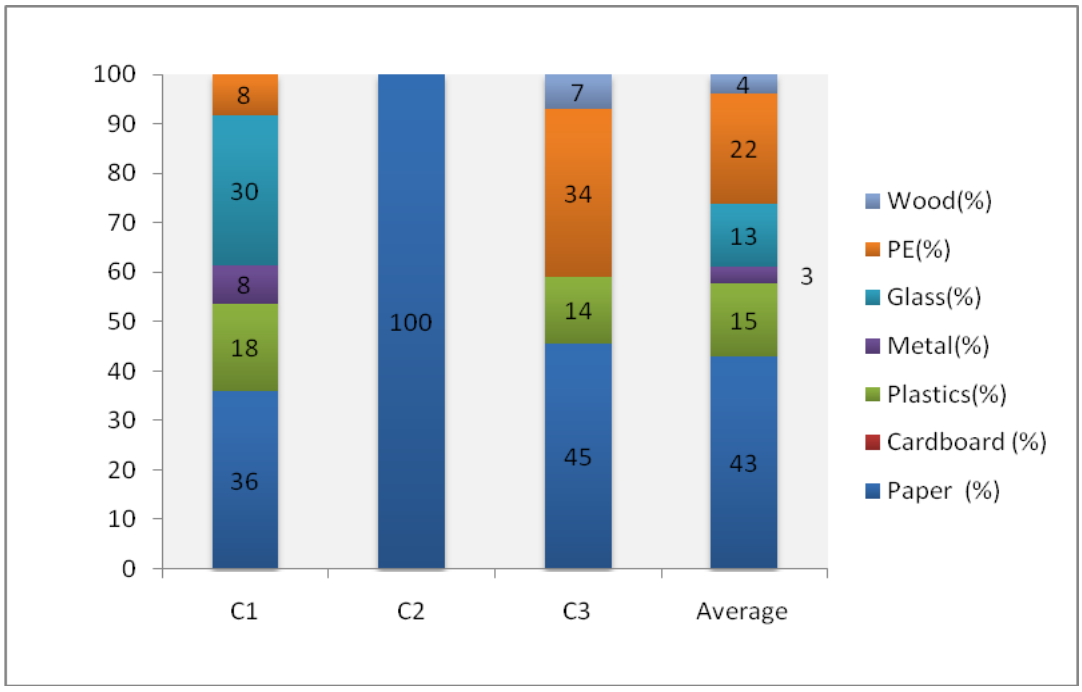

Figure 4.9 Percentage breakdowns of packaging wastes for vegetable oil industry

From Figure 4.9, it is clear that the major component of packaging waste in vegatable oil industry sector is paper. In addition, Table 4.11 and Figure 4.10

present monthly amounts of packaging wastes produced by the three companies concerned.

Table 4.11 Monthly amounts of packaging wastes for vegetable oil industries

Companies	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL (t/y)
C1	17460		4780		5660					13800			**41.700**
C2			640	700	300			900					**2.540**
C3								31700	6480	4560	5380	6720	**54.840**

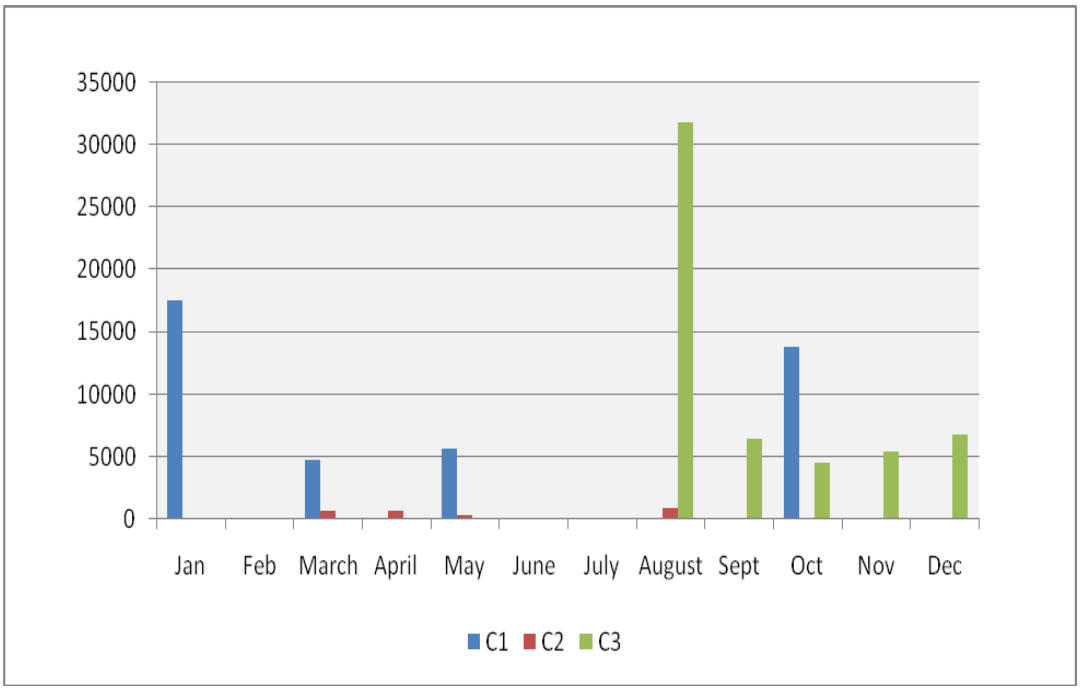

Figure 4.10 Monthly amounts of packaging wastes for vegetable oil industries

Figure 4.10 shows that packaging waste are mainly produced in Fall months, especially in vegetable oil industry sector.

Table 4.12 and Figure 4.11 show data of amounts of sales on output by the first 250 companies in 2008 according to Aegean Region Chamber of Industry.

Table 4.12 Sales on output for vegetable oil industries

Companies	Sales on Output (TL)
C1	52225722
C2	17632141
C3	419397194

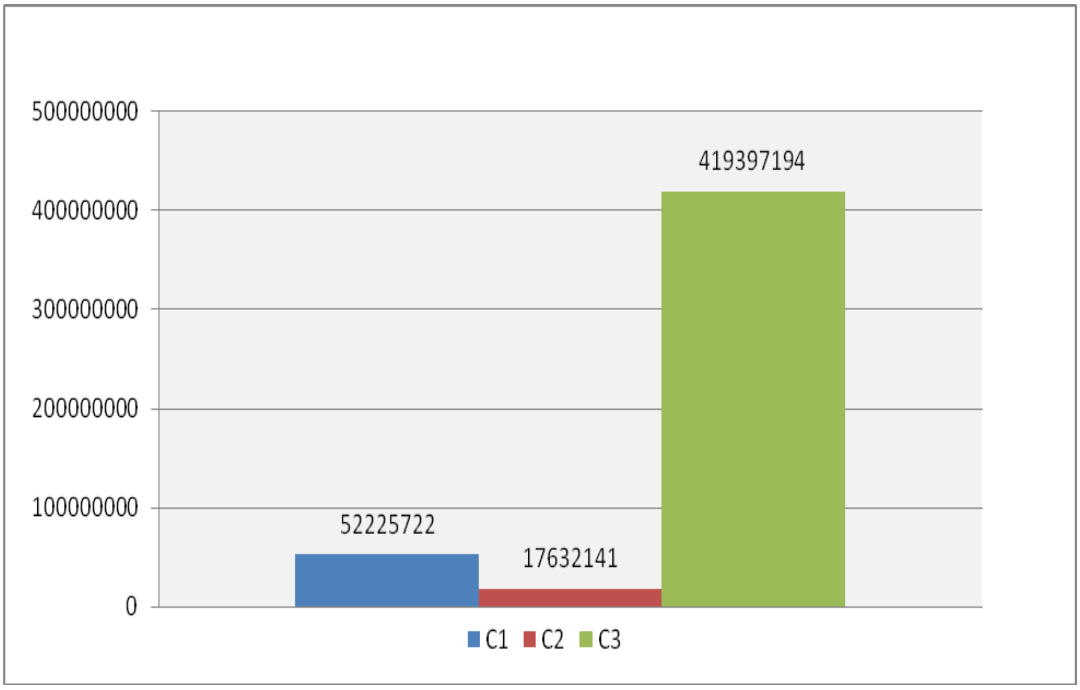

Figure 4.12 Sales on output for vegetable oil industries

Table 4.13 shows information on amounts of sales on output and number of packaging waste produced by the three companies chosen from the sector.

Table 4.13 Data of amounts of sales on output and packaging wastes for vegetable oil industries

Companies	Amount of Packaging Waste (kg/year)	Sales on Output (TL)
C1	41700	52225722
C2	2540	17632141
C3	54840	419397194

Correlation has been established between amount of packaging waste and number of sales on output from the equation “S = 7681.93 P + 1879966.74” in Figure 4.13, where (P) is amount of packaging waste produced and (S) number of sales on output.

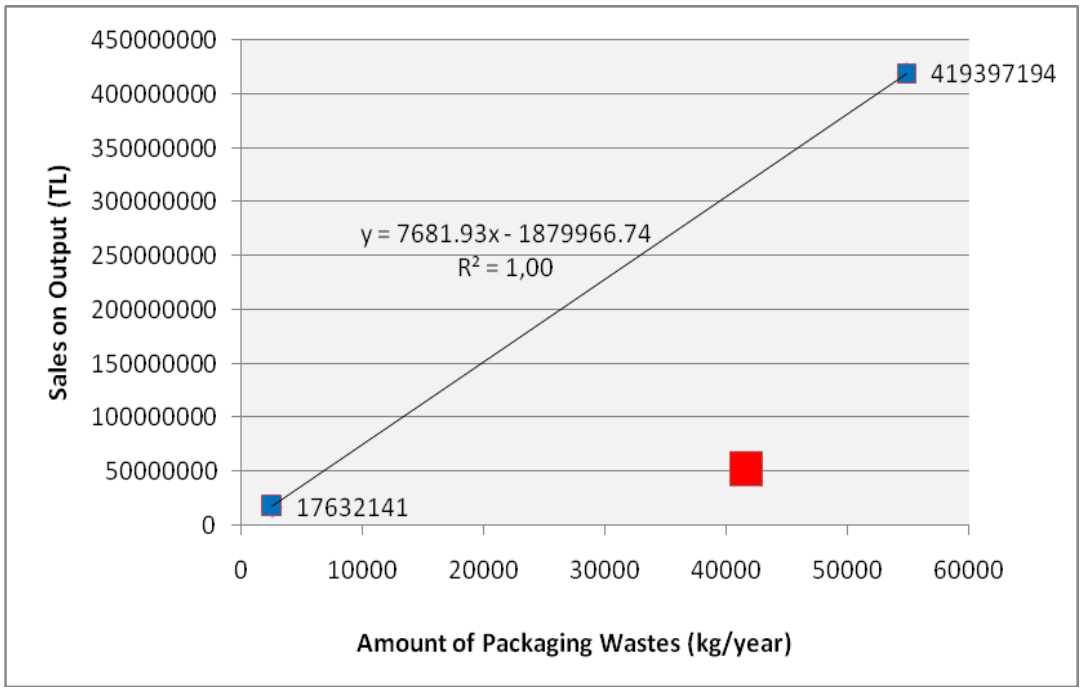

Figure 4.13 Correlation between amount of packaging wastes and number of sales on output for vegetable oil industries

Likely packaging waste amounts have been calculated to be produced by the 6 companies included in the first 250 ones using EBSO data of annual sales on output in the above equation where (S) is applied to yearly sales on output, according to which the inventory of packaging waste has been formed for the vegetable oil sector. Potential amount of packaging waste to be produced by these companies is 120.632 tonnes/year in Table 4.15.

Table 4.15 Inventory of packaging waste for vegetable oil industries

Companies	Amount of Packaging Waste (kg/year)	Sales on Output (TL)
C1	**41700**	**52225722**
C2	**2540**	**17632141**
C3	**54840**	**419397194**
C4	8658	64629559
C5	7803	58064835
C6	5091	37225551
TOTAL (tones)	**120.632**	**-**

4.4 Beverages Industries

Table 4.16 shows annual amount of packaging wastes and their percentage breakdowns declared by the five companies chosen from beverages industries. Figure 4.14 includes percentage breakdowns according to types of packaging wastes produced (paper-cardboard, plastics, metals, glass, nylons, woods).

Table 4.16 Annual amount of packaging wastes for beverages industries

Types of Packaging Wastes	D1	D2	D3	D4	D5	TOTAL (tonnes)
Paper (kg)	26270	1120	0	159440	122600	**309.430**
Cardboard (kg)	0	1410	0	0	0	**1.410**
Plastics(kg)	0	0	0	168670	134830	**303.500**
Metal(kg)	0	0	97100	483904	73330	**654.334**
Glass(kg)	12080	600	1102990	241640	2751430	**4.108.740**
PE(kg)	2200	0	30760	49080	14510	**96.550**
Wood(kg)	5800	0	0	536600	185530	**727.930**
TOTAL(tonnes)	**46.350**	**3.130**	**1.230.850**	**1.639.334**	**3.282.230**	**6.201.894**

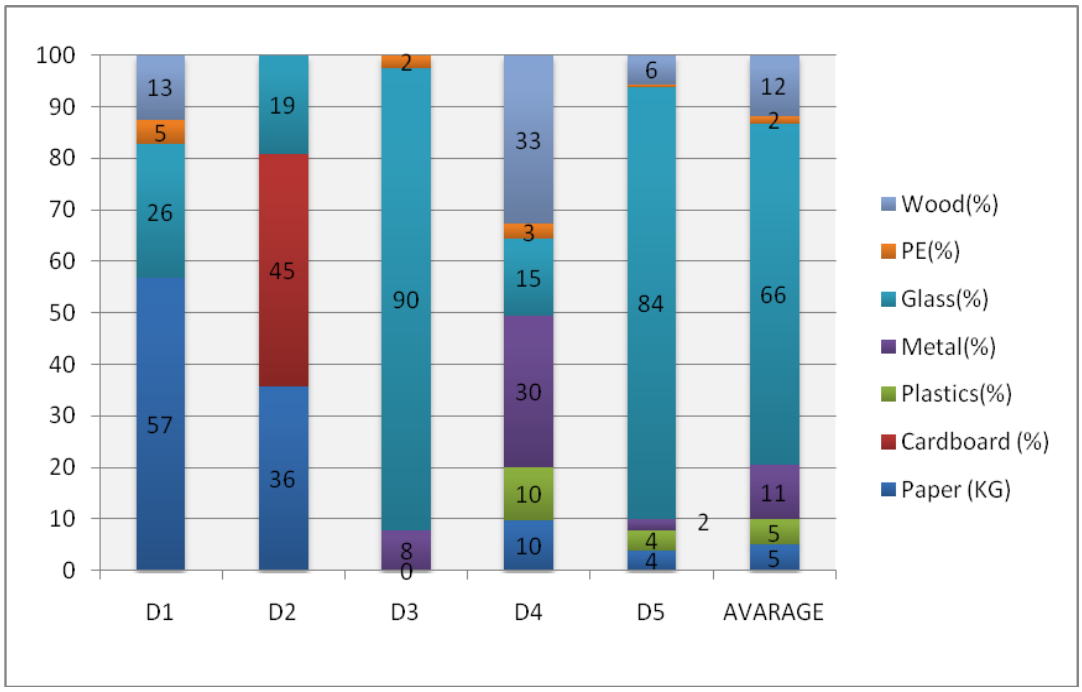

Figure 4.14 Percentage breakdowns of packaging wastes for beverages industries

Figure 4.14 presents that the major component of packaging waste in beverages industry sector is glass.

In addition, Table 4.17 and Figure 4.15 present monthly amounts of packaging wastes produced by the five companies concerned.

Table 4.17 Monthly amounts of packaging wastes for beverages industries

Months	D1	D2	D3	D4	D5
January			59900	79560	14420
Feb			47540	40772	379060
March			34880	67980	383790
April			40720	249300	998200
May			48100	181000	101520
June			509890	199740	504070
July		1120	62000	132952	48860
August		600	85760	119460	64340
Sep			69900	111750	338710
Oct	11560	410	92920	65520	48170
Nov	14900		112080	65980	377710
Dec	19890	1000	67160	325320	23380
TOTAL (tonnes/year)	**46.350**	**3.130**	**1.230.850**	**1.639.334**	**3.282.230**

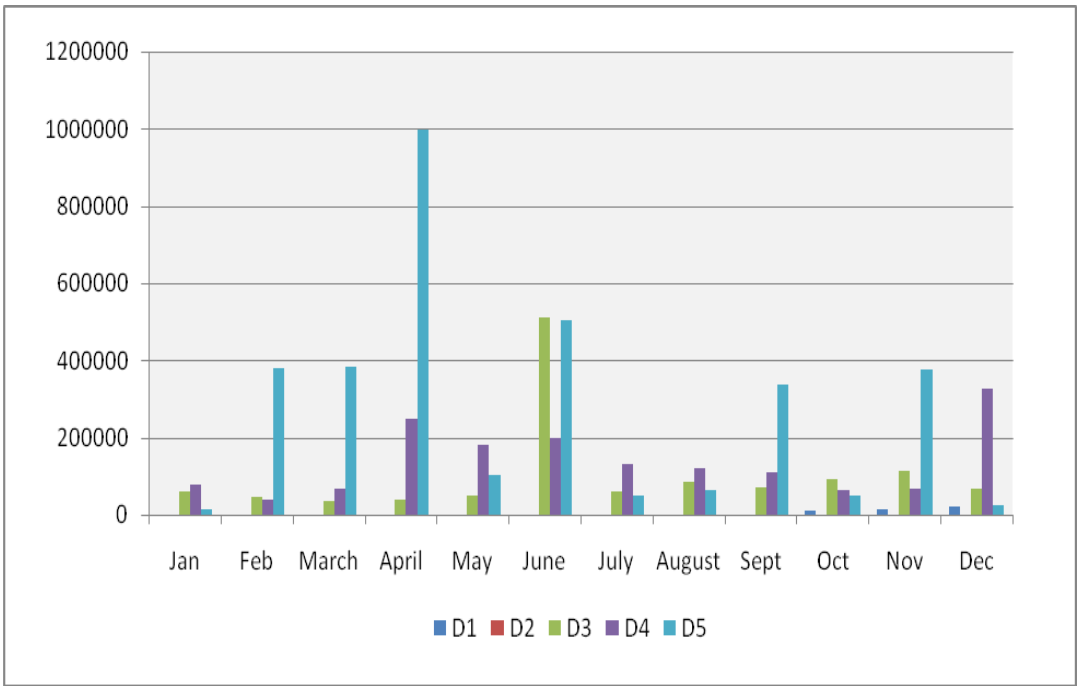

Figure 4.15 Monthly amounts of packaging wastes for beverage industries

Figure 4.15 shows that packaging waste is mainly produced in spring months in beverages industry sector.

Table 4.18 and Figure 4.16 show data of amounts of sales on output by the first 250 companies in 2008 according to Aegean Region Chamber of Industry.

Table 4.18 Sales on output for beverage industries

Companies	**Sales on Output (TL)**
D1	23184543
D2	22147646
D3	51600649
D4	61400180
D5	100816756

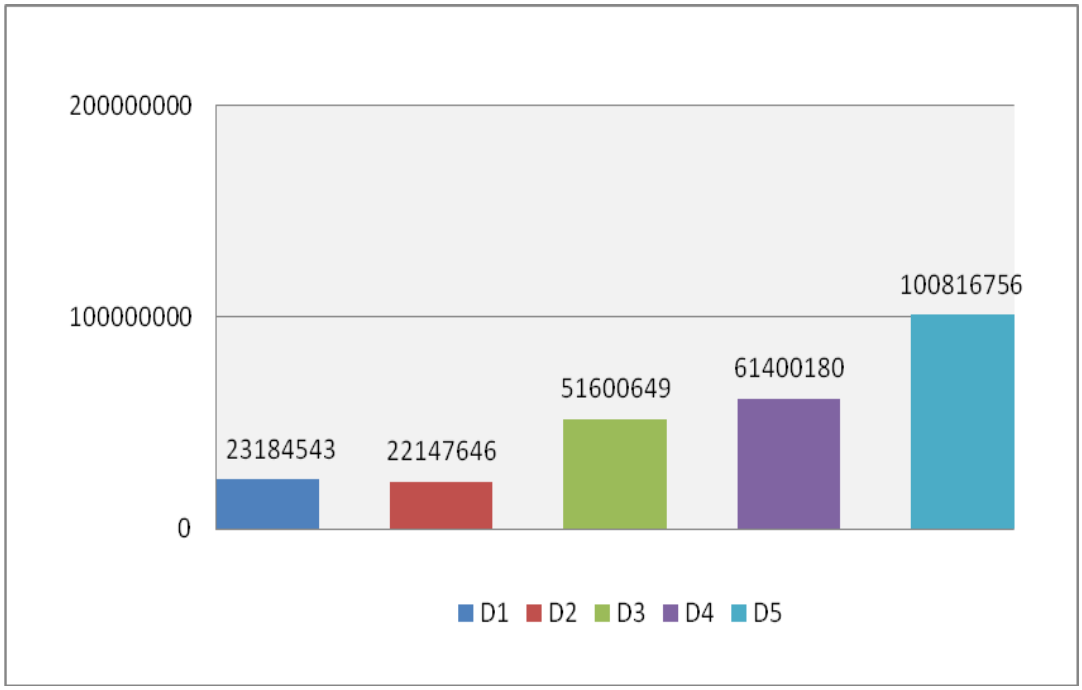

Figure 4.16 Sales on output for beverage industries

Table 4.19 shows information on amounts of sales on output and number of packaging waste produced by the five companies chosen from the sector.

Table 4.19 Data of amounts of sales on output and packaging wastes for beverage industries

Companies	**Amount of Packaging Wastes (kg/year)**	**Sales on Output (TL)**
D1	46350	23184543
D2	3130	22147646
D3	1230850	51600649
D4	1639334	61400180
D5	3282230	100816756

Correlation has been established between amount of packaging waste and number of sales on output from the equation “S = 23.99 P – 22072557.06 ” in Figure 4.17, where (P) is amount of packaging waste produced and (S) number of sales on output.

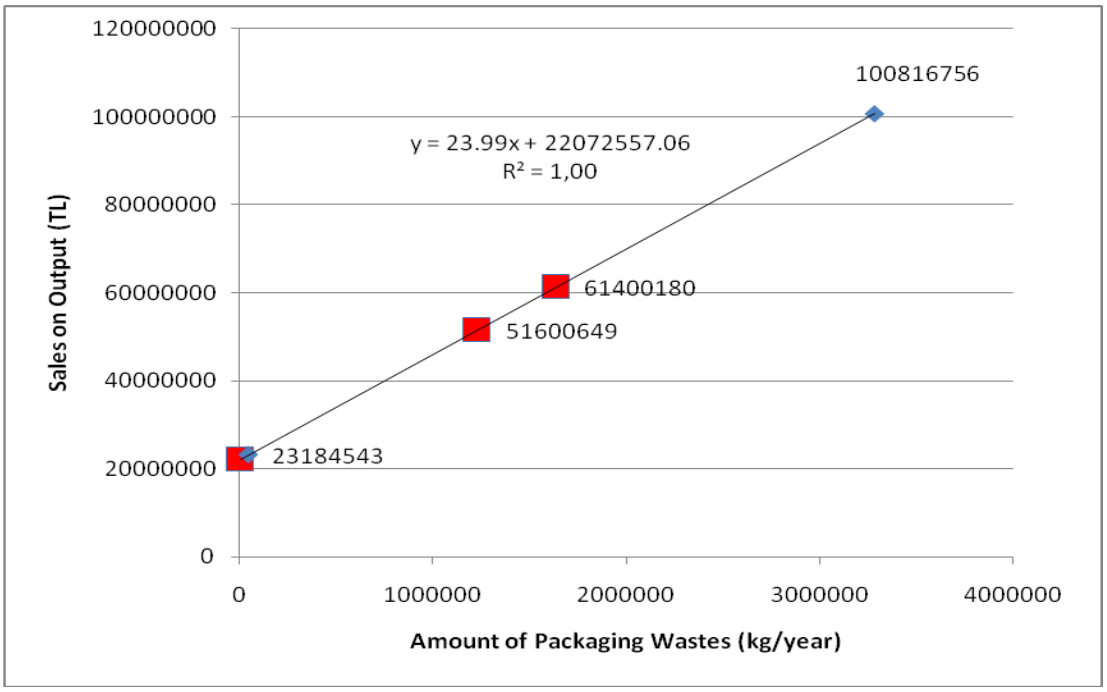

Figure 4.17Correlation between amount of packaging wastes and number of sales on output for beverage industries

Likely packaging waste amounts have been calculated to be produced by the seven companies included in the first 250 ones using EBSO data of annual sales on output in the above equation where (S) is applied to yearly sales on output, according to which the inventory of packaging waste has been formed for the beverages sector. Potential amount of packaging waste to be produced by these companies is 14386.524 tonnes/year in Table 4.20.

Table 4.20 Inventory of packaging waste for beverage sector

Companies	Amount of Packaging Wastes (kg/year)	Sales on Output (TL)
D1	**46350**	**23184543**
D2	**3130**	**22147646**
D3	**1230850**	**51600649**
D4	**1639334**	**61400180**
D5	**3282230**	**100816756**
D6	8184630	218421836
D7	1445095	56740386
TOTAL (tonnes)	**14386.524**	**-**

4.5 Chemistry and Chemicals Production Industries

Table 4.21 shows annual amount of packaging wastes and their percentage breakdowns declared by the five companies chosen from chemical industries. Figure 4.18 includes percentage breakdowns according to types of packaging wastes produced (paper-cardboard, plastics, metals, glass, nylons, woods).

Table 4.21 Annual amount of packaging wastes for chemicals industries

Types of Packaging Wastes	E1	E2	E3	E4	E5	TOTAL (tones)
Paper (kg)	12480	2820	14600	57460	13560	**100.920**
Cardboard (kg)	0	0	3760	14500	18860	**37.120**
Plastics (kg)	650	310	1200	2700	0	**4.860**
Metal (kg)	0	0	0	2740	0	**2.740**
Glass (kg)	0	0	0	1740	0	**1.740**
PE (kg)	1420	1080	2420	20600	0	**25.520**
Wood (kg)	0	0	29750	73960	0	**103.710**
TOTAL(tones/year)	**14.550**	**4.210**	**51.730**	**173.700**	**32.420**	**276.610**

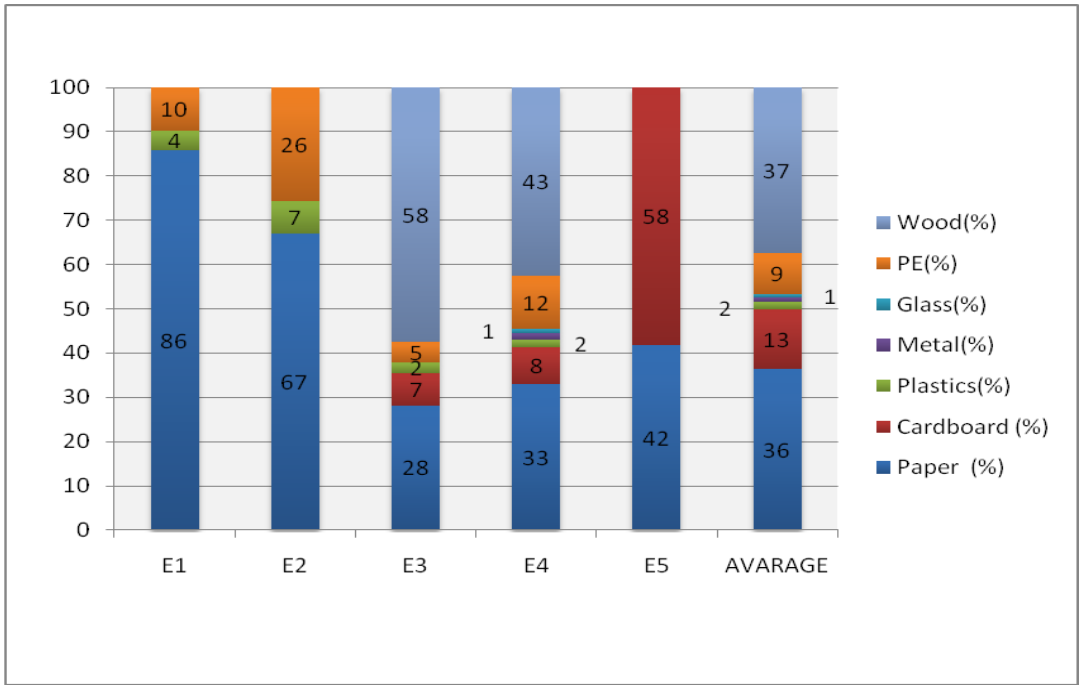

Figure 4.18 Percentage break downs of packaging wastes for chemistry industries

Figure 4.18 shows the major components of packaging waste in chemicals sector are paper and wood.

In addition, Table 4.22 and Figure 4.19 present monthly amounts of packaging wastes produced by the five companies concerned.

Table 4.22 Monthly amounts of packaging wastes for chemistry industries

Months	**E1**	**E2**	**E3**	**E4**	**E5**
January				6860	
Feb	1660		2000	8820	
March			2620	7640	
April	1430		3540	30480	
May	1700		1180	19960	2000
June	1220		8820	13200	11560
July	1660	2860	4500	7640	
August		340	1740	8680	
Sep	1440	340	6600	26460	
Oct	1920	310	4500	27320	6480
Nov	1990	360	7240	4760	
Dec	1530		8990	11880	12380
TOTAL (tones/year)	**14.550**	**4.210**	**51.730**	**173.700**	**32.420**

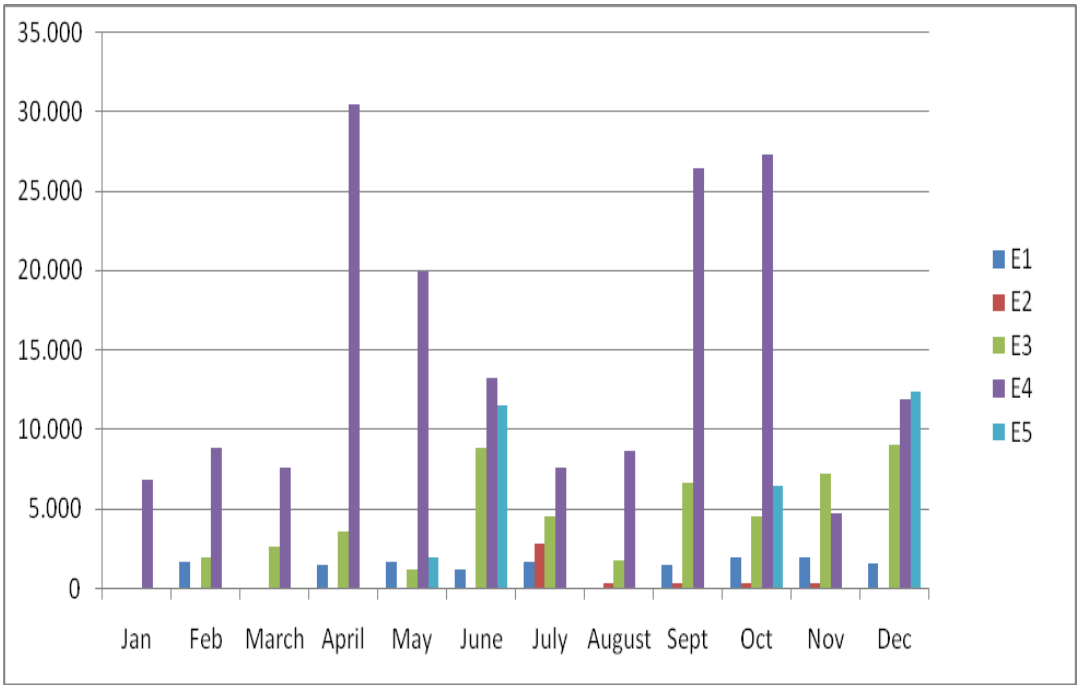

Figure 4.19 Monthly amounts of packaging wastes for chemistry industries

Figure 4.19 indicates that packaging waste is mainly produced in spring and fall months, in beverages industry sector. This is an expected finding, since the waste production period starts just after the product output and sales.

Table 4.23 and Figure 4.20 show data of amounts of sales on output by the first 250 companies in 2008 according to Aegean Region Chamber of Industry.

Table 4.23 Sales on output for chemistry industries

Companies	Sales on Output (TL)
E1	156553465
E2	205178761
E3	241291744
E4	3476676148
E5	368914148

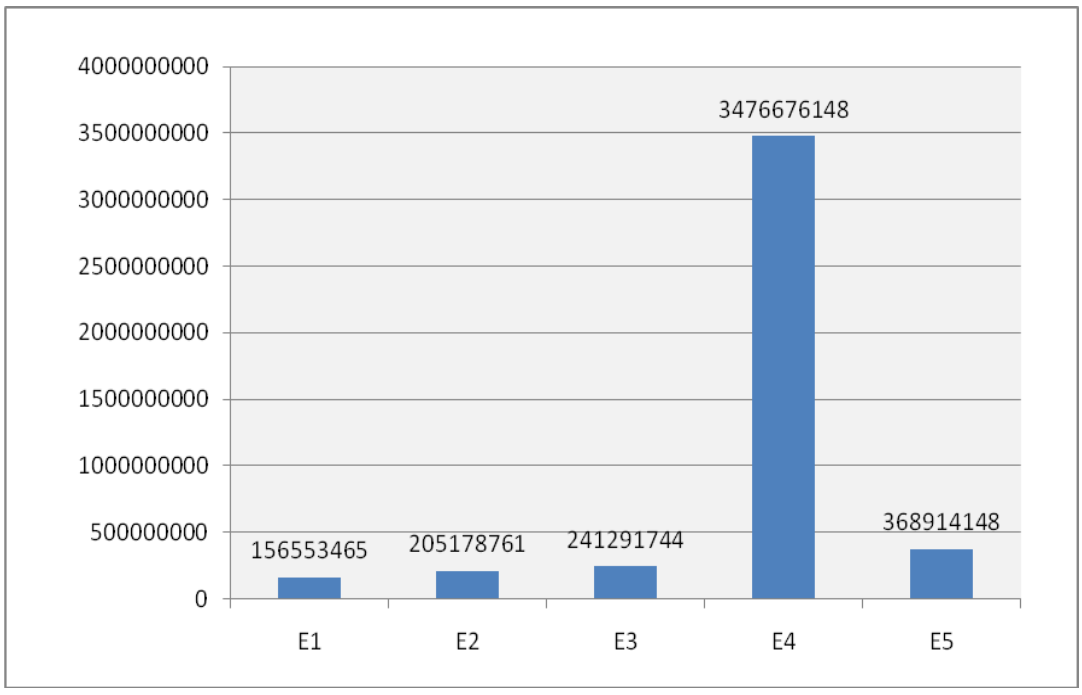

Figure 4.20 Sales on output for chemistry industries

Table 4.24 shows information on amounts of sales on output and number of packaging waste produced by the five companies chosen from the sector.

Table 4.24 Data of amounts of sales on output and packaging wastes for chemistry industries

Companies	Amount of Packaging Waste (kg/year)	Sales on Output (TL)
E1	14550	156553465
E2	4210	205178761
E3	51730	241291744
E4	173700	3476676148
E5	32420	368914148

Correlation has been established between amount of packaging waste and number of sales on output from the equation "S = 21295.71 P – 232393846.33" in Figure 4.21, where (P) is amount of packaging waste produced and (S) number of sales on output.

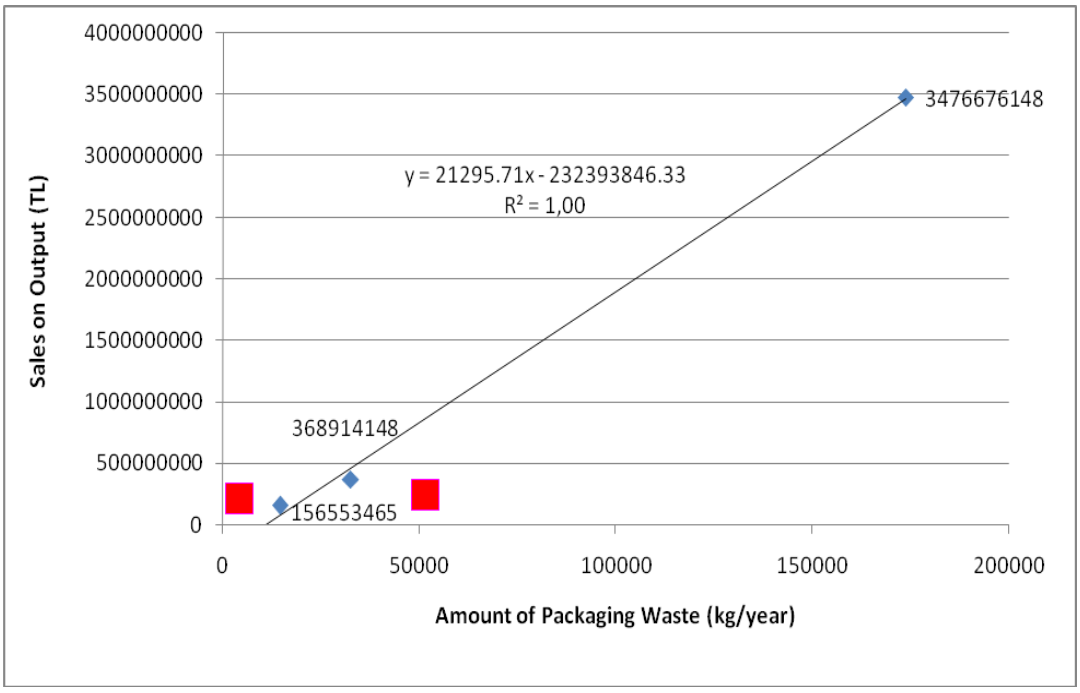

Figure 4.21Correlation between amount of packaging wastes and number of sales on output for chemical industries

Packaging waste amounts have been calculated to be produced by the ten companies included in the first 250 ones using EBSO data of annual sales on output in the above equation where (S) is applied to yearly sales on output, according to which the inventory of packaging waste has been formed for the chemistry industries. Potential amounts of packaging waste to be produced by these companies is calculated as 450.405 tonnes/year as can be seen in Table 4.25.

Table 4.25 Inventory of packaging waste for chemistry sector

Companies	**Amount of Packaging Waste (kg/year)**	**Sales on Output (TL)**
E1	**14550**	**156553465**
E2	**4210**	**205178761**
E3	**51730**	**241291744**
E4	**173700**	**3476676148**
E5	**32420**	**368914148**
E6	11859	20157982
E7	11838	19711733
E8	17972	150323663
E9	118525	2291684633
E10	13601	57246306
TOTAL (tones)	**450.405**	**-**

4.6 Petroleum Industries

Table 4.26 shows annual amount of packaging wastes and their percentage breakdowns declared by the three companies chosen from petroleum industries. Figure 4.22 includes percentage breakdowns according to types of packaging wastes produced (paper-cardboard, plastics, metals, glass, nylons, woods).

Table 4.26 Annual amount of packaging wastes for petroleum industries

Types of Packaging Waste	F1	F2	F3	TOTAL (tones/year)
Paper (kg)	95700	9620	12960	**118.280**
Cardboard (kg)	26860	1460	3452	**31.772**
Plastics(kg)	13960	7820	1980	**23.760**
Metal(kg)	0	0	0	**0**
Glass(kg)	0	1060	0	**1.060**
PE(kg)	1500	4800	7700	**14.000**
Wood (kg)	0	0	1320	**1.320**
TOTAL(tones/year)	**138.020**	**24.760**	**27.412**	**190.192**

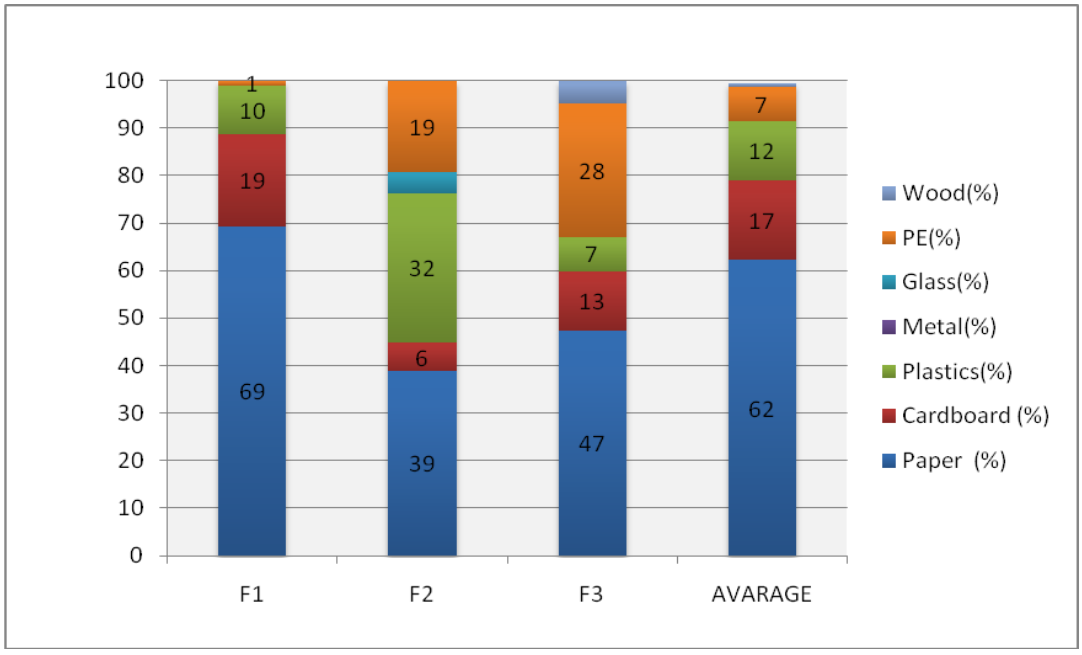

Figure 4.22 Percentage breakdowns of packaging wastes for petroleum industries

Figure 4.22 shows the major components of the packaging waste generated in petroleum sector, which are paper and PE.

In addition, Table 4.27 and Figure 4.23 present monthly amounts of packaging wastes produced by the three companies concerned.

Table 4.27 Monthly amounts of packaging wastes for petroleum industries

Companies	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL (tonnes)
F1	15000	16640	28180	7460	4720	4680	12460	8420	9100	12220	9360	9780	**138.020**
F2		2140		2820	1860	2120	4820	2060	1940	3700	1560	1740	**24.760**
F3			1720	2260	3060	2220	2340	3460	4080	1827	3240	3205	**27.412**

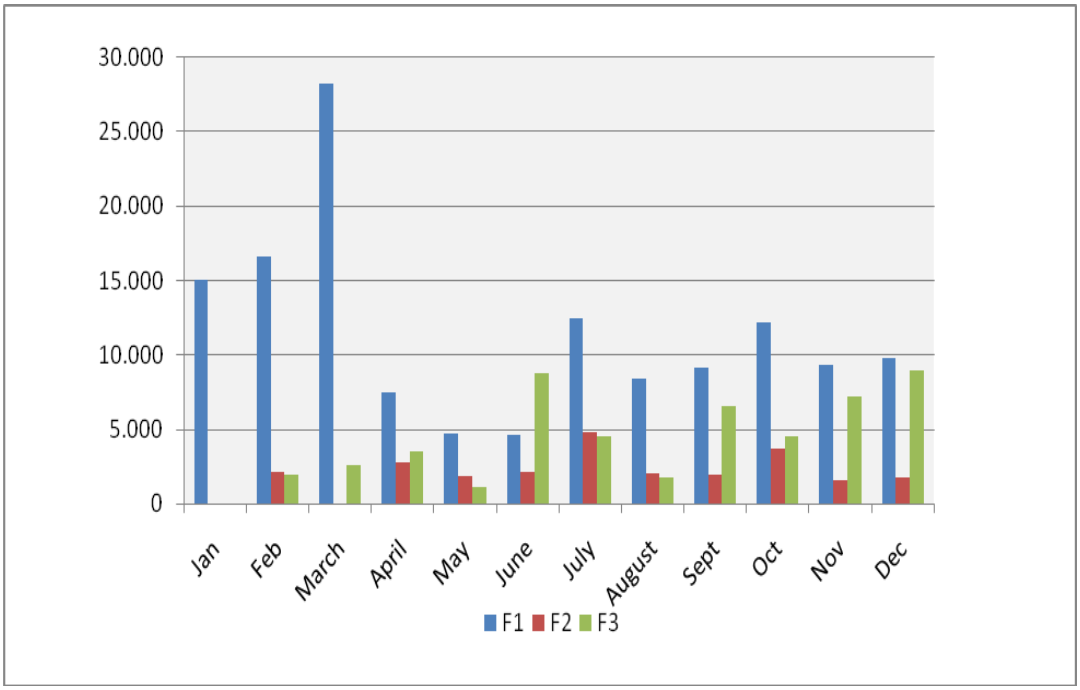

Figure 4.23 Monthly amounts of packaging wastes for petroleum industries

Figure 4.23 indicates that packaging waste is produced in winter months, especially in petroleum sector.

Table 4.28 and Figure 4.24 show data of amounts of sales on output by the first 250 companies in 2008 according to Aegean Region Chamber of Industry.

Table 4.28 Sales on Output for Petroleum Industries

Companies	Sales on Output (TL)
F1	10657101156
F2	166449886
F3	102405449

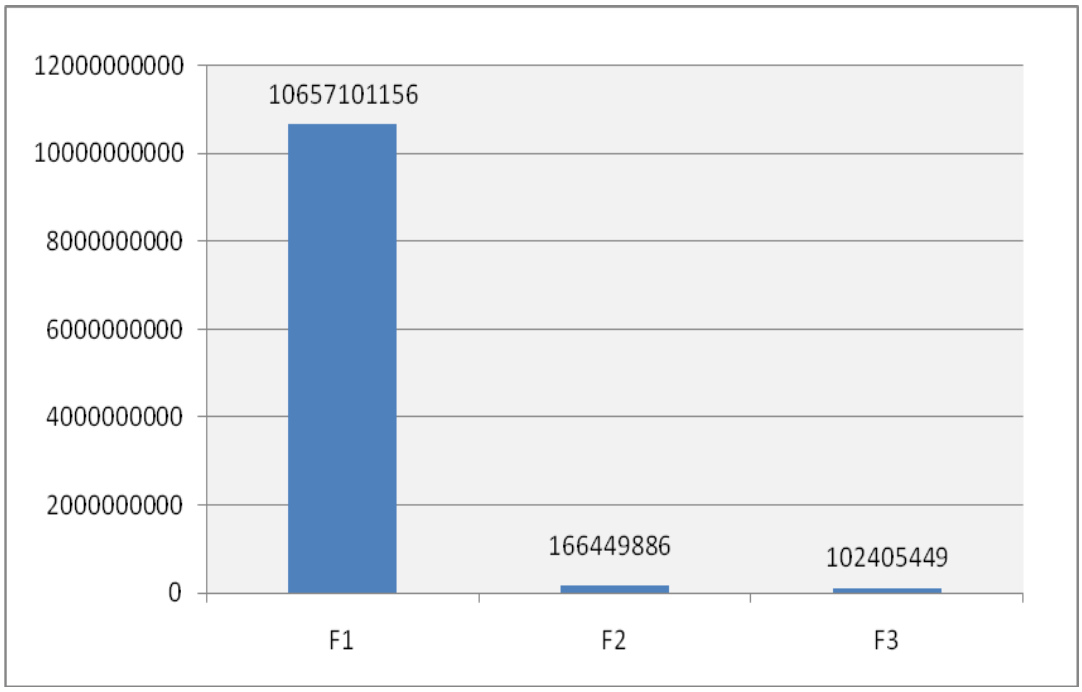

Figure 4.24 Sales on output for petroleum industries

Table 4.29 shows information on amounts of sales on output and number of packaging waste produced by the three companies chosen from the sector.

Table 4.29 Data of amounts of sales on output and packaging wastes for petroleum industries

Companies	Amount of Packaging Waste (kg/year)	Sales on Output (TL)
F1	138020	10657101156
F2	24760	166449886
F3	27412	102405449

Correlation has been established between amount of packaging waste and number of sales on output from the equation "S = 95424,34 P – 2513366635,48" in Figure 4.25, where (P) is amount of packaging waste produced and (S) number of sales on output.

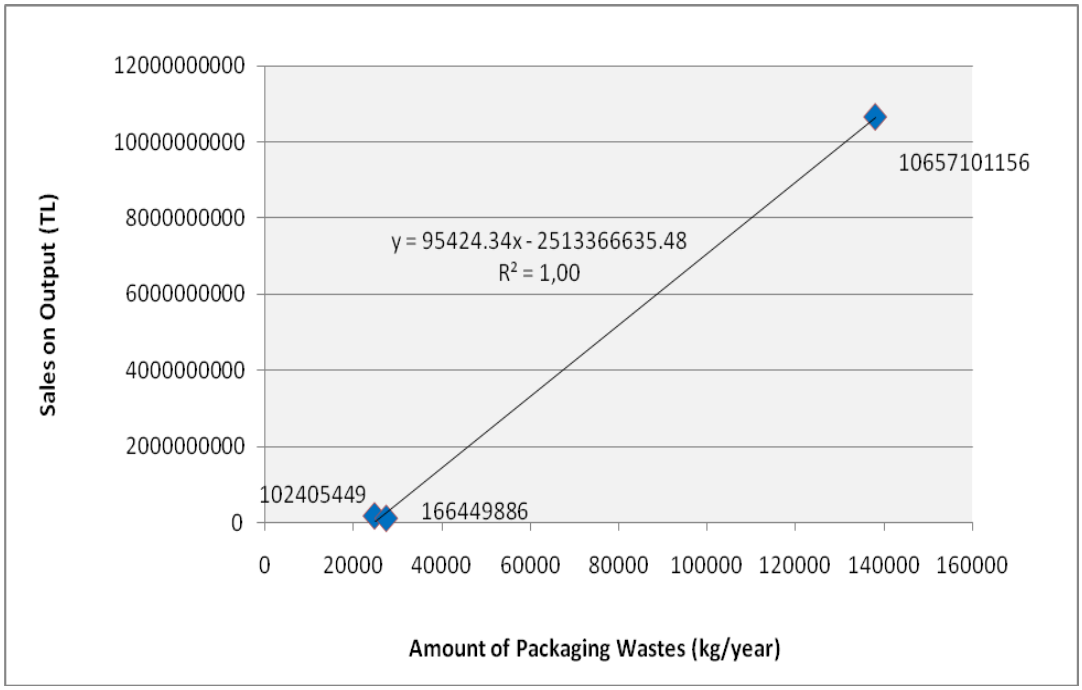

Figure 4.25 Correlation between amount of packaging wastes and number of sales on output for petroleum industries

Packaging waste amounts have been calculated to be produced by the four companies included in the first 250 ones using EBSO data of annual sales on output in the above equation where (S) is applied to yearly sales on output, according to which the inventory of packaging waste has been formed for the petroleum industries. Potential amount of packaging waste to be produced by these companies is 216.864 tonnes/year in Table 4.30.

Table 4.30 Inventory of packaging waste for petroleum sector

Companies	Amount of Packaging Waste (kg/year)	Sales on Output (TL)
F1	**138020**	**10657101156**
F2	**24760**	**166449886**
F3	**27412**	**102405449**
F4	26672	31807813
TOTAL (tones)	**216.864**	**-**

4.7 Iron & Steel Industries

Table 4.31 shows annual amount of packaging wastes and their percentage breakdowns declared by the four companies chosen from iron & steel industries. Figure 4.26 includes percentage breakdowns according to types of packaging wastes produced (paper-cardboard, plastics, metals, glass, nylons, woods)

Table 4.31 Annual amount of packaging wastes for iron & steel sector

Types of Packaging Wastes	G1	G2	G3	G4	TOTAL (tones/year)
Paper (kg)	2550	1660	1500	2650	**8.360**
Cardboard (kg)	0	2993	0	3033	**6.026**
Plastics (kg)	500	170	700	190	**1.560**
Metal (kg)	0	0	0	0	**0**
Glass (kg)	0	60	150	0	**210**
PE (kg)	0	125	0	110	**235**
Wood (kg)	0	0	0	0	**0**
TOTAL (tones/year)	**3.050**	**5.008**	**2.350**	**5.983**	**16.391**

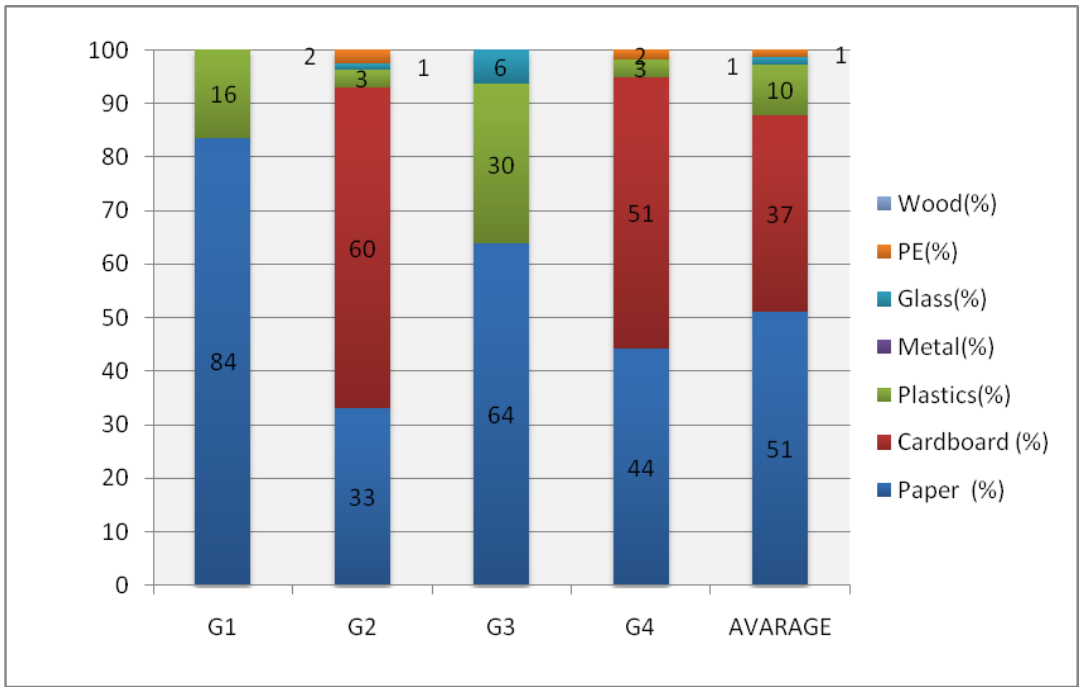

Figure 4.26 Percentage breakdowns of packaging wastes for iron & steel sector

Figure 4.26 presents the major component of packaging waste in iron&steel sector as paper and cardboard.

In addition, Table 4.32 and Figure 4.27 present monthly amounts of packaging wastes produced by the four companies concerned.

Table 4.27 Monthly amounts of packaging wastes for iron & steel industries

	Jan	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**TOTAL (tonnes)**
G1	350	550		950	250	350	100	350	150				**3.050**
G2	360	220	120	140		140	160	320	280	1283	810	1175	**5.008**
G3	0				2.350								**2.350**
G4						750	950	950	1550	723	405	655	**5.983**

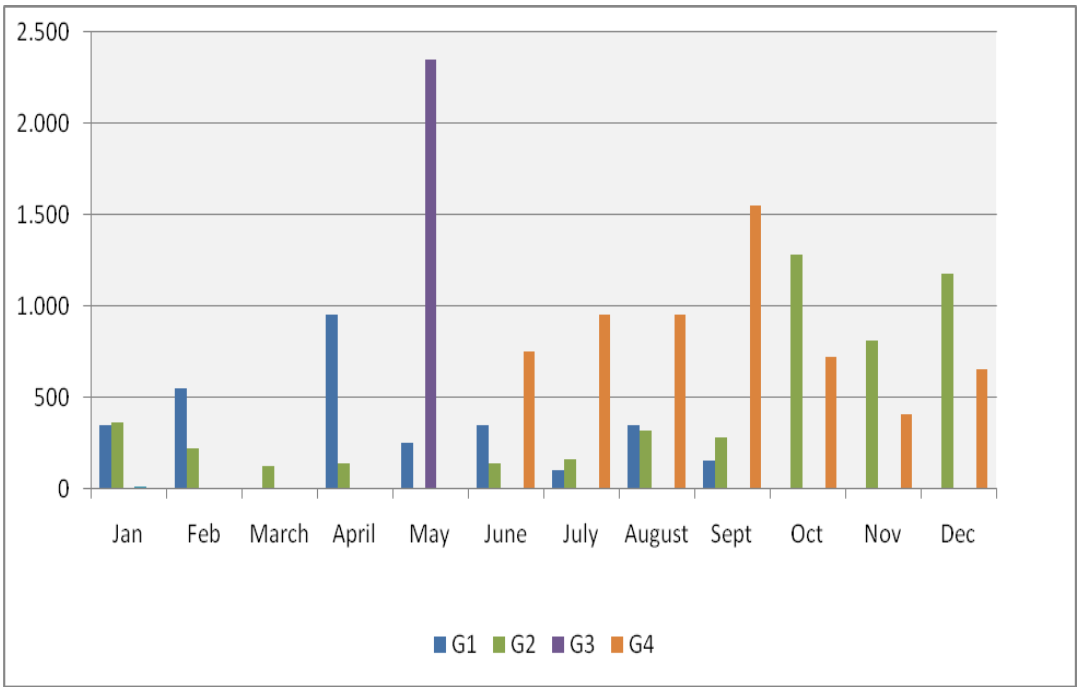

Figure 4.27 Monthly amounts of packaging wastes for iron & steel industries

Figure 4.27 shows that packaging waste are dominantly produced from June to January in iron&steel sector.

Table 4.33 and Figure 4.28 show data of amounts of sales on output by the first 250 companies in 2008 according to Aegean Region Chamber of Industry.

Table 4.33 Sales on output for iron & steel industries

Companies	**Sales on Output (TL)**
G1	218685839
G2	1293751270
G3	541165338
G4	633280515

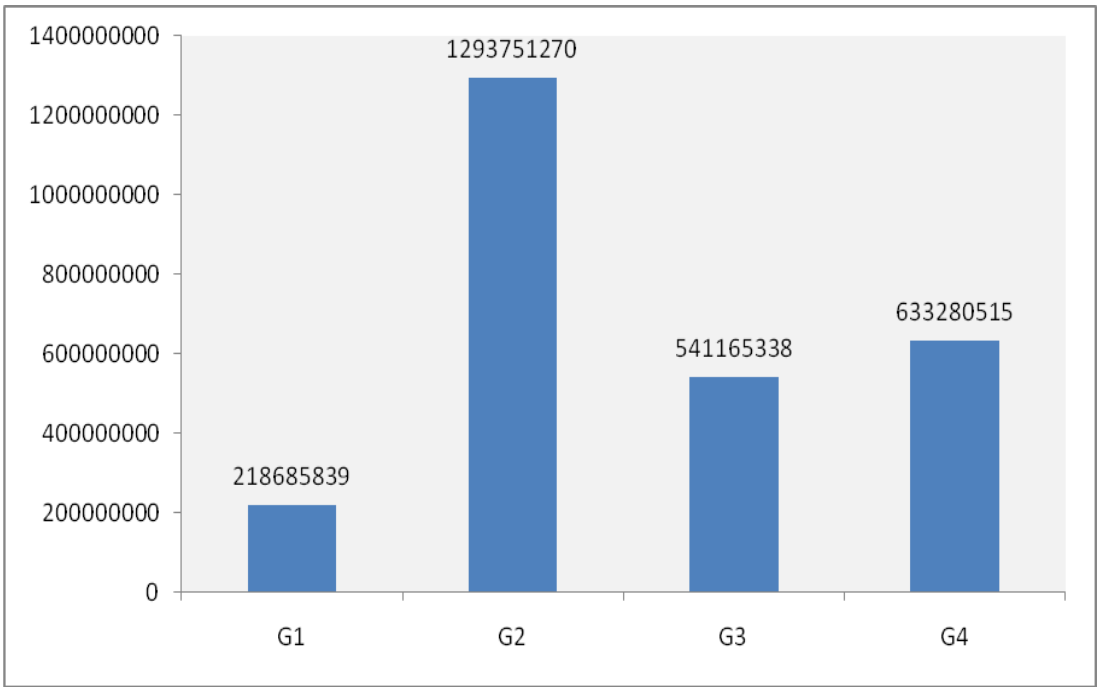

Figure 4.28 Sales on output for iron & steel industries

Table 4.34 shows information on amounts of sales on output and number of packaging waste produced by the four companies chosen from the sector.

Table 4.34 Data of amounts of sales on output and packaging wastes for iron & steel industries

Companies	**Amount of Packaging Waste (kg/year)**	**Sales on Output (TL)**
G1	3050	218685839
G2	5008	1293751270
G3	12170	541165338
G4	5983	633280515

Correlation has been established between amount of packaging waste and number of sales on output from the equation “S = 141355,16 P – 212447390,39” in Figure 4.29, where (P) is amount of packaging waste produced and (S) number of sales on output.

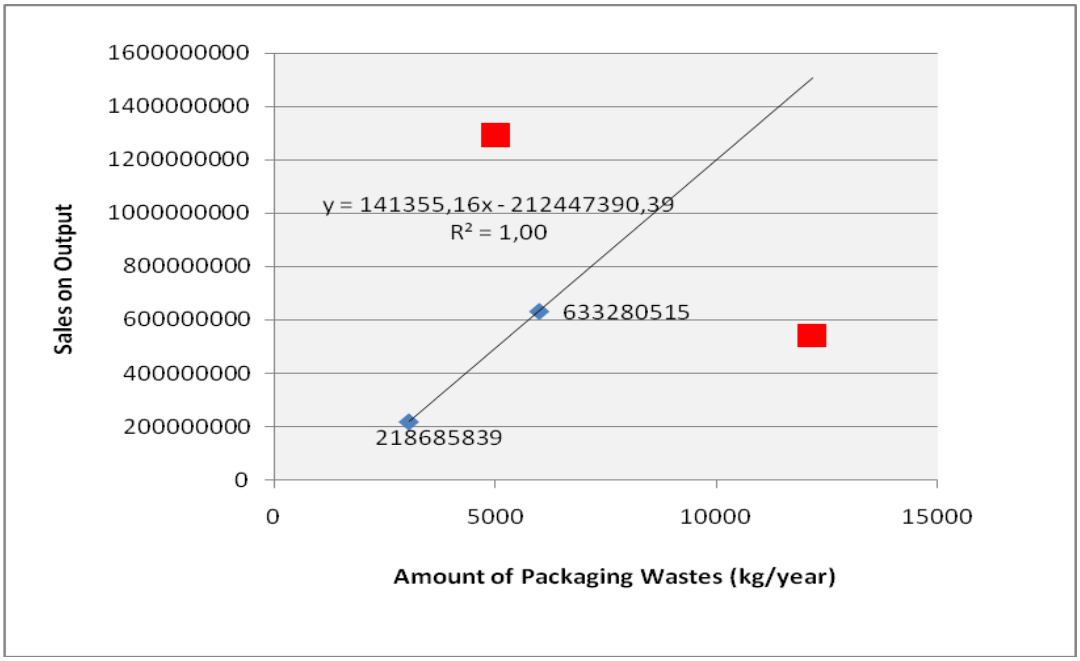

Figure 4.29 Correlation between amount of packaging wastes and number of sales on output for iron & steel industries

Packaging waste amounts have been calculated to be produced for the seven companies included in the first 250 ones using EBSO data of annual sales on output in the above equation where (S) is applied to yearly sales on output, according to which the inventory of packaging waste has been formed for the iron & steel industries. Potential amount of packaging waste to be produced by these companies is 44.579 tonnes/year in Table 4.35.

Table 4.35 Inventory of packaging waste for iron-steel industries

Companies	**Amount of Packaging Waste (kg/year)**	**Sales on Output (TL)**
G1	**3050**	**218685839**
G2	**5008**	**1293751270**
G3	**12170**	**541165338**
G4	**5983**	**633280515**
G5	10700	1300000000
G6	2366	122012646
G7	5302	537005830
TOTAL (tones/year)	**44.579**	

4.8 Automotive Industries

Table 4.36 shows annual amount of packaging wastes and their percentage breakdowns declared by the six companies chosen from automotive industries. Figure 4.30 includes percentage breakdowns according to types of packaging wastes produced (paper-cardboard, plastics, metals, glass, nylons, woods)

Table 4.36 Anuual amount of packaging wastes for automotive sector

Types of Packaging Wastes	H1	H2	H3	H4	H5	H6	TOTAL (tones/year)
Paper (kg)	12480	2820	14600	57460	13560	235445	**336.365**
Cardboard (kg)	0	0	3760	14500	18860	0	**37.120**
Plastics(kg)	650	310	1200	2700	0	0	**4.860**
Metal(kg)	0	0	0	2740	0	0	**2.740**
Glass(kg)	0	0	0	1740	0	0	**1.740**
PE(kg)	1420	1080	2420	20600	0	64890	**90.410**
Wood(kg)	0	0	29750	73960	0	0	**103.710**
TOTAL(tonnes/year)	**14.550**	**4.210**	**51.730**	**173.700**	**32.420**	**300.335**	**576.945**

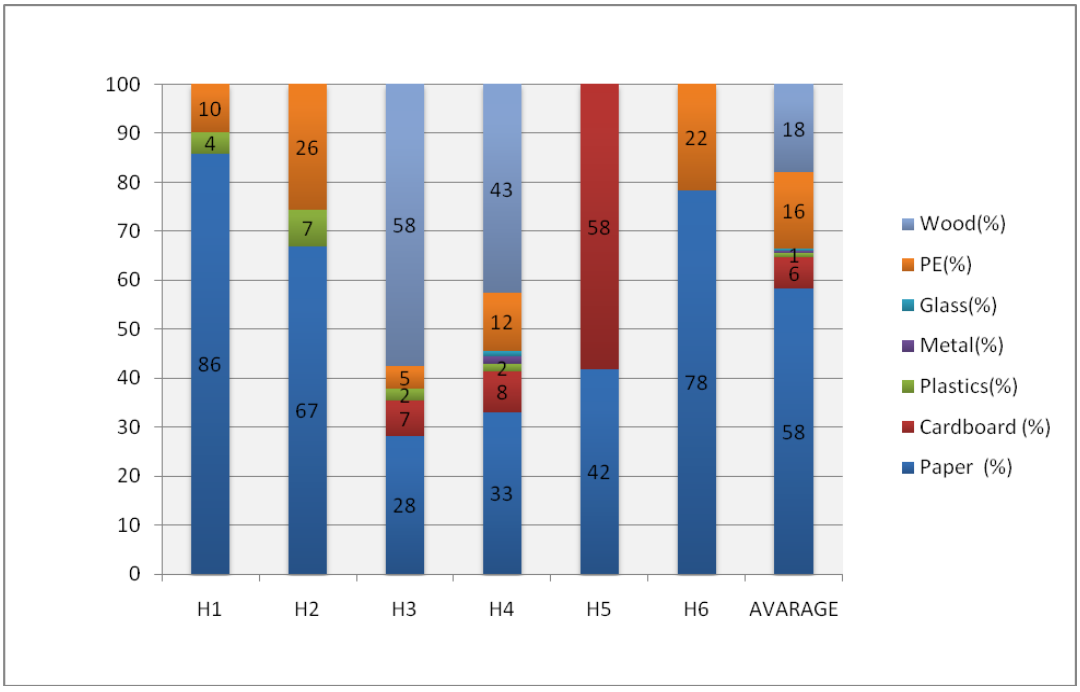

Figure 4.30 Percentage breakdowns of packaging wastes for automotive sector

Figure 4.30 presents the major components of packaging waste in automotive sector; paper and wood. In addition, Table 4.37 and Figure 4.31 show monthly amounts of packaging wastes produced by the six companies concerned.

Table 4.37 Monthly amounts of packaging wastes for automotive sector

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	TOTAL (tonnes)
H1		1660		1430	1700	1220	1660		1440	1920	1990	1530	**14.550**
H2							2860	340	340	310	360		**4.210**
H3		2000	2620	3540	1180	8820	4500	1740	6600	4500	7240	8990	**51.730**
H4	6860	8820	7640	30480	19960	13200	7640	8680	26460	27320	4760	11880	**173.700**
H5					2000	11560				6480		12380	**32.420**
H6	41968	22522	32559	26460	15990	16330	20970	19970	17969	28700	33163	23734	**300.335**

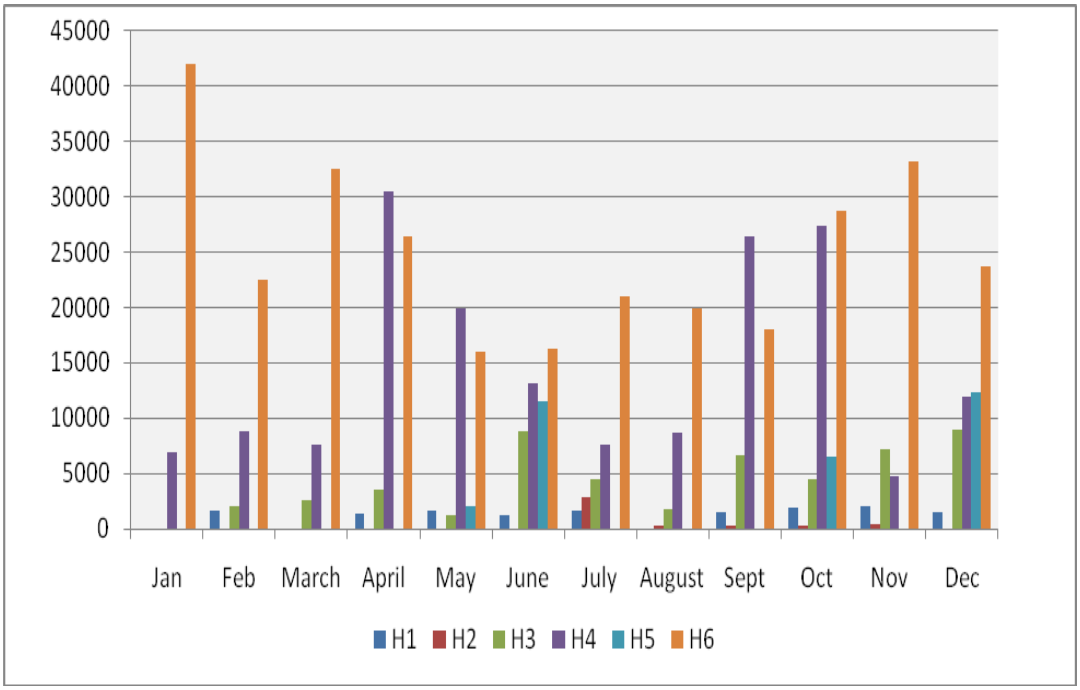

Figure 4.31 Monthly amounts of packaging wastes for automotive sector

Fig. 4.31 shows that packaging waste produced in months, in automotive industry sector.

Table 4.37 and Figure 4.32 show data of amounts of sales on output by the first 250 companies in 2008 according to Aegean Region Chamber of Industry.

Table 4.37 Sales on output for automotive sector

Companies	Sales on Output (TL)
H1	97650075
H2	67313349
H3	30927704
H4	288948025
H5	93701078
H6	681250108

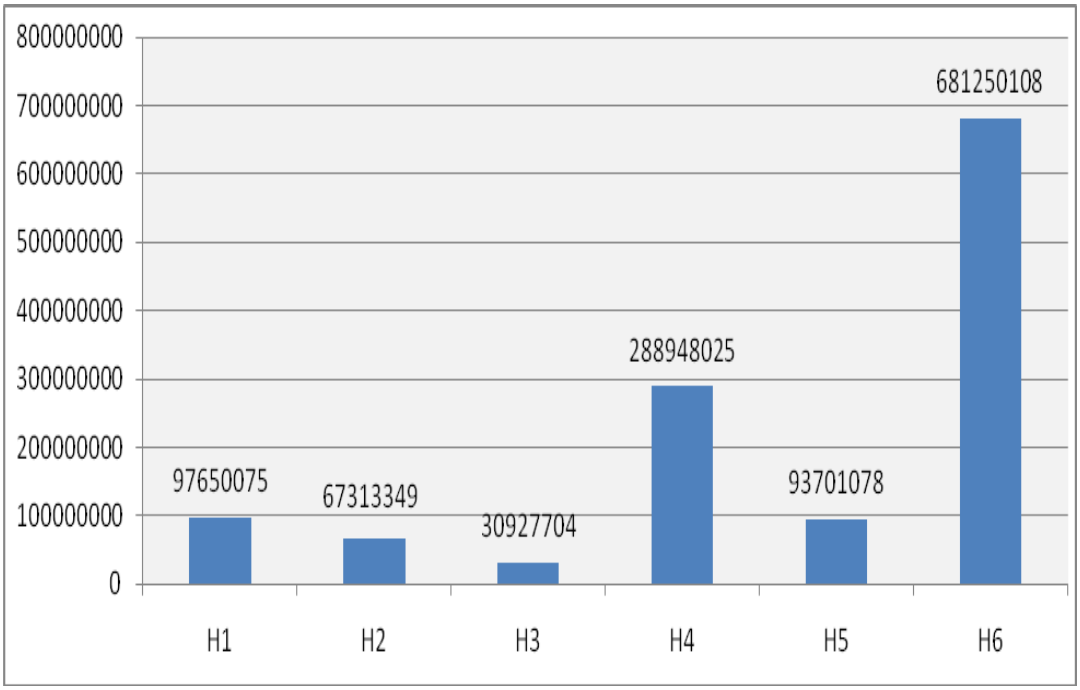

Figure 4.32 Sales on output for automotive sector

Table 4.38 shows information on amounts of sales on output and number of packaging waste produced by the six companies chosen from the sector.

Table 4.34 Data of amounts of sales on output and packaging wastes for automotive sector

Companies	Amount of Packaging Waste (kg/year)	Sales on Output (TL)
H1	14550	97650075
H2	4210	67313349
H3	51730	30927704
H4	173700	288948025
H5	32420	93701078
H6	300335	681250108

Correlation has been established between amount of packaging waste and number of sales on output from the equation "S = 2615.89 P –104392092.30" in Figure 4.33, where (P) is amount of packaging waste produced and (S) number of sales on output.

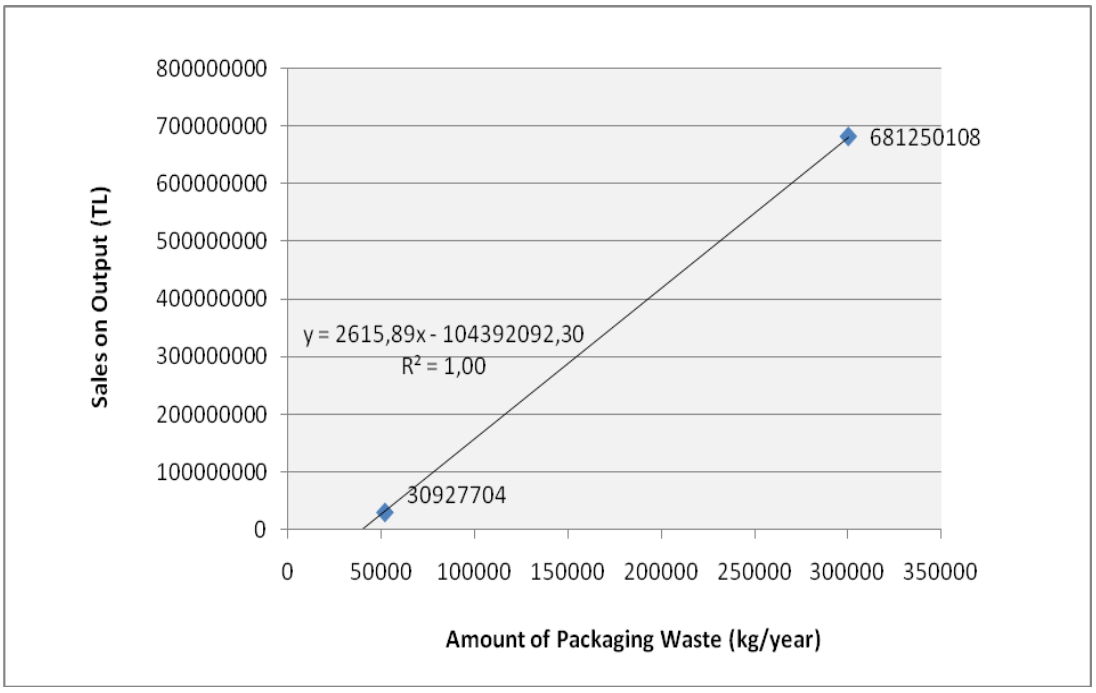

Figure 4.33 Correlation between amount of packaging wastes and number of sales on output for automotive sector

Similarly, packaging waste amounts have been calculated to be produced by the 11 companies placed in the first 250 ones using EBSO data of annual sales on output in the above equation where (S) is applied to yearly sales on output, according to which the inventory of packaging waste has been formed for the automotive

industries. Potential amount of packaging waste to be produced by these companies is 845.378 tonnes/year in Table 4.39.

Table 4.39 Inventory of packaging waste for automotive sector

Companies	Amount of Packaging Waste (kg/year)	Sales on Output (TL)
H1	**14550**	**97650075**
H2	**4210**	**67313349**
H3	**51730**	**30927704**
H4	**173700**	**288948025**
H5	**32420**	**93701078**
H6	**300335**	**681250108**
H7	52979	34195076
H8	64372	63997259
H9	51007	29035508
H10	50205	26938040
H11	49871	26064598
TOTAL(tones)	**845.378**	

4.9 Tobacco Industires

Table 4.40 shows annual amount of packaging wastes and their percentage breakdowns declared by the three companies chosen from tobacco industries. Figure 4.34 includes percentage breakdowns according to types of packaging wastes produced (paper-cardboard, plastics, metals, glass, nylons, woods)

Table 4.40 Annual amount of packaging wastes for tobacco industries

Types of Packaging Wastes	I1	I2	I3	TOTAL (tones/year)
Paper (kg)	27440	4235658	0	**4263.098**
Cardboard (kg)	0	0	0	**0**
Plastics (kg)	0	9180	0	**9.180**
Metal (kg)	0	159835	0	**159.835**
Glass (kg)	0	0	0	**0**
PE(kg)	0	279950	0	**279.950**
Wood (kg)	4220	747640	0	**751.860**
TOTAL (tones/year)	**31.660**	**5432.263**	**0**	**5463.923**

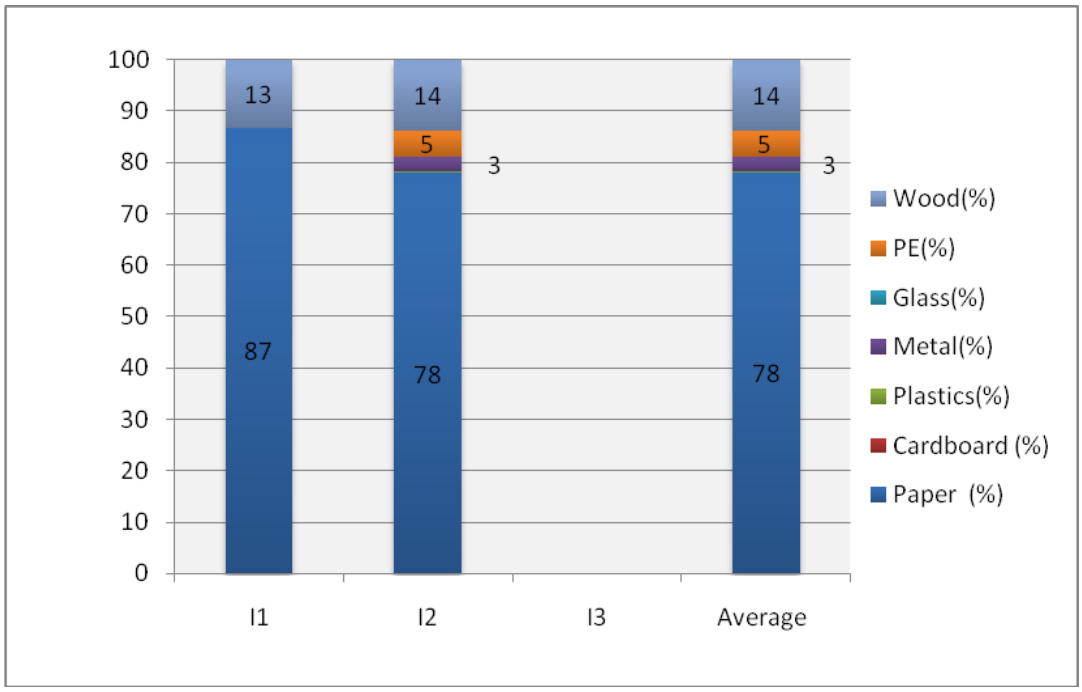

Figure 4.34 Percentage break downs of packaging wastes for tobacco industries

Figure 4.34 indicates that the major components of packaging waste in tobacco sector are paper and wood.

In addition, Table 4.41 and Figure 4.35 present monthly amounts of packaging wastes produced by the three companies concerned.

Table 4.41 Monthly amounts of packaging wastes for tobacco industries

Months	**I1**	**I2**	**I3**
January		326280	
Feb	3540	433120	
March		489680	
April	1160	447260	
May	9220	429350	
June	16120	472590	
July		501480	
August		416560	
Sep		442665	
Oct		534560	
Nov		432520	
Dec		506198	
TOTAL (tones)	**31.660**	**5432.263**	**0**

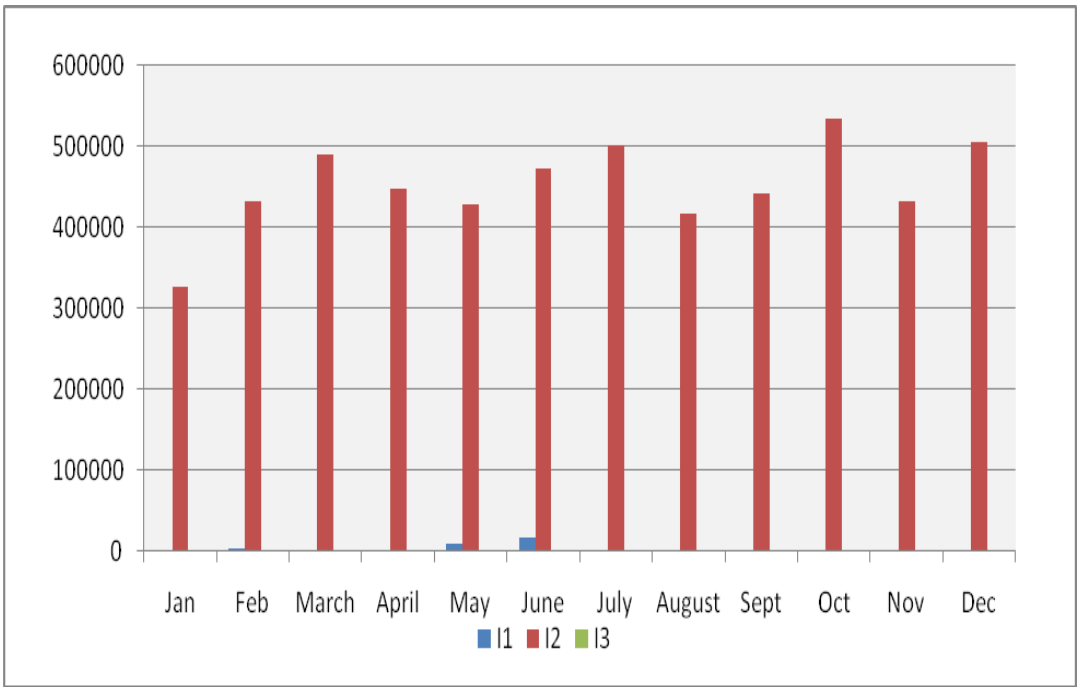

Figure 4.35 Monthly amounts of packaging wastes for tobacco industries

Figure 4.35 shows that packaging waste is produced by only the I2 companies in tobacco sector.

Table 4.42 and Figure 4.36 show data of amounts of sales on output by the first 250 companies in 2008 according to Aegean Region Chamber of Industry.

Table 4.42 Sales on output for tobacco industries

Companies	**Sales on Output (TL)**
I1	40117455
I2	143811814
I3	27509466

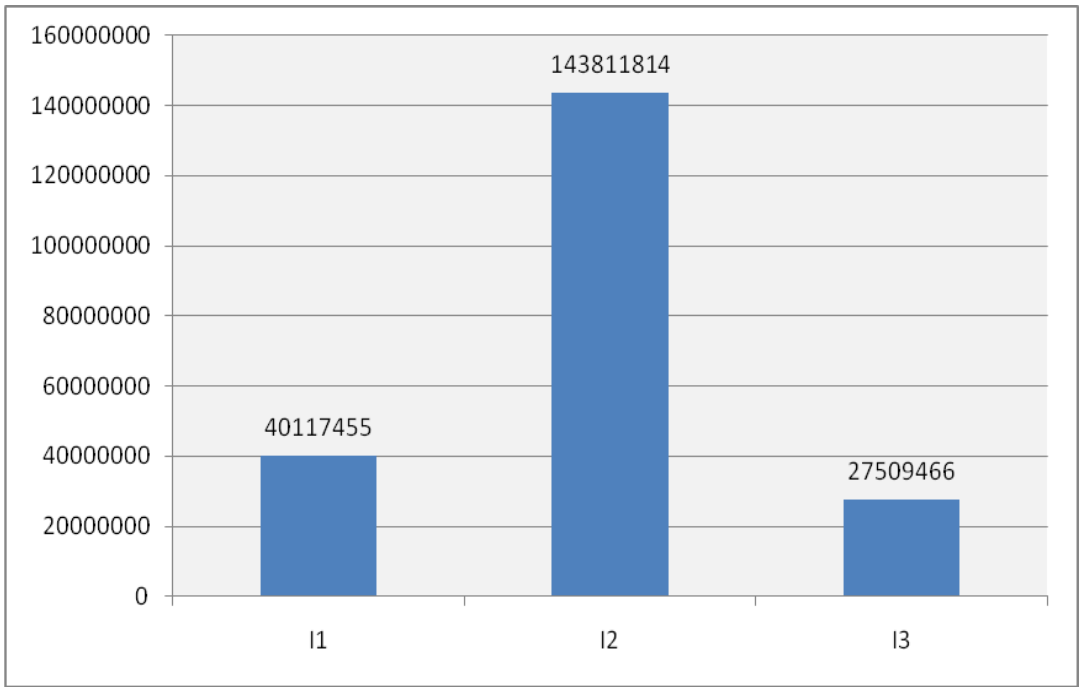

Figure 4.36 Sales on output for tobacco industries

Table 4.43 shows information on amounts of sales on output and number of packaging waste produced by the three companies chosen from the sector.

Table 4.43 Data of amounts of sales on output and packaging wastes for tobacco industries

Companies	**Amount of Packaging Waste (kg/year)**	**Sales on Output (TL)**
I1	31660	40117455
I2	5432263	143811814
I3	0	27509466

Correlation has been established between amount of packaging waste and number of sales on output from the equation “S = 21.41 P + 27509466” in Figure 4.37, where (P) is amount of packaging waste produced and (S) number of sales on output.

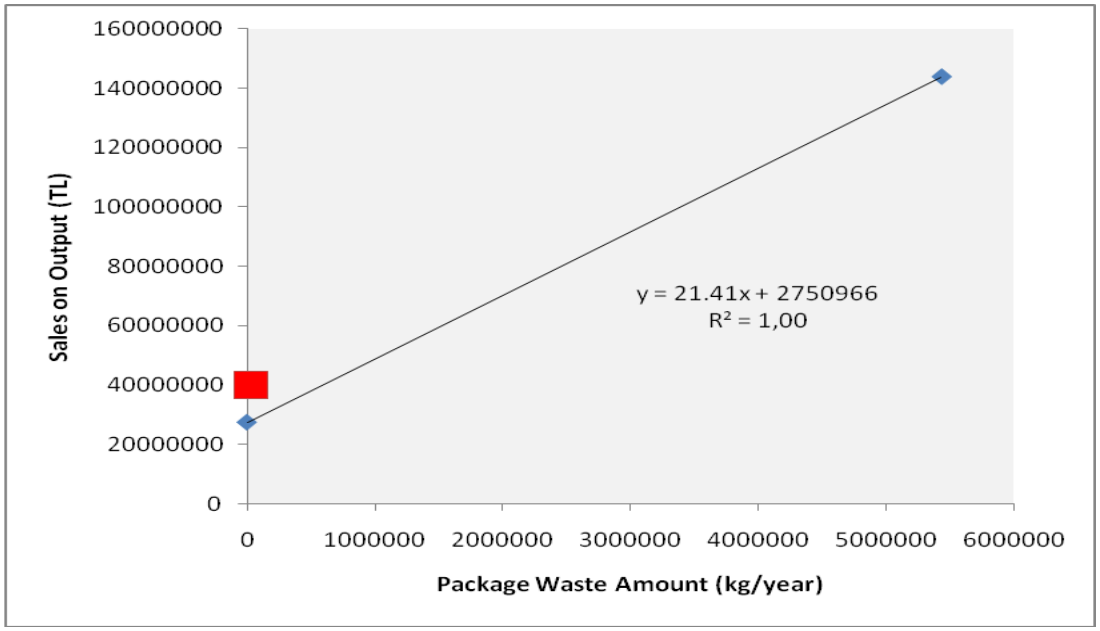

Figure 4.37 Correlation between amount of packaging wastes and number of sales on output for tobacco industries

Similarly, packaging waste amounts have been calculated to be produced by the eight companies included in the first 250 ones using EBSO data of annual sales on output in the above equation where (S) is applied to yearly sales on output, according to which the inventory of packaging waste has been formed for the Tobacco Industries. Potential amount of packaging waste to be produced by these companies is 480780.034 tonnes/year in Table 4.44.

Table 4.44 Inventory of packaging waste for Tobacco Industry

Companies	**Amount of Packaging Waste (kg/year)**	**Sales on Output (TL)**
I1	**31660**	**40117455**
I2	**5432263**	**143811814**
I3	**0**	**27509466**
I4	23052447	521062350
I5	7452053	187057928
I6	6848070	174126642
I7	4870519	131787285
I8	391022	35881244
TOTAL (tones)	48078.034	-

4.10 Total Potential Amount of Packaging Waste Produced by the Industries in Izmir

According to the findings and data processings completed, the total amount of recyclables from nine different sectors active in Aegean Region of Turkey is determined as 67206 tonnes per year as the companies in the rank of first 250 due to their direct sales.

The summary table that expresses the direct sales amounts and the predicted packaging waste amounts is given below (Table 4.45).

Table 4.45 Direct sales amounts and the predicted packaging waste for sectors

Sector Type	Number of Companies Studied	Sales on Output, Million TL/Year	Packaging Waste Amount, tonnes/year
Glass - Ceramic Industry	4	264	516
Food Industry	28	1841	2548
Vegetable Oil Industry	6	649	121
Beverage Industry	7	534	14387
Chemistry Industry	10	6988	450
Petroleum Industry	4	10957	217
Iron- Steel Industry	7	4646	45
Automotive Industry	11	1440	845
Tobacco Industry	8	1261	48078
TOTAL	**81**	**28580**	**67206**

It was seen that the amount of packaging waste generated in different industrial sectors is not directly related with direct sales, but the type of the product. In Table 4.46, the amount of packaging waste produced in the sectors is given as a function of direct sales (ton packaging waste produced/million TL of direct sale).

The amount of packaging waste produces for a million TL of direct sale is very high in Tobacco Industry and Beverage Industry sectors.

Table 4.46. Amount of packaging waste produced for million TL of direct sale in the studied sectors.

Sector	ton Packaging Waste Generated/ Million TL Direct Sale
Glass - Ceramic Industry	1,955
Food Industry	1,384
Vegetable Oil Industry	0,186
Beverage Industry	**26,942**
Chemistry Industry	0,064
Petroleum Industry	0,020
Iron- Steel Industry	0,010
Automotive Industry	0,587
Tobacco Industry	**38,127**

Interestingly, in sectors such as petroleum industry and iron and steel industry, the amount of packaging waste produced is very low for each million TL direct sale. This can be a reason of bulk sales of their products, rather than packaged.

In Table 4.47, the distribution of packaging waste types is given. As can be seen the major packaging waste produced is paper which is followed by wood and glass (Fig.4.38).

Table 4.47 Inventory of total potential amount of packaging waste produced in Izmir

NO	Type of Industry	Number of Industry	TOTAL (kg)	Paper (kg)	Card board (kg)	Plastics (kg)	Metal (kg)	Glass (kg)	PE (kg)	Wood (kg)
A	Glass - Ceramic Industry	4	516056	371560	25803	77408	0	0	36124	5161
B	Food Processing Industry	28	2547619	1146650	451397	272906	208650	0	369784	98232
C	Vegetable Oil Industry	6	120632	51667	0	18047	3993	15368	26985	4572
D	Beverage Industry	7	14386524	717888	2877	703501	1517778	9531072	224430	1688978
E	Chemistry Industry	10	450405	164328	60443	7914	4462	2833	41554	168871
F	Petroleum Industry	4	216864	135360	36344	26775	0	1207	15701	1476
G	Iron- Steel Industry	7	44579	22737	16389	4243	0	571	639	0
H	Automotive Industry	11	845378	492864	54391	7121	4015	2550	132475	151963
I	Tobacco Industry	8	48078034	37511760	0	80776	1406417	0	2463330	6615750
TOTAL (tonnes/year)		**81**	**67206**	**40615**	**648**	**1199**	**3145**	**9554**	**3311**	**8735**

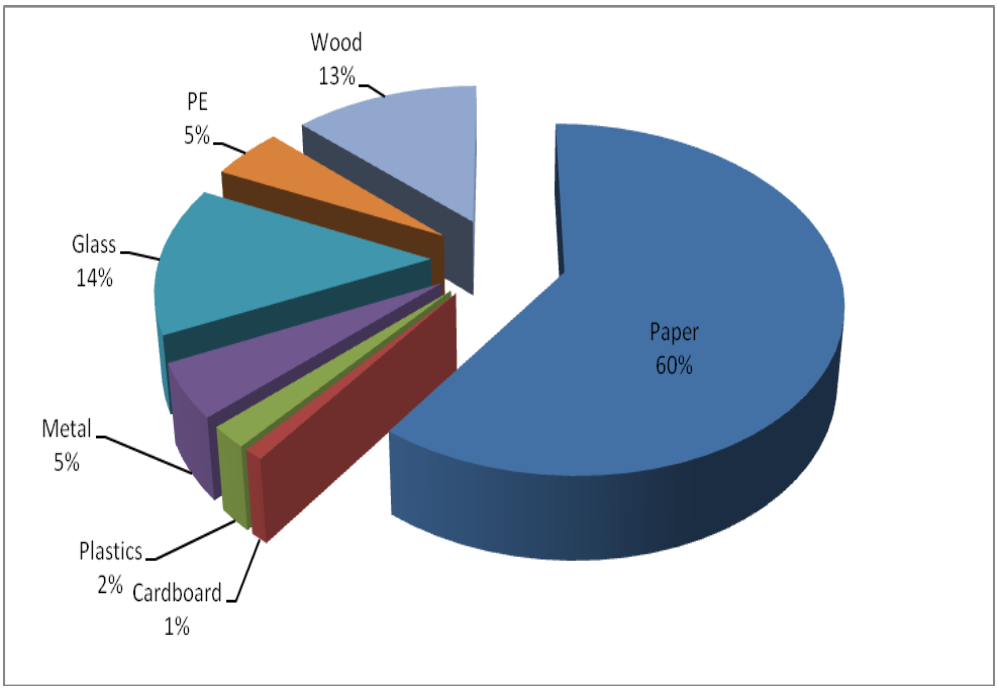

Figure 4.38 The overall distribution of packaging wastes in studied sector

CHAPTER FIVE

CONCLUSIONS

In the content of the study the packaging waste amount and types produced in nine different industrial sectors in Izmir was determined by using the data of 37 industries. The inventory is evaluated for totally 81 industrial companies which are in the rank of first 250 in Aegean Region according to their direct sales. By this way, the study made the estimation of total industrial packaging waste produced in Izmir and neighbourhood areas.

It was determined that, annually, 67206 tonnes of packaging waste is produced by the 81 companies concerned. The total capacity of licenced packaging waste collection and sorting companies in Izmir and surroundings is 184.000 tonnes where the capacity of recycling facilities is 186.000 tonnes.

Since the amount of packaging waste produced in concerned 81 facilities is more than 67206 tonnes per year, the current collection and recycling capacity in the region is quite low.

This seems to be a strong indication of uncontrolled and illegal collection and recycling activities in Izmir and adjacent areas.

This situation should be seriously controlled by the Ministry, since the value of the recyclables in the scrap market is considerably high because of the number of industrial companies from various sectors is over 4000 in Izmir and its vicinity.

REFERENCES

Aegean Region Chamber of Industry, (2008). The rank of first 250 in Aegean Region according to their direct sales. (Retrieved November 19, 2009). from http://www.ebso.org.tr/kurumsal/media/100buyuklistesi.pdf.

Erdem, E. (2009). Developments Related to Waste Management Legislation. *Waste Technologies,* 2, 33.

Europan Comission, (2010). *Packaging and Packaging Waste Introduction.* (Retrieved September 19, 2010). from http://ec.europa.eu/environment/waste/packaging_index.htm

Europan Comission, (2010). *Waste*. Retrieved 19, September, 2010, from http://ec.europa.eu/environment/waste/index.htm

Official Gazette of the Europan Union, L 47/26, (18.02.2004). *Directive 2004/12//EC of The Europan Parliamnet and of the Council of 11February 2004 Amending Directive 94/62/EC on Packaging and Packaging Waste.*

Official Gazette of the Europan Union, L 194, (27.7.1975). *Directive 75/442/EEC of The Europan Parliamnet and of the Council of 26 April 1999 on the Landfill of Waste.*

Official Gazette of the Europan Union, L 365, (31.12.1994). *Directive 94/62/EC of The Europan Parliamnet and of the Council of 20 December 1994 on Packaging and Packaging Waste.*

Official Gazette, (11.08.1983). No: 18132, *Law on Environment Numbered 2872,* The Ministry of Environmental and Forestry, Ankara, Turkey.

Official Gazette, (14.03.1991). No: 20814, *Regulation on Solid Waste Control*, The Ministry of Environmental and Forestry, Ankara, Turkey.

Offical Gazzette (10.07.2004*) Law on Great Municipalities, Numbered 5216 Amending Law on Great Municipalities Numbered 3030*, The Ministry of Environmental and Forestry, Ankara, Turkey.

Official Gazette, (30.07.2004). No: 25538, *Regulation on Packaging Waste Control*, The Ministry of Environmental and Forestry, Ankara, Turkey.

Official Gazette, (24.06.2007). No: 26562, *Regulation on Packaging Waste Control*, The Ministry of Environmental and Forestry, Ankara, Turkey.

The Packaging Waste Management Plan of The Great Municipalities of Izmir, (2008). Solid Waste Management Directory of the Great Municipality of Izmir, Turkey.

The Ministry of Environment and Forestry, (2009). *The Statics of Waste* (Retrieved November 21, 2009). from http://www.atikyonetimi.cevreorman.gov.tr/ambalaj/istatisitkler/2007_yili_ist.pdf.

The Ministry of Environment and Forestry, (2009). *The Statics of Waste* (Retrieved November 22, 2009). from http://www.atikyonetimi.cevreorman.gov.tr.

The Ministry of Environment and Forestry. Waste Management Action Plan, (2008-2012).