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Master in European Regional Development Studies

REGIONAL INNOVATION AND INNOVATIVE WASTE MANAGEMENT SYSTEMS

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ABSTRACT

The present dissertation will attempt to present the regional innovation problem and how small and medium sized enterprises settled outside of high innovative regions can innovate and produce high innovative products.This study also tries to evaluate the regional innovation environment. This environment is seen as a system of innovation networks and institutions located within a region, with regular and strong internal interaction that promotes innovativeness and is characterized by embeddedness. Innovations are increasingly seen to be the results of non-linear processes deeply embedded in normal social and economic activities. The non-linear and interactive nature of the innovation processes sets new demands for social cohesion in the regional innovation system. For the purposes of the study I will present the problem of waste management in Greece and evaluate a modern environmental solution. Urban, hospital and industrial waste threatens the water wagon horizon of our country and increases continuously the atmospheric pollution. Occasionally, various strategies have been proposed not only by private sector, but also by central state level with uncertain results that even today didn't give solution in the enormous problem. Plenty of local and foreign enterprises have proposed completed solutions round the subject, solutions however that remain unexploited. Taking advantage of the development and manufacturing of an innovative and internationally patented green product developed by the company Soukos Environmental SA the present research presents an initial investment plan of waste management mentioning simultaneous obstacles and opportunities that are provided through European and National regulations. Using a two case investment scenario for the new robotic waste management system developed by Soukos Environmental SA, this study concludes that through innovation and business synergies, regional problems can be faced effectively and increase local economic development.

Keywords: Regional innovation systems, innovation policies, regional competitiveness, learning systems, networking, network leadership, waste management

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List of Acronyms

AC	Audit Commission
ARPA-K	Architects & Regional Planners Associates, Kyoto
C&D	Construction and Demolition (waste)
CA	Civic Amenity (sites)
CIPFA	Chartered Institute of Public Finances and Accountancy
COPA	Control of Pollution Act
DSO	Direct Service Organization
EC	European Commission (directives)
EPA	Environmental Protection Act
FCA	Full Cost Accounting
GBP	Pound Sterling (currency)
GLA	Greater London Authority
InvP/hh	Inverse of person per household
JPY	Japanese Yen (currency)
JWMA	Joint Waste Management Authority (Ichibu jigyô kumiai)
LA	Local Authority
LAWDC	Local authority waste disposal company
LD%	Share of Liberal Democrat votes in local elections
LWP	Light Weight Packaging
MBI	Market-based Instrument
MHW	Ministry of Health and Welfare (Kôseishô, Japan)
MRF	Materials Reclamation (Recycling) Facility
OLS	Ordinary Least Squares
PAYT	Pay As You Throw
PPP	Polluter Pays Principle
PRP	Producer Responsibility Principle
PI	Performance Indicator (Audit Commission)
PRN	Packaging waste Recovery Notes
RCEP	Royal Commission on Environmental Pollution
VOC	Volatile Organic Compounds
WCA	Waste Collection Authority
WDA	Waste Disposal Authority

WDF	Waste Derived Fuel
WLS	Weighted Least Squares
WLWA	West London Waste Authority
WPA	Waste Planning Authority
WRA	Waste Regulation Authority

INTRODUCTION

The importance of the regional level in research has risen during the last two decades. A vast literature in the fields of, for instance, evolutionary and institutional economics, network theory, innovation and learning systems, as well as in sociology, has focused on regional level questions. In this literature a region is seen as an essential part of the economic co-ordination under the present techno-economic and socio-institutional paradigm. Accordingly, there is much influential empirical evidence that the present world includes phenomena increasing the role of regions in explaining the ongoing economic transformation. Innovations are increasingly seen as the driving force of regional competitiveness and economic growth.

However, our understanding of the nature of innovation has changed during the last century. Innovation was earlier seen as a radical invention accomplished by a heroic inventor. Nowadays, innovation is considered to be most often a result of co-operation in normal social and economic activities. The innovation process normally includes many kinds of interaction, and innovations do not have to be radical, on the contrary, they are as well incremental social and organizational changes as technological advancements.

Consequently, innovations are not just the results of scientific work in a laboratory-like environment. They are done in networks where actors of different backgrounds are involved in the process setting new demand for innovativeness. The science push effect as the driving force of innovations is an exception rather than a rule in these processes. A more influential source of innovations seems to be factors like the ability to interact, learn collectively and build trustful relations between the innovating partners. Innovativeness depends in most cases on the innovation network's ability to interact rather than on an individual actor's progress in a particular scientific field (Archibugi, D. and Michie, J. 1995).

The demand for new innovation policies and strategies is clear and widely accepted. It is, however, far from clear what practical form these new policy applications should take. The regional policy-makers lack practical step-to-step methods for reforming regional innovation environments in order to respond better to the demands of the new techno-economic paradigm.

CONDITION THAT CREATED THE IDEA

The problem of the management of waste we face today constitutes one of the most complex and difficult problems for each modern society. According to the current available data for our country, each year millions of tonnes of urban solid waste are produced since each resident creates roughly 1kg per day of waste. Moreover, large quantities of useful materials such as paper, glass, aluminium, plastic, metals, and timber are lost daily, while they could be developed into new products, re-used or recycled, thus economising enormous quantities of raw material and energy . The modern perceptions and practices for the management of urban solid waste dictate henceforth the planning and concretisation of completed systems, with fundamental objectives and viability, and the effective management and saving of natural resources and energy.

The existing problems in the management of urban waste that developed this idea are following:

• The small capacity of the common mechanical bins for waste is the cause for the often deposition of waste outside of them, which contributes to the burden of public health, the environment and aesthetics of the area. Each citizen that comes in contact with these open areas of pollution such as the unpleasant gases, liquids and microbes, affects and also determines the quality of their daily life.

• The lack of resistance in the changes in climate conditions (heat, cold, and rain) due to the non leak-tightness

• The common waste bin use is non user friendly for all ages within the age spectrum (children, elderly and, persons with special needs)

• Its operation is noisy and unpleasant during the collection of waste (opening, closure of the bin) and also during the evacuation and the transportation.

• All users and workers from the cleaning service come in contact with the waste, which is very hazardous to their health and anti aesthetic.

• The lack of frequent disinfection of bins of waste, as well as the lack of disinfection of stored waste inside the common bins, constitute piles of pollution and endanger public health.

• The possible and relatively easy relocation of common bins wherever and whenever by anyone (e.g. to create a parking space, arsons, relocation of buckets for dams), creates issues in the order of our lives

• The large number of common waste bins required due to their small capacity, the storage, the maintenance and repair, the frequent almost daily need for evacuation, which is all at the cost of the cleaning service responsible for the bins.

• And generally, the complete picture of common bins of waste which are anti-aesthetic and its function is not consistent with the culture of everyday routine of modern city.

The products that were presented in the market in order to replace the common mechanical bins, while they resolved certain problems, in total did not constitute competitive products and for this reason were not successful.

In particular, the existing problems are the following:

- The small capacity of common mechanical waste bins is the reason for the often dumping of waste outside of them; a fact that burdens public health, the environment and aesthetics. Every citizen contacts these open sites of pollution, which include foul odours, gasses, liquids and microbes that, among others, affect the citizen's quality of everyday life.
- Their use is not easy for citizens of all ages, such as children, seniors, or persons with disabilities).
- Their waterproof qualities cannot sustain weather changes (heat, cold, rain) and frequent use.
- Their possible and relatively easy moving by anyone and at anytime and for any reason (e.g. creation of parking space, arson, and use as barriers by vandals) poses a problem to our everyday lives.
- Their large numbers, due to their small capacity, the storage, maintenance and repair result to a significant cost for the qualified Authority (www.ypes.gr).

OBJECTIVE OF THE STUDY AND RESEARCH QUESTIONS

Objective of the study

The objective of the present study is to understand the regional innovation in the information era in order to increase sustainable regional competitiveness through innovative companies. In order to be able to solve the research problem and reach the objective of the study the following questions should be considered in the study:

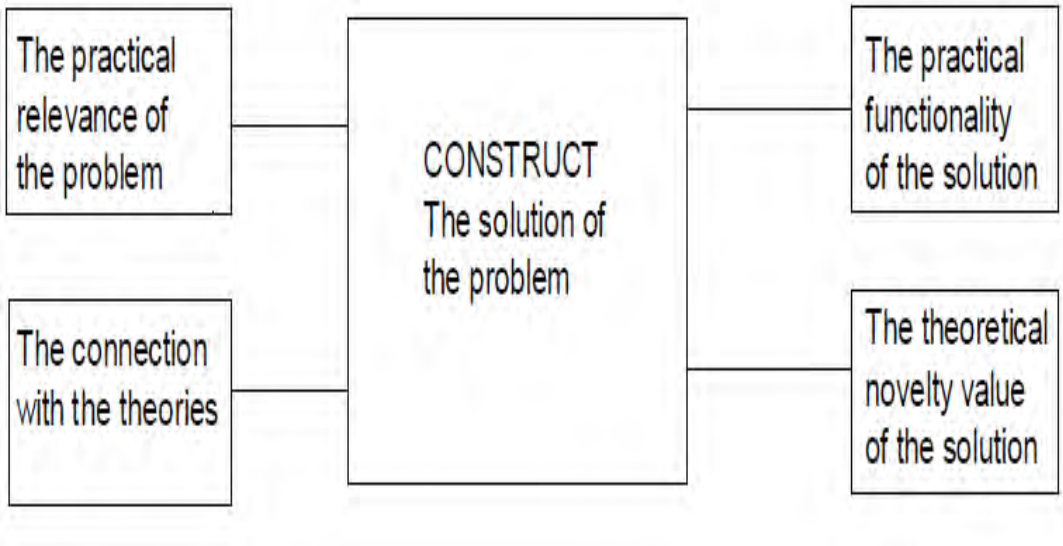
- How does the new techno-socio-economic paradigm affect the regions?
- How have the political processes changed the development environment of the regions?
- What are the important factors in creating sustainable regional competitiveness in the present society?
- What is a regional innovation system and what is its role in forming regional competitiveness?
- What are the main elements and goals of regional innovation policy?
- Can innovative investments be feasible in low innovative regions?

RESEARCH METHODOLOGY

The study is powerfully based on the theories on evolutionary economics and regional innovation systems defining regions as highly individual and specific entities where general development strategies and policies are normally useless encouraging the use of deeply qualitative case methods. Combining scientific research with practical work has its pros and cons. The researcher, being part of the phenomenon studied and being able to steer the studied development process, enables a quick practical application of the conclusions drawn by reflective observation and abstract combining. The developer's role in a research project also gives a good basis for the applicability of the final results of the study.

For valuation purposes NPV, IRR and CAPM valuate methods are used in the part of the case study.

Figure 1: The basic parts of constructive research



Source: (Kasanen et al., 1991)

STRUCTURE

The structure of the present research study is as follows:

In Chapter 1 the environment in which the regions exist in today's world is considered. The assessment tackles the role of regions under the present techno-economic and socio-institutional paradigm. The focus is on the factors forming sustainable regional competitiveness in the information era. Chapter 2 tackles the regional innovation environment and the main factors and phenomena affecting regional innovation systems.

Chapter 3 sheds light on the strategic and policy matters in regional development, especially in the development of a regional innovation environment. Finally, theses for building sunrise innovation policies and strategies are stated. Chapters 1, 2 and 3 are based on a theoretical assessment of the relevant existing literature predominantly in the fields of innovation and learning systems, strategic management, evolutionary and

institutional economics, regional sciences, sociology and networking theory. In Chapter 4, the importance of innovation in the business field is being analyzed.

Chapter 5 describes the regional innovation problem in the EU and presents the national innovation system of Greece. In Chapter 6 we present data on research and development. In chapter 7 and 8 there is an analytical presentation of the product and of the company that create the idea. Chapter 9 and 10 presents the external environment analysis and some competitive products that exist in the market. In Chapter 11 the conclusions of the research are drawn. Finally, in Chapter 12 some directions for further research are outlined.

MAIN TERMS AND CONCEPTS OF THE STUDY

Because of the holistic nature of the study many different terms and concepts are used in this present study. These terms and concepts have many different and sometimes even partly contradictory definitions. Therefore, it is reasonable to give definitions of the main terms and concepts already at this early stage of the study.

National innovation system

National innovation system is “the system of interacting private and public firms (either large or small), universities, and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social, and financial, inasmuch as the goal of the interaction is the development, protection, financing, regulation of new science and technology” (Niosi *et al.*, 1993: 212).

Sectoral innovation system

Sect oral innovation system can be defined as a set of products and a set of agents carrying out market and non-market interactions for the creation, production and sale of those products. A sect oral system has a specific knowledge base, technologies, inputs and demand. Agents are individuals and organizations at various levels of aggregation (Malerba 2002).

Regional innovation system

The regional innovation system is “a system of innovative networks and institutions located within a certain geographical area, with regular and strong internal interaction that promotes the innovativeness of the region´s companies.” (Kostiainen, 2002: 80.)

Learning economy

Learning economy is “an economy, where the ability to learn is decisive for the economic success of individuals, firms, regions and nations. Learning, in this context, does not just refer to the acquisition of information or access to the sources of information, but also to the development of new areas of competence and new skills” (Lundvall and Borrás, 1999: 29).

Learning region

Learning regions are regions that “function as collectors and repositories of knowledge and ideas, and provide an underlying environment or infrastructure which facilitates the flow of knowledge, ideas and learning. Learning regions are increasingly important sources of innovation and economic growth” (Florida, 1995: 528).

CHAPTER 1

CHANGE IN THE REGIONAL DEVELOPMENT ENVIRONMENT

1.1 TECHNOLOGICAL ADVANCE - TECHNOLOGICAL CHANGE. HISTORICAL BACKGROUND

The concept of technological advance, and development in general, is relatively recent to humankind, and, in specific, it dates back to the Renaissance period. Since Renaissance the conceptual nature of technological advance in Western Civilization has been influenced by a series of new perceptions, which have given advance a set of characteristics. For example, technological advance contributes directly to the improvement of material, social, cultural and spiritual life, thus accelerating civilization's building, conquering nature and forcing nature to serve mankind. Technology and civilization have reached their peak in Western industrialized world (Vernardakis, 2006).

Throughout history, technology was the basic element diversifying the phases of human evolution, identifying survival skills and nation or civilization dominance or fall and exclusion. Nowadays, it leads new economical, social and cultural relations worldwide to new organization patterns. In fact, it is a powerful tool for economic change, social dynamics and political power (Giannitsis, 1991).

1.2 TECHNOLOGY & DEVELOPMENT. THEORETICAL APPROACHES

Smith acknowledged technological advance's key role to wealth increase and distinguished the way in which labor division creates positive conditions for technological advance, which subsequently counteracts in division expansion, quality improvement and labor productivity and, therefore, wealth increase. The particular form, adapted by Smith, constitutes a sophisticated, multi-leveled relation between technological advance and economic trends, and in the meantime it integrates them in labor division dynamics. Two trends of theoretical thinking stem from Smith's ideas. The first one from Ricardo and Mill, led to Neoclassic Theory, which treats technological advance as a dimension defined out of the economical system. The other, which answers

to Smith's analysis, and was developed mostly by Marx, treats technology as an inner dimension of the economical system. Of course, there are approaches attempting to combine these two basic theoretical trends (Pakos, 1992).

According to J.S. Mill, economies tend to balance at the point set by the stagnation state. Technological advance is a factor causing transient disturbance. This approach influenced the development of Limit Theory and its occupation with the definition of the static general balance presuppositions within a model of perfect competition (J.S.Mill, 2002). Marx took over the original ideas from Smith and Ricardo and subjected them to austere criticism and detailed empirical inspection, he adjusted them to the mature capitalism conditions of his time and developed them. Marx supported continuous growth and capitalism transgression. For Marx, technological advance was a cause and effect at the same time. It's integrally connected to the capitalistic accumulation process. A capitalistic business is always under pressure to invest profits acquired by the exploitation of manpower into new means of production, in order to replace the losses, to increase quantity, and maintain a close and tight relationship with technological advance (Robert Bills).

Recent studies (Matthiews, 1982, Denison, 1985, Jorgenson, 1990) attribute about one third of growth in technology, however omitting to mention the causes responsible for the technological advance. It is quite difficult to measure the product size of a business, originating from innovative changes. One of the most important studies classification is the degree in which they try to make the know how surplus and the dispersion process endogenous. Benefits from this research expand to vicinal businesses, thus gaining not only from the indigenous technological infrastructure, but from research done abroad, as well. In the mid 70s and in the recent years mostly, there is a new dynamic scientific field rising, regarding economic matters relative to technology and to technical change, extending to economic and social change.

Within Greek economy and society, where technology was marginalized until recently as a political and social priority, the relation between technology and development should be the center of theoretical and political problematic. As a result of the economy's impotence to complete what other upcoming countries succeeded over the

last decade, Greek economy is going through a crisis, there is enhanced imbalance on all economic fields and it's almost impossible to sustain and handle them effectively.

1.3 ECONOMICS OF TECHNOLOGY

Technology economics (or Technology Finance or Evolutionary Economics) is a new field in economics sciences, created over the last 30-35 years. The development of Technology Economics is the result of a long-standing need for economic theory update and a need to become realistic (Vernardakis, 2006). This need comes as a result of two factors.

Firstly, there was a discomfort towards the current orthodox economy theory (neoclassic theory), because of its difficulty to describe the economic surroundings. This theory is lame when it comes to explaining the origin and causes of development. In all neoclassic models, if we distribute a percentage of growth to the capital and another to labor, there is always a significant other (40%-60%) which cannot be justified - also known as Abramowitz balance or Solow balance (Solow, 1957). Another problem often met in economic development theory is the disparity between predictions based on the current theory and reality, as regards to the congruity between pioneers and leaders of the rear guard, which leads to a new economic development theory. Current theories predict congruity of economies while real life differs much. Similar problems are met in other fields of economic theory, such as microeconomic theory, international relations etc.

Secondly, technology is becoming more and more present in the economic future and it is used in an effort to increase productivity, within a continuously increasing competitive environment. Competition mechanisms are influenced, which forces a part of the market to operate according to microeconomic theory, thus products competing in price. However, there are superior products, of current or advanced technology, competing in innovation, not in price. For example, a personal computer will make it in the market if its innovative characteristics brand it as superior to other products, regardless of price.

To summarize technology is the driving force of globalization. It enables the fast execution of different transactions around the world at a reasonable cost. The progress in

information and communication technologies, in particular, has caused a significant change in the global ways of acting. Another remarkable force in globalization is the political and economic liberalization enabling the actual use of the opportunities offered by technology. The world is getting smaller in an economic, social and cultural sense (Castells, 1996).

CHAPTER 2

TECHNOLOGY DEFINITION
SHIFT OF THE TECHNO-SOCIO-ECONOMIC PARADIGM

2.1 THE NOTION OF TECHNOLOGY

Technology is a human activity section, dealing with Science application in everyday life and activity. Technology describes a wide field, dealing with Science knowledge application via tools and techniques. It is often said that "Technology is Science in action". According to Giovanni Dosi 1991 a wider definition is that technology is a sum of knowledge parts; know how, methods, processes, successful and failed experiences and machines and equipment. Current machines and equipment embody technological advances in order to perform a certain problem solving activity.

Economists have defined technology in such a way, as to appoint the economic effect of the term. Within economic sciences, the term technology refers to all kinds of knowledge towards economic relations. In neoclassic economic theory the term technology is distinguished for its strictly technical content, since it is interweaved with production, in the production equation.

2.2 THE TWO TECHNOLOGY DIMENSIONS

Technology can be distinguished in two dimensions. The one is the creative and applied and the other is the substantial one. The creative dimension allows a business to meet more needs and goals. It expands over a wide range of activities, from research to application, and specifically product service. The creative dimension depicts a complete technology image (Karvounis, 1995). It shows us all the technological activities, from elementary research to distribution and product service. Besides the technology dimension covering a wide range, from new knowledge creation to application and mixing new and current knowledge, technology also has a second dimension, the substantial one. People mostly deal with this dimension.

2.3 PRODUCTION TECHNOLOGY

Common belief connects technology to products. Usually, it includes a task related to the technical director and product engineering in a production unit. However, product technology also includes product programming, product engineering, application engineering and service engineering. Another wider technology aspect, which is starting to become acknowledged, is about production technology. Its main points are: (a) the equipment and various parts, (b) material selection work, (c) material distribution, (d) production systems, (e) quality control, (f) maintenance. These points are not separate functions, but rather a total of various specialties and knowledge (Karvounis, 1995).

2.4 INFORMATION TECHNOLOGY

Information systems are the third and most important field in technology. This field is applied in administration, since it mostly consists of acquiring, processing and transferring information. Information technology includes information technology hardware and software, applied information systems, natural and no tic processes, supporting decision systems and new businesses, based on informatics (Karvounis, 1995).

During the last century, the world lived through the change from the agricultural era to the industrial era. Nowadays, the world is in the middle of the change from the industrial era to the information era. The information era represents a new techno socio-economic paradigm emerging mainly because of the development in information technology. Perhaps the most commonly used term of the current techno-socioeconomic paradigm is that of 'information society' (see e.g. Webster, 1995). The terms 'information economy' (see e.g. Porat, 1977) and 'information age' (see Castells, 1996, 1997, 1998) are also related to this term. In the present study, all of these frameworks are treated under the same concept of information society.

The concept of the information society emphasizes information's central role in building economic wellbeing. Webster (1995), (see also Hautamäki, 1996b), divides the theories of the information society into two main classes: continuity theories and

revolution theories. The former emphasize the continuous development of society, whereas the latter suggest that the new era is radically different from the old ones. Probably both classes of theories have their pros and cons, but the latter theories often suggest that the leaps in societal development have often been shorter than thought, and that the leaps are strongly labeled by path dependency. In the present paper, it is considered that the shift towards the information society is a continuous process with some changes that can be categorized as radical.

Castells (1996) emphasizes the enormous transformation process from the industrial era to the information era due to the vast development in technologies. This change has enabled the emergence of the global information society. Consequently, special attention is given to technologies, especially those that enhance the production, processing and exchange of information. These technologies are termed 'information technologies' (Sokol, 2003).

The theoretical analysis in this section was largely trying to enlighten the wide debate on the change in the techno-socio-economic paradigm that has taken place in the last few decades. The development of information technologies and networks does not assure the quality of information running in the networks (Niiniluoto, 1996). However, it is hard to imagine any region would be prosperous, if information technologies and networks were not available and if they were not deeply embedded within the economic and social processes.

CHAPTER 3

SEMANTIC DEFINITION OF INNOVATION

3.1 THE NOTION OF INNOVATION

Hand in hand with the emphasis given on the notion and value of technology comes the term, ‘innovation’. According to several international organizations (E.U. and OECD) innovation is the basic instrument of development, both in local and regional level. An elementary definition of innovation could be that it transforms an idea into market output or service, functional production method or distribution or new service delivery method. Of course, this definition refers both to the process and its results (Green Paper on Innovation, 1995). Originality is a key characteristic. It could also be a creative expression of the human mind or the human inventiveness and it is closely connected to technique and science. Innovation diffusion is about passing on processes (methods and practices used) or processes' results (new products).

3.2 INNOVATION DISTINCTION

Product and process technological innovation (PPTI) includes technologically materialized new products and processes, as well as significant product and processes technological improvements. A PPTI materializes as soon as it's out in the market (when it comes to product innovation) or as long as it is used in a production process (when it comes to process innovation). A PPTI includes a series of scientific, technological, organizational, economical and commercial activities. A product and process technological innovation business is defined as a business which materializes technologically new or improved products and processes during the period of study.

In order to enter the system, the company is limited to introduce a newly used (or improved) product or process, not necessarily new to the rest of the world. PPTI relevant to main or secondary activities, as well as process innovations relevant to auxiliary processes are also included. PPTI are distinguished according to their reference to

products or processes, and according to their novelty degree (Green Paper on Innovation, 1995).

3.2.1 PRODUCT TECHNOLOGICAL INNOVATION

Materialization or commercialization of a product with improved performance data (new service delivery) is considered product technological innovation. A product technological innovation is distinguished in two categories:

1. Technologically new product
2. Technologically improved product

A technologically new product is the one whose technological characteristics or future use differ in a significant degree from the products already released in the market. This kind of innovation can include the use of radically new technology or a combination of existing technologies for new future uses or it can originate from the use of new knowledge. (Frenkel, et all. 1997, Sirelli 2001)

Original processors, as well as original video recorder machines, i-pods use radically new technologies and represent technologically new products from the first category. On the contrary, original tape recorders (walkman type), in which a combination of tape (already existing) and small size headphones was used, were a technologically new product from the second category, combining pre existing technologies. In both cases the end product was new. A technologically improved product is the one whose efficiency is upgraded or enforced significantly. Any given simple product can be improved (meaning it can be more efficient or cost lower) thanks to high efficiency material or component use, while a complex product (made after compositing several technical subsystems) can be improved thanks to componential changes in one of the subsystems. Distinguishing between new and technologically improved products can be quite difficult, especially in the service field. (OAKEY Ray, ROTHWELL Roy, COOPER Sarah 1998)

3.2.2. PROCESS TECHNOLOGICAL INNOVATION

As process technological innovation is considered the adoption of new or significantly improved production or product delivery methods, which might include equipment changes, production organization changes or may come from new knowledge. Adopting such methods aim at production or at new or improved product delivery or at efficient production or at existing product delivery.

In some sectors of the service field, distinguishing between product and process is not always easy. For example, a single change in telecommunications processes, aiming to introduce a "smart" network, can cause a market opening to a whole group of new products, such as call waiting or caller id. For example, in the bank sector, "smart cards" or multiple use plastic cards or phone banking service, allowing the customer to have transactions by phone, without visiting the bank, are a few examples of technologically innovating products and processes. (Journal article by Mary J. Benner, Michael Tushman; Administrative Science Quarterly, Vol. 47, 2002)

3.3 NEED FOR INNOVATION

Often, in business there might be a hostile environment. A hostile environment is a situation in which businesses, and other institutions, must make a drastic effort in order to manage external environmental reactions towards change. Furthermore, they must be prepared to support changes originating from the organization itself. Thus, two important issues are raised: the change type and the management way. Historically, innovation boosts come as a result of changes in client demand models or of competitive activities in the market (Karvounis, 1995).

Some studies during the '80s reveal that the competitive or reactive effect has increased (latest recession decreased the importance of innovation in the coverage of demand increase or resources reduction). An important factor in some type of innovation creation remains the change on the total demand, but what is evident in these studies is that the basic factor determining most innovations is competition impact. The conclusion

drawn from the analysis of competitive powers in the market is that the enterprising element of innovation will become more and more significant, and that companies will be forced to gain control of the market by searching and introducing changes, which will be enterprising instead of reactive (Freeman, 1987).

Though changes can be irritating to most business executives, they will increasingly become part of an enterprising and national existence. However, some will fail to adjust to changes. As the competition hardens, so is danger increased (markets become less attractive for future investments, because they cannot guarantee high profits anymore, but rather uncertainty regarding investment returns). So, businesses need to be more cautious in defining and controlling innovation, while governments should adopt more sensitive manners of business innovation encouragement and support.

In the present techno-economic paradigm, innovation is widely seen as a driving force of competitiveness. As Archibugi and Michie (1995: 1) put it, "the production and use of knowledge is at the core of value added activities, and innovation is at the core of firms' and nations' strategies for growth". The concept of innovation, however, has been understood in numerous ways during the last century.

Nowadays, innovation is seen as a social as much as a technical process. Innovations are seen to emerge as non-linear processes. They are considered to be deeply embedded in normal social and economic activities. Processing innovations deal with producing new knowledge or combining knowledge in new ways and turning it into economically profitable products and processes. Innovations have different characteristics; they can be called, for example, radical or incremental, or they can be technical, process related, social or organizational. The terms are partly overlapping, but each of them describes the nature of the innovation underlying them. Innovation processes can be categorized as two main types, linear or non-linear, depending on the type of interaction in them. Recent development has emphasized the increasing role of non-linear innovation processes and incremental innovations in creating economic success. Characterizing innovation as a social, non-linear and interactive learning process raises the question of the role of socio-cultural structures in innovation processes (North, 1986 and 1990; Asheim, 1999). The regional socio institutional environment where innovations emerge plays an essential role in successful innovation processes.

CHAPTER 4
INNOVATIONS AS THE DRIVING FORCE OF ECONOMIC GROWTH

4.1. THE GOLDEN RULES OF INNOVATION

Those who always keep in mind that a product is a series of benefits to the customer - technical, non technical, behavioral - are likely to become successful innovators. The golden rules of innovation stem from the detailed analysis of those benefits and distinguished a successful innovation from a failure (Greek Centre of Innovation, Innovation, Research and Technology, 2005).

1. Strategic way of thinking: strategic way of thinking includes the effort for the organization to control the environment and competition, instead of trying to avoid them.
2. Different way of thinking: No company has ever become successful by copying its competitor. Successful and failed innovations must be distinguished explicitly. There is no completely defined product. The market leader is the company which manages to achieve faster the best performance of product soundness.
3. Thinking in favor of the client: A company can really benefit a client, simply by changing the color, design, appearance or components, instead of adding extra functionality, which is not considered a gain. So, it's most important to give the impression to the client that there is something new about the product or that something makes it new.
4. Attention to detail: The detailed design is fundamental in effective innovation and that's what makes a company capable of turning the required by the customer benefits into a final effective innovative idea. The above can be achieved by accurately determining the components of each highly beneficial process phase, such as the existence of experimental dynamics in the organizations, the strict control over cash flow and the innovation expenses etc (http://europeanris.wordpress.com/).
5. Internal issues: An innovation is a difficult and elaborate process, which can be improved if the company conducts a careful, full scale evaluation of the demands set in each project, and if it can count on the existing capabilities of the organization.

Emphasizing on internal issues, a business could avoid costly mistakes regarding products, clients, technology or markets fully understood.

6. Knowledge: Employees' knowledge, skillfully applied, could benefit the products, enabling the company to reinvest vast sums of money on its further existence, and could lead to higher added value products and competition advantage. Companies must emphasize on knowledge expansion within the working environment, not only by deciding which information is elementary for the development of a new product, but also by creating an internal environment, via knowledge acquisition and expansion can be maximized.

7. People: By choosing the right people, a company can ensure work effectiveness and above all the thrill to manage the innovation. Companies which do not emphasize on personnel knowledge are bound to fail.

8. Size: Companies must have knowledge and respond quicker and in more innovation environment fields than their competitors. Change application, client understanding, bigger added value production are the key elements to leadership in a new environment (http://www.ekt.gr/).

4.2 THE IMPORTANCE OF INNOVATION

Innovation as a result of research activity and know how conveyance leads to the production of new products or to the improvement of others, and justifiably it is considered as the necessary background on which national economies base productivity increase and competiveness improvement.

A series of studies based on empirical data connected to various level of analysis (enterprise, fields, economy) innovation to development. Another significant conclusion drawn from many studies is that innovation rarely comes as a result of an effort made by a single company. On the contrary, most of the times it comes as a result of collaboration, where each partner teaches the other and they interact.

The fact that in the early '80s appeared a new technological innovation system, in which various cities and districts offer a friendly and favorable environment in order to develop and spread technological innovations, is not accidental. Silicon Valley in

California, Cambridge in Great Britain, Tagus Park in Portugal as well as other Technological and Scientific Parks in Europe are only a few of the most characteristic examples (Stamatis George, 1993).

4.3 INNOVATION ECONOMICS

Innovation is in the center of economic change. According to Schumpeter, radical innovations shape great international changes, while incremental innovations influence the changing process continuously. Schumpeter suggests a list of various kinds of innovation (Schumpeter, 1942).

- Introduction of a new product or qualitative change of an existing one.
- Innovation process, which will be a novelty for an industrial field.
- New market opening
- Development of new sources in raw material or influx supply
- Changes in the industrial organization

According to Schumpeter, businesses innovate because they seek profits. A new technological tool is the source of benefits got by the innovator. In case of process innovations, which improve productivity, the business has an advantage on cost in relation to its competitors. This allows a share expansion in the market and boosts the quest for more profits, either by increasing the profit margin, or by combining lower prices and wider profit margin in relation to its competitors. In the case of innovative products, the company acquires a monopoly, either by patenting an invention (legal monopoly) or by gaining time until competitors copy. This monopoly allows a company to set higher prices than in a competitive market and, thus, gain more profits.

Companies innovate in order to compete, and try to develop, competitive advantages. A company can innovate out of reaction, that is in order to prevent market constraint by an innovating competitor, and preventively, that is in order to gain a strategic place in the market in relation to its competitors. For example, by developing and trying to enforce products of high technical specifications.

4.4 INVENTION AND INNOVATION

An invention is an idea on a project which is so different, that it wouldn't be evident not even to a professional specialized in the field (Karvounis, 1995).
An innovation is a successful product launch in the market. Distinguishing between inventions and innovations is quite significant, since only a small portion of patents become actual innovations.

Once in a decade, science presents new impressive products to the markets. However, even in cases like lasers, radar, atomic energy, atomic bombs, and genetically modified plants and drugs, there was a lot of waiting before these became products. In each one of these cases, the scientific cost necessary to prove the feasibility was much less in time and money than the cost of the efforts necessary to turn feasible into commercial product. At times, some inventions carry an impressive impact in our lives. These inventions change our way of living. For example, fast, comfortable, long distance communications are now an everyday activity, thanks to Bell's invention of the telephone. Transportation by car is also quite useful and necessary in modern society.

Maybe, the greatest inventions are not the ones affecting our life quality, but the ones affecting life itself (Lundvall, 1992). These inventions go beyond usefulness, profit, comfort and everyday activities, and have an actual impact on our views regarding existence and the world in general. These innovations change our civilization. Some clear-cut examples of major innovations are the discoveries made in the field of nuclear chemistry and led to nuclear power and nuclear weapons. Both technologies have caused a cultural warp and at times intense differences of opinion. Via this technology, we managed to produce energy in order to live a comfortable life and obtained the power to destroy the lives we are currently enjoying (Karvounis, 1995). More hopeful and promising examples of major innovations come from the pharmaceutics field and the development of "synthetic" replica "natural products".

Several researchers might claim that the difference between invention and innovation is partly due to the commercial success of a new product or a process. (Ruttan 1959) However, commercial success comes as a natural consequence of an innovating

process and since it is new, useful, presented at the right timing and satisfying a certain need, then economic success is justifiably expected.

4.5 THE IMPORTANCE OF AN INNOVATING IN THE BUSINESS FIELD

It is widely accepted that the knowledge background of a business is its most valuable asset and that learning is the most important knowledge input, acquisition and production process (Lundvall, 1992). It is a crucial challenge for every company to develop the mechanisms and systemic processes necessary to ensure knowledge transformation into corporate knowledge asset, so that its success, as noted by De Geus (1997), "will depend on the degree on which the company is able to produce knowledge, not individual, but applicable to the complete operation of the company". Of course, the ability to produce, exploit and spread new knowledge depends on the form of knowledge that is whether knowledge is tacit or explicit (Polanyi, 1962).

Tacit knowledge is to a certain degree personal, subconscious and non-structured. It lies deep within the person's actions and experience, as well as in ideals, values and emotions. Thus, it is extremely difficult to take a specific form, be transmitted and shared with others. In other words, tacit knowledge, according to Polanyi, cannot be uttered because it is internalized in the subconscious and thus "we know more than we can utter" (Jensen, 2004). Explicit or "cod able" knowledge is objective, can be acquired via logic and notion and method use, it can be linguistically uttered, attributed via grammar, math and handbooks (Nonaka et. al 1995). This kind of knowledge can be externalized; spread officially and systematically, shared with other people or saved in the form of data, rules, and scientific formulas and coded processes.

It turns out from the definition of both forms of knowledge that what differentiates them is the degree of communicability from person to person, from group to group and from place to place (Ancori et al., 2000). This difference actually accounts for the high degree of topicality in tacit knowledge (Pakos, 2003).

Research has also shown that knowledge is accumulative, because it is accumulated gradually through personal, collective actions and experience (Teece 1981, Nelson and Winter 1982) and is it characterized by path dependence, in the sense that is it

is strongly affected by political, historical developments and economic, cultural conditions. Moreover, knowledge is collective (Fischer, 2005) and localized (Fritsch, 2003). These characteristics become more evident in tacit knowledge. These two kinds of knowledge and the company's ability to exploit, enrich, transfer and assimilate them (Sweeny, 1987) make up the company's innovative profile, thus shaping dialectic forces between the innovative company and (tacit) knowledge. The more enriched tacit knowledge is, the greatest the company's innovative activities and the more the company's high innovation quality, the more tacit knowledge is created.

In order to maintain and renew their competitive advantage, companies are forced to transform into powerful "cognitive organizations" and become "organized from top to bottom aiming at a constant method, product and process improvement" (Best, 1990), thus enforcing their innovation dynamics. The presence of innovative companies in an area functions as a mechanism motivating and directing the rest of the companies towards constant research, experimentation and adoption of rapid, effective innovative changes. Schumpeter (1947), the first theorist analyzing specially and extensively innovation business, distinguished two business archetypes: the adaptable and the creative ones. Adaptable refers to actions that draft knowledge from the market and to activities adapting changes occurring in the company's action environment, for example adaption to demand conditions, technological changes, new markets. (Pakos, 2005)

On the contrary, a creative or innovative business is the one adopting a creative reaction towards changing market conditions and "participating with its activities in the formation of an economic and social environment" (Lazonick, 2001). Its characteristics are "firstly, it is always understood ex post, not ex ante, secondly, creative reaction forms the string of events coming up as well as a long-term result...thirdly...the study of a creative reaction becomes synonymous to innovative business dexterity study" (Schumpeter, 1947).

Even though knowledge and innovation are being produced within a business, results are shed in a wider area surrounding it. Innovation businesses are proliferative fields in local economies. They form supply and demand relations, not only in science and technology, but also in labor and communications. They produce high tech products and great added value services, thus making the best out of the scientific personnel and

the specialized manpower. Moreover, they attract businesses, of the same or similar field, and develop common partnerships, thus creating new economic activity fields.

Furthermore, an innovative business by producing new or improved products, which meet local demand, enforces productivity and efficiency, widens sales, increases economic size and improves its competitive place in local or domestic markets (Frenkel, et all. 1997, Sirelli 2001). It is also a fact that an innovative business has the direct capability to create new job openings, especially in times of economic turmoil or uprising unemployment and in areas where there is vast manpower (Piater, 1981).

Moreover, an innovative business can contribute to the innate development dynamics of an area. It ensures innate manpower high quality viability, human capital restrain and reduction in migration abroad (Rothwell, 1985). So, the local community maintains stable population, which is necessary for the whole developmental process.

Innovative activity affects employment composition, when it comes to employees' skills. In particular, there is a reduction in low specialization manpower demand and simultaneously an increase in high specialization manpower demand. "Highly skilled manpower constitutes the foundation of technology assimilation and application, an innovative effort basic condition, as well as a de facto factor of flexibility and adaptability to the necessary changes, both in production and organization" (Palaska et al., 1999).

Innovations are widely seen to be the driving force of economic growth in the information era. The concept of innovation, however, has been understood in numerous ways during the last century. In the early stages of industrialization, innovations were seen mostly as great leaps of knowledge achieved by talented individuals or research groups. With regard to this, Schumpeter (1942) created his theory of the heroic entrepreneur being the driving force of successful innovation. Innovations were largely seen to be results of linear processes. This has given a name to the concept of “linear model of innovation”.

The traditional linear model of innovation focuses on explicit knowledge developed in research processes. Each level in the linear model produces outputs that are transferred to the next level as inputs. The flow of knowledge is unidirectional, that is, later outputs do not provide inputs for earlier stages (Kline and Rosenberg, 1986). The

linear model of innovation is often connected with radical innovation processes. These processes are mainly caused by science push or market pull effects. In today's world, linear innovation processes are, in reality, exceptions. The traditional approach is seen as too research based and technocratic. Many scholars have criticized the linear model due to its incompatibility with the present techno-economic paradigm (cf. Kline and Rosenberg, 1986; Lundvall, 1988; Dosi, 1988; Asheim, 1999).

Schienstock and Hämäläinen (2001: 50) have listed the main reasons for the criticism as follows:

- Innovation processes are seen as exceptional events
- Knowledge creation is understood as a process of reasoning and inference isolated from the rest of human activities
- Problems of uncertainty are not dealt with
- Research focuses only on R&D as the main function in innovation processes
- Collaborative elements are seen as irrelevant.

Nowadays, the innovation process is seen as a social as much as a technical process. Innovations are seen to emerge as the results of non-linear processes deeply embedded in normal social and economic activities, and as the processes of interactive learning between firms and their environment (Lundvall, 1992). The interactive and non-linear innovation model emphasizes "the plurality of types of production system and innovation (science and engineering is only relevant to some sectors), 'small' processes of economic coordination, informal practices as well as formal institutions, and incremental as well as large-scale innovation and adjustment" (Storper and Scott, 1995: 519).

In non-linear innovation processes, multi-directional information flows are emphasized in creating and combining knowledge. Non-linear innovation is a consequence of many kinds of learning processes embedded in various ordinary economic activities. Many different kinds of actors are involved in innovation processes. The non-linear model assumes that innovations can be triggered by various causes. Instead of understanding innovation as a linear process, we have to take into account

complicated feedback mechanisms and interactive relationships involving science, technology, learning, production and demand (Edquist, 1997: 1).

Evolutionary economics emphasize the uncertain and cumulative nature of innovations (Dosi, 1988). Uncertainty is included in innovations because of the manifold risks that are involved in the innovation processes. The uncertainty is especially embedded in the unresolved technological problems and in the impossibility of knowing the future consequences of the decisions made. Innovations seldom happen randomly and individually. They follow rather certain technological paths making them cumulative in nature. Thus, innovations are strongly path dependent and they include high risk factors making it important to promote learning processes and to diminish unnecessary uncertainty in the innovation environment.

CHAPTER 5
INNOVATION AND REGIONAL DEVELOPMENT

5.1 CRITICAL PROBLEMS IN THE AREA

Agglomeration in the Regional Innovation Environment

The area variable is becoming more and more important in the social prosperity equation. Problems rising up from social and economic changes have a direct impact on area organization and are also affected by it. Area and its size affect the social prosperity process. The most important of these problems, which are the main social studies research object, are globalization, geopolitical unit activation, urbanization and spatial equilibrium and environmental pollution (Consolas, 1997).

One important aspect affecting regional innovativeness and forming a regional innovation environment is agglomeration economies. Already Smith (1776) recognized the benefits of specialization. He introduced the idea that productivity increases with the scale of production allowing the firms and workers to specialize in specific tasks. This specialization and division of labor increased productivity. Marshall (1916) emphasized agglomeration economies and the importance of production clusters behind the phenomenon. Marshall pondered the concept of industrial atmosphere describing the characteristics of spatial industrial agglomerations. He found regions where this atmosphere was very beneficial for certain industries. An important observation was that the atmosphere had been developed over a long period and could not be moved. Marshall also saw that the interaction in an industrial district was not just buying and selling. He called the interaction constructive co-operation, describing the multifaceted characteristics of the communication process.

The benefits of agglomeration economies are a mixture of both “classical” location and urbanization economies based on modern” knowledge-based reasons (Malmberg and Maskell, 2002). Therefore, the advantages of agglomeration and clusters are, for example, (Cappelin and Steiner, 2002, citing Marshall, 1916; Chinitz, 1961 and Porter, 1995):

- access to a maximum flow of information and ideas and a provision of shared or non-traded inputs specific to an industry
- greater opportunities for collaboration
- greater availability of specialist subcontractors and suppliers
- greater availability and efficiency of particular local services such as venture capital, specialized property, education institutions, airports, ICT and other public goods and infrastructures
- development of a local pool of specialized labor related to the existence of specialist training institutions
- less risk for firms and workers to locate in clusters than elsewhere, because their options are greater

Economies of scale deal mostly with increasing returns achieved by the quantity of transactions. Another important dimension is, however, the quality of transactions. This leads to the consideration of the regional institutional settings and, for example, social cohesion in the networked regional innovation environment. This present study suggests that some important transactions might be more effectively and efficiently accomplished in smaller scale urban areas, where things like shared vision and mutual trust can be more easily achieved.

Therefore, there might also be room for smaller successful agglomerations that specialize in a few industries based on location economies or more diversified small agglomerations based on urbanization economies using the better co-ordination of innovation activities as the source of success. In these possible cases “the advantages of smallness” must be based on the sound institutional organization of regional decision-making, learning, leadership, networking and innovation processes and social cohesion in a region in order to overcome the disadvantage caused by lacking the benefits of economies of scale (Freeman, C. 1987).

5.1.1. GLOBALIZATION (POST WAR ERA ECONOMIC CHANGES)

Globalization is one of the main phenomena affecting society in today's world. Globalization is said to mean a new, deeper internationalization process evoked by technology and liberalization. Some of its elements are the continually growing interdependence among all areas of the planet. (Grabher, G. 1993) The interconnected market, production and employment systems have reduced the significance of changes in national economies and increased the influence of these changes to global economy.

The most crucial changes have a spatial planning dimension. Raw material production is not so significant in the global economy system, thus affecting countries producing agricultural products and some minerals. Employment in industrial processing has decreased, while industrial production has increased, thus creating a new international division of labor. Capital inflow is a major power in promoting developmental processes, while the importance of international trade has been reduced.

High tech advances, structural rebound and reindustrialization phenomenon, a turn to flexible production, consortium adjustability to new environments and informal economy growth are some of the changes that should be added (Consolas, 1997). Through globalization and different political processes, nation states have, in fact, lost many of the tools by which they controlled economic, social and cultural activities. For example, there are practically no limitations in foreign direct investments, money can be sent around the world in seconds, markets have shown their power against monetary and currency policies etc.

To summarize, the Greek regions are strongly influenced by the globalization process triggered by new forms of economic, social and cultural transactions and, at the same time, by the fragmegration process including elements from political integration and fragmentation. The regions find themselves in a situation where they have to be increasingly transformed from nation-led policy objects to the subjects in the European multilevel governance environment (Henderson, J. 1985).

5.2. REGIONAL ECONOMIC POLICY

Regional economics is a new field in economic studies, which studies impact or the regional factor in economic activities. Regional economic policy includes all state interventions, aiming at improving the economic activity geographical distribution. Regional economic policy is trying to amend regional consequences of free market economy, in order to achieve two interconnected objectives: economic growth and social distribution improvement (http://ec.europa.eu/regional_policy/funds/recovery/ accessed on 30-11-2010).

Regional economic policy is applied mainly when the following are defined:

- The characteristics of theoretical and applied analysis of the regional problem causes
- The objectives and the quantity countable goals linked to the problem
- The restrictions and planning techniques
- The strategy adopted
- The combination of measures and means used
- The role of the communal regional politics
- Politics evaluation

  (Cooke and Morgan, 1998)

5.3. THE REGIONAL PROBLEM

The regional problem refers to inequality among various regions, on an economic, social, political, cultural, environmental etc. level. The causes of this regional problem compose a complex political-economic-social factor system, which historically is a long term functional relationship among unequal regional units. Structural changes in these units' characteristics have an impact on the regional problem.

The center-region model, in which form the regional problem is manifested, can be met even in high developed countries (for example E.U. countries and Greece). Even though regional inequality causes vary, some schools of thought claim that capitalist growth and especially its form based on mass production, mass consumption and great

businesses always comes along with intense geographical inequalities, which worsen the pre existing inequality stemming from unequal natural resources regional distribution.

Defining the sum of factors causing the regional problem in a region can be quite difficult, since it requires various empirical researches and regional phenomenon analysis in a wider regional unit. The most important factors causing regional inequalities deal with imperfections and weaknesses of the market mechanism, with unequal natural resources distribution, with the country's institutional organization framework, regional economy structure and its field structure. The factors contributing to what is called regional problems are the following: (Consolas, 1997).

1. Geographical factors: They include regional soil formation, existence or lack of natural resources, geographical position. If a region lacks natural resources this influences negatively its economic growth. On the contrary, if a region is wealthy in natural resources and raw materials there are advantages towards promoting the developmental process faster. The distance between a region and the developed centers in a country, when it is large and geographically isolated, is a significant factor in the creation of a specific regional problem in this area. In geographically remote areas, the transportation cost is higher, thus the product prices are higher, business profits are reduced, and the size of the areas developing business activities is minimized (Olson, M. 1982).

2. The structure of regional economy. The branching structure of regional economy is a crucial factor in the diachronic evolution of the regional problem. Regions based on traditional industries (for example agriculture) or regions based on obsolete technology decay when product demand decreases. The same thing could happen in a region based on one industry only (tourism), when the demand conditions alter. Unemployment rises instantly and growth rate decreases. Regions economically based on dynamic industries (for example motor-powered industry, machine manufacturing) steadily improve their place in relation to other regions. Changing conditions in international markets demand constant monitoring of economic structure, so as to take measures when there's a recess on a product demand of a prosperous region.

3. Low work and capital mobility. Work mobility towards regions where there is demand is relatively slow, thus there is always time difference between the demand manifestation

and the manpower influx. Work production factor is not always stagnant. Capital movement is granted, otherwise there would be no internal or external migration.

4. Institutional factors. The institutional framework of a country's organization and the organization and function principal in a society and the decision making mechanism regarding regional problems affect income increase and employment opportunities in the region. Limited decentralization of public administration functions and local government authorities inhibit economic activity in the regions and create regional problems. The accumulative administration system is one out of two basic causes intensifying the regional problem and creating binary economy conditions (Skayannis P. 2002).

5. Political factors. Political decisions such as wars, abrupt relocation of population, natural resources destruction, and country division all create regional problems, both on national and international level.

6. Cultural factors. The cultural development of a region improves educational standards, increases manpower productivity, boosts business initiative undertaking and triggers cultural activities of great importance in the terser sector development.

7. External economies. Capital and urban center supply with perfect transport and communication systems, combined with the existence of specialized manpower and the most important decision making centers installation cause the creation of important socially and economically structured outside economies, technology, urban centralization etc. Outside economies is a main factor orienting business foundation in prosperous regions.

8. Environmental factors. Differences among regions combined with climatic conditions create the "environmental image" of each region. This "image" attracts investors, especially in advanced technology, scientific research, tourism, education etc. Projecting this "image" is of high importance for the foundation of Tech-cities and Technological parks in a region.

9. Innovative activities lack of spread. The lack of conditions in order to promote inventions, innovations or to absorb technological research results from the spread centers is the basic cause of the regional problem.

10. External control. The regional problem can be created due to business decisions, made by administrations outside the region. Often, the lack of information about local conditions leads to measures affecting negatively the developmental process in a region.
11. Limited business initiative. A basic cause of the regional problem is the lack of business initiatives and "business climate" in a region. Mobilizing local funds, informing and vocationally training local business owners, combined with the positive orientation of local leading agents towards business activity can be measures towards new initiatives in all fields of economic activity. The most important factors, calling for a solution to the regional problem, can be categorized as follows: economic, sociopolitical, and environmental (Ohmae, K. 1995).

5.4 MEANS OF EXERCISING REGIONAL POLITICS.

Endogenous development strategy employs new means of regional politics, which are mentioned below:

Local development

Local development enforces alterations on the local socio-economic system, reacts to outside challenges, promotes local development initiatives and activates local production resources. The infrastructure of a local development measure system depends mostly on the degree of specialization in the local economy, the local business size, productive interactions, innovation spread and local institutions. The main characteristics of local development are the high autonomy degree in economic activities and the tendency to create self-fed development conditions on a regional level. This process begins with the appearance of local enterprise, the creation of productive relations network among local businesses, the increase of export performance and finally the dominance of local economic activity in the region.

Production manner adjusts to flexible specialization model and production rapidly becomes oriented towards demand, by differentiating products, constructing and promoting new products, of innovative kind. Local development institutions may be

public or private. Local development was successful in Southern Europe, especially in Spain, "Third Italy" and Southern France. E.U. has emphasized local development enforcement, mainly by supporting technological advance spread methods and by organizing and improving productivity in small businesses (Bernadakis, 2006).

Small and Medium Size Enterprises (SME)

Two are the main reasons for a small business entering new means of regional politics: new job openings and products, meeting demands or incorporating new innovating ideas. Moreover, small businesses improve enterprise environments, since all manpower hold favorable relations and ensure a competitive business position. Furthermore, small businesses have the ability to differentiate their production rapidly and face enterprise hazards stemming from an enterprise initiative more flexibly and effectively. After all, small businesses' adaptability to economic conditions is their main advantage in seeking additional partnership with a big business, either by contracts, or in the form of an intermediate phase in the production process of larger companies.

Small businesses are the main means of promoting local development, since they support local entrepreneurship and create new job openings, thus reducing unemployment in the region and man power migration. Also, they contribute to political measures application aiming at introducing innovations, developing partnerships, stimulating traditional industrial fields in the region and making the most of out the scientific results in the new product production.

Small businesses' development in Europe is being supported by many European programs, since small businesses contribute in facing unemployment and promote economic and social cohesion among regions of the Union. Support towards a region is expressed mainly through reinforced actions of local development and new technologies spread, which create an innovative environment in decaying and delayed regions (Pyke, F., Becattini, G. and Sengenberger, W. 1990).

New technology

In every theory on regional sciences and spatial economic activity distribution, technological progress is quite significant in the developmental process empowerment. New technology develops in two fields: that of original ideas and inventions, and in the field of their application, by illustrating innovative activities. The second field progresses in two phases. The first one deals with primary innovation application and the second one with application spread in other regions. It is a common finding of scientific research and political practice that supporting technological progress, by attracting high tech companies, promotes rapidly regional development. According to Malecki, technology is a basic element of regional enlargement, since high tech companies are dynamic businesses, offering both high quality products and high salaries.

Tardy regions in many countries have applied innovation improvement programs and have boosted significantly local companies, in order to improve their technological level. The efficiency of regional technological policy is reinforced in some countries by innovation improvement programs, on a national level. These program mostly include education upgrade measures, especially vocational education and management schools, public and private research center reinforcement, institution activation to apply technology in all fields of production, communications and airport modernization and establishment of innovative product production motives, by high tech companies.

There are quite a lot of regional policy measures combinations, promoting new and advanced technology, and they are realized according to the goals in every region and the innovating environment, which shapes based on the facilities available and the modernization degree of the institutional support framework in business activity. The success of regional technological policy is based on small high tech businesses, whose development requires sufficient capital funding. These capitals, either seed capitals or venture ones, must be approved under special conditions, since the initiatives are high risk operations.

Urban center infrastructure improvement, mostly in the fields of residential and cultural environment, is an important region orientation condition for high tech companies. Connection among these companies to Universities and Research Centers

requires a high living standard environment, in order to attract extremely specialized in the field of dynamic technologies executives and researchers. The spatial dimension of regional technological policy is completed by founding Tech-cities and technological Parks (Szulanski, G., 1996).

Tech-cities

New technology promotes new industrial activity cores. They have spatial and sector dimensions. A tech-city is created out of the combination of the two. A tech-city is influenced by the specifications of a particular space and by the influence of the knowledge spread mechanisms. In the case of high tech activities, all the classic factors evaluated during the region selection process acquire a new standing. This is due to the fact that raw material weight and volume are reduced, there is highly specialized manpower, the market addressing these products is international etc. So, these factors behave in a different manner from the traditional one.

Technological changes leading to technological revolutions (computers) create new standards, which affect employment, markets, investments, institutions and the social network in general. Tech-cities is one of the tools, maybe the most important one, in the advance technology spread process, in the innovation industrial development process and finally in the economic growth maximization process (Storper, M. 1997).

5.5 UNEQUAL SPATIAL DEVELOPMENT.

Spatial development science is a new scientific field, under formation. It is a term containing various definitions and several fields of interest. It connects and complements various scientific fields, always maintaining its autonomy (Massalas V, 2005).
Spatial development science components are:

- Real objects
- Collective territories
- Theoretical approaches

Most attempts to administer effective regional policy deal with development in relation to center-periphery. A common belief in developmental intervention is that the

market mechanism creates developmental dualism phenomena. On the one hand, it creates central, developed and autonomous regions, and on the other hand, it creates isolated, underdeveloped and subsidiary regions.

Balanced regional development aims at rapid development of underprivileged regions, in order to reach the development level of already developed regions (income standards equation). Defining the notion of "balanced development", as the same developmental pace on all the regions of a country does not contribute to solving the region problem that is the inequalities among regions. This is due to the fact that the development pace of underprivileged regions will be equal to the pace of the developed regions, thus income imbalances keep growing.

A traditional view of Regional Economic Policy stressed the importance of capital and work mobility, in order to face regional inequalities. For this process, a motive mechanism is powered in order to attract investments, adapt income redistribution measures, increase employment in the public sector, improve facilities etc. According to a new reading of Regional Development phenomenon, the main factors influencing regional development lack mobility in space, such as natural facilities, specialized manpower, local techniques and organizational know how etc. Regional policy shouldn't aim at production factors mobility but in full time employment and higher local wealth-producing sources productivity. Empirical researches and endogenous development strategy theoretical approaches indicate various ways of promoting development. Among them, is the emphasis to the spatial dimension of the developmental process, instead of the sector dimension, the need for more region autonomy, the partnership among local businesses, third sector activity spread, technological advance spread and innovation take-up, small businesses centralization to enterprising parks, spatial connection between research and high-tech companies -Tech-cities - (Consolas, 1997).

Anticipated changes in Regional Economic Policy refer to a wider variety of regional "weaknesses" and, thus, to more regional categories, to enforcement of a "regional innovation" strategic, to broaden decentralization, to technology spread based on informatics, to planning full programs, to problematic region rotation etc (Giannitsis, 1991).

5.6 LOCAL CONDITIONS CONTRIBUTION TO ENCOURAGING INNOVATING ACTIVITY.

Todtling and Trippl (2005) define three kinds of regions, which engage in different innovating activity:

a. Peripheral regions are characterized by: lack of industrial concentration, organization thinness, cheap unskilled manpower, low E&A expenses etc. Moreover, knowledge spread and capital funding supporting innovation cannot be absorbed by companies, due to low productive and technological capability.

b. Old industrial regions are characterized by over-specialization in mature industries, decaying and losing competitive benefit and innovative ability.

c. Metropolitan regions offer the best innovation background, due to natural (appropriate site, natural resources) and acquired (facilities, specialized manpower) advantages, thus sealing their financial advantage. Metropolitan regions are the most important places to innovate (Audretsch and Feldmann, 1996) or, alternatively, they have high innovation capabilities (Browner et al., 1999), because they offer spatial, technological, and institutional vicinity and specific resources.

5.7 NATIONAL INNOVATION SYSTEM

The recent discussions about developing competitiveness and innovativeness have dealt with innovation systems. Depending on their context, they can be called “national innovation systems” (cf. Freeman, 1987; Lundvall, 1992; Nelson, 1993), “regional innovation systems” (cf. Cooke *et al*., 1997; Storper, 1997; Braczyk *et al.*, 1998; de la Mothe *et al.*, 1998; Doloreux, 2002) or “sectoral innovation systems” (cf. Breschi and Malerba, 1997; Malerba, 2002). Since the focus in the present study is on the regional innovation environment, the concept of the regional innovation system is closest to the scope of this study. However, understanding the national and sectoral systems of innovation is equally important in developing a regional innovation environment.

The National Innovation System, peripheral innovations systems and business networks-clusters fall in this category. Since the end of the '80s economists, and especially C. Freeman, B. Lundvall, R. Nelson, have dealt with National Innovation Systems (Karvounis, 1995). National Innovation System is a sum of national institutions and motive structures and their abilities, determining the technological learning pace and direction in a country (Freeman, 1987). These institutions are acknowledged as the innovation system central characteristics and usually are businesses, universities and similar foundations, providing basic research and training, public and private agencies, as well as governments.

Complementing Freeman's view regarding a national innovation system, Lundvall adds two definitions. In his specialized definition, Lundvall claims that an innovative system consists of organizations and institutions, which work in the fields of research and development, technological institutes and universities. According to Lundvall's general definition, an innovation system includes all aspects of institutional configuration, which affect the learning process, research and investigation. For example, the financial system and the production system are sub-systems, in which learning takes place (Sokol, 2003).

According to Cooke, a Regional Innovation System is a system, in which businesses and other organizations are systematically involved in a knowledge creation and exploitation process and connect to global and national innovation systems. P.I.S. consists of businesses, organizations, infrastructures, peripheral learning and adjacency (Philip Cooke, 1992).

According to Porter, a cluster is a geographically close group or a geographical accumulation of associative companies, specialized providers, and organizations in a specific field, which acknowledge one another and collaborate (Sokol, 2003). Even though there is a notable resurgence of regional economies the innovation and technology policies and related resources are often at the national level. Therefore, regional innovation systems are embedded entities in national innovation systems and strongly influenced by the national level. The national innovation system includes not only industries and firms, but also other actors and organizations, primarily in science and technology, as well as the national innovation policy. Freeman (1987) defines national innovation system as”a network of public and private institutions that through its activity

and interaction creates, brings, modifies and spreads new technologies". Niosi *et al.* (1993: 212) give the definition: a national innovation system is "a system of interacting private and public firms (either large or small), universities, and government agencies aiming at the production of science and technology within national borders.

Development and innovation processes call for an organized innovative system. The main characteristics of innovative systems, as well as their effectiveness and dynamics, are defined in a dialectic-historic manner derived from the jointed economic, social, political, educational and research environment, within which they develop and function. To the degree those environments contain unique components and to the degree their historical paths differ, innovative systems (local, peripheral, national, supranational) will be different, thus affecting developmental dynamics (Massalas, 2005). From this point of view, Porter's claims are quite suggestive. According to him, a competitive advantage is created and maintained via an elaborated localized process. Differences in national economic infrastructures, values, cultures, institutions and histories are crucial parameters in competitive success.

According to Freeman, who initiated the term national innovation system, this is a "public and private sector institutional matrix, whose activities and interactions creates, introduce, modify, adjust and spread technologies" (Freeman, 1987). Lundvall is more analytical. He introduces two definitions. A specialized and a general one, According to the first one, an innovation system consists of "organizations and institutions activated in research and investigation fields, such as research and development departments, technological institutions and universities". In a more general definition, he includes "all the parts and aspects of economic structure and institutional composition, which affect the learning process, as well as research and investigation: production system, trade system, financial system are subsystems within which learning occurs.

Despite the fact that there are several empirical examples, stating the existence of regional innovation systems, local technological system isolation and delimitation is a rather painful process. Among the various dimensions in regional innovation systems formation and dynamics regional economic size, development level, regional funding resources, and especially those deriving from successful human activity, local economy

system sector and domain structure, local businesses' organization and technological potentials, local educational and research system etc. are included.

5.8 LOCAL KNOWLEDGE AND LOCAL LEARNING

The understanding of the nature, creation sources, and developmental function of a local innovation system demands a thorough and systematic treatment of all the above components. In this particular unit local knowledge and local learning will be emphasized, which as a whole in dialectic movement make up the heart of a local innovative system.

Technological knowledge is explicit or tacit. The most important element differentiating these two kinds of knowledge is the transmittance degree from person to person, group to group, place to place. There is proof indicating that the first knowledge category, the general one, is highly mobile, while the second one low. The main factor defining mobility of various kinds of knowledge is their offering to objective recording or decoding. High level perception of innovation signifies the importance of transportation and spread of ideas, skills, knowledge, information and every kind of message. Even though information transmission channels and networks are included in the social, political, cultural background of a country, the institutional framework still guides and limits them. The National System of Innovation approach studies innovative businesses in relation to external institutions, governmental policy, competition, clients and suppliers, value systems, social and cultural practices affecting their functions.

Research and information diffusion are the developmental basis in an intensive knowledge economy. In modern economic analysis and based on the local development model prevail the last years, knowledge and its spreading ability have become so important that many consider them as an independent production factor, equally valuable to natural resources and labor (O'Dell C. & Grayson, C.J., 1998).

CHAPTER 6

TECHNOLOGY AND ECONOMIC GROWTH

6.1 RESEARCH AND DEVELOPMENT

All innovation records kept till today are coated in a degree by R&D records. For example, R&D expenses are included in both records. In some cases, there are other common topics, as well. Coating is inevitable, since the organizations licensed to record innovation do not always have access to R&D records data, on business level, but it can give accurate R&D data: up till now, most innovation records document more businesses conducting R&D than the R&D records do. This occurs due to the fact that in some countries R&D statistics do not include circumstantial or off-record R&D, because questionnaires can be really demanding, thus preventing smaller businesses from answering, or because records cover different statistical populations. Usually, small or mid size businesses are covered by innovation records, but not by R&D researches (http://www.gsrt.gr/).

Data coming from patented inventions (applications or approvals) do not indicate innovation outcomes, but inventions, not necessarily leading to patents. However, it is crucial to include relative questions in the records, in order to understand in depth the innovation process. The total number of inventions filed or patented by a business, is a fundamental data, filed in various national and international data banks (Matthiews, 1982, Denison, 1985, Jorgenson, 1990).

Therefore, services, such as computer, research and development (R&D) and training services, are among the economy’s most rapidly growing sectors and play an important role in the regional innovation system (OECD, 2000). The most innovative regions are typically in the most innovative countries. Nearly all the "high innovators" regions are in the group of "Innovation Leaders" identified in the European Innovation Scoreboard (EIS). Similarly all of the "low innovators” regions are located in countries that have below average performance in the EIS.

6.2 R&D GREEK AGENCIES

Agencies involved in R&D activities in Greece are usually state research centers, universities and businesses. Most state research centers are under the jurisdiction of the General Secretariat for Research and Technology (GSRT), Ministry of Education, Lifelong Learning and Religious Affairs while a limited number of centers are under other Ministries. GSRT oversees 16 research agencies and 15 technological agencies, which include 6 technological development companies. Other R&D state agencies include the National Agricultural Research Foundation (N.AG.RE.F.) under the Ministry of Agriculture, the Institute of Geology and Mineral Exploration (IGME) under the Ministry of Environment, Energy and Climate Change and the National Defense Research and Technology Center **(**NDRTC) under the Ministry of National Defense (http://www.gsrt.gr/).

The Ministry of Environment, Energy and Climate Change are also responsible for Industry, Energy, Trade and Tourism issues. From this scope, MD coordinates all developmental activities and, in particular, R&D activities, funded by the 3rd Community Support Fund (3rd CSF 2000-2006) and also oversees research centers, which carry about 20% of our National research effort. The main office responsible for negotiating the 3rd CSF is the Ministry of Finance. Other Ministries involved in R&D activities include the Ministries of Education, Agriculture and National Defense. The Greek Ministry of National Education and Religious Affairs is responsible for the research organizations within universities. Moreover, R&D issues in the agricultural field are monitored by the Ministry of Agriculture, while issues of defense research and technology are monitored by the Ministry of National Defense. Tertiary Education Foundations (Research University Institutes) are under the Ministry of Education, Lifelong Learning and Religious Affairs and cover the widest range of research activity, since most of the Greek researches are employed in these projects (http://www.gsrt.gr/).

Various businesses, industries etc. also develop research activity, especially in the field of information and communication technology. However, private investment in R&D is quite limited. Compared to other countries, Greece employs high quality researchers both within Greece and abroad. Greece's geographical position as well as the

existence of a significant international Greek scientific community in universities and research centers in Greece and abroad enables serious and constant support to existing national research networks, offering significant results in research quality. Greek research system's total efficiency is quite satisfactory, taking into account certain additional factors.

As it has already been mentioned, R&D Expenditure and personnel constitute the basic parameters for the measurement of research and technological development. However, it is also interesting to study demographic and economic characteristics of enterprises that participate in the inquiring activity, such as:

- Business enterprises size
- The regional distribution of business enterprises
- Foundation year
- Legal Entity
- Proprietary Status
- Existence of special department of research and development

The analysis of the above mentioned elements, allows the acquisition of knowledge in relation to the profile of business enterprises that developed research activities during 2005 (Measurement of R&D within Greek Business Enterprise Sector – Reference Year 2005, General Secretariat for Research and Technology).

Business Enterprise Sector by Size Class

The official data of National Statistical Service indicate that in Greece are activated mainly small enterprises. The same result holds also for the business enterprises that activate in the area of research and the technological growth. More concretely, 70.17% of business enterprises that declared expenses for R&D in 2005, have total personnel less than 50 individuals.

Table 6.1 Business Enterprise Sector by Size Class

BUSINESS ENTERPRISE SECTOR BY SIZE-CLASS	
TOTAL PERSONNEL	**PERCENTAGE**
Less than 50 employees	70,17%
50-249 employees	19,20%
More than 250 employees	10,63%
Total	**100%**

Source: http://www.gsrt.gr/

Intermediate in size business enterprises that carried out R&D in 2005 is estimated that constituted 19.20% out of the total number of enterprises with research activity, while the corresponding percentage for large business enterprises approaches 10.63%.

Business Enterprise Sector by Region (NUTSI)

With regard to the regional distribution of companies that declared expenses for R&D, the results of analysis indicate that the 64.67% headquarters are located in ATTIKI and 18.69% belong to the region of North Greece.

Table 6.2 Business Enterprise Sector By NUTS1

BUSINESS ENTERPRISE SECTOR BY NUTS1	
NUTS1	**PERCENTAGE**
ATTIKI	64,67%
VOREIA ELLADA	18,69%
KENTRIKI ELLADA	12,02%
NISIA AGAIAOU, KRITI	4,61%
ΣΥΝΟΛΟ	**100%**

Source: http://www.gsrt.gr/

According to the results, yields that in Central Greece the levels of R&D activity oscillate at 12.02% of business enterprises in the particular region. Finally, in the Islands of Aegean and Crete, the number of business enterprises that dealt with R&D in 2005 is small since the rate of representation by the particular region approximates 4.61%.

Year of Establishment- Legal Form – Proprietary Status

Taking into consideration the year of foundation of business enterprises that declared expenses for R&D in 2005, it results that the particular activity is practiced by relatively new companies. More analytically, it is appreciated that 51.45% of business enterprises that activated in the sector of research and development in 2005, were founded after 1990, while 22.65% was founded during the period 1981-1990.

Table 6.3 Business Enterprise Sector By Year of Establishment

BUSINESS ENTERPRISE SECTOR BY YEAR OF ESTABLISHMENT		**LEGAL FORM OF BUSINESS ENTERPRISES**	
YEAR OF ESTABLISHMENT	**PERCENTAGE**	**LEGAL FORM**	**PERCENT**
Before 1980	25,91%	SA	71,22%
1981-1990	22,65%	LTD	11,45%
After 1990	51,45%	Other Legal Entities	17.33%
ΣΥΝΟΛΟ	**100%**	**TOTAL**	**100%**

Source: http://www.gsrt.gr/

Regarding the legal form of enterprises, results in that 71.22% of business enterprises are Societe Anonyme. Under the particular category are included S.A companies with various types of S.A legal forms, which are legitimated by the law that concerns the operational and legal status of enterprises in Greece. The percentage of business enterprises that report expenses for R&D and have Limited legal entity (Ltd) approximates 11.45%. Finally, companies whose legal entity is diversified from S.A and Ltd, represent 17.33% of enterprises that participated in 2005 in R&D projects.

The majority of business enterprises that performed research and technological development in 2005 were immiscibly private (96.64%), while hardly 2.77% of business enterprises comes under the wider public sector and 0.59% were DEKO.

Table 6.4 Business Enterprise Sector By Proprietary Status

BUSINESS ENTERPRISE SECTOR BY PROPRIETARY STATUS	
STATUS	**PERCENT**
PRIVATE	96,64%
PUBLIC	2,77%
DEKO	0,59%
TOTAL	**100.00%**

Source: http://www.gsrt.gr/

Special Department of Research and Development

For the conduction of research activities, business enterprises may dispose special department of research and development. Usually, special departments exist in business enterprises where research and development constitute at high degree, if not at complete, a distinguishable process of these enterprises. In regard to investigating the existence of such a department in business enterprises that declared expenses for R&D in 2005, the study indicated that 60.45% allocates special department that is specialized in activity relative to R&D. Out of the total of business enterprises that carried out research and development, 45.08% has a special department and all of the research was carried out by this department. Respectively, 15.37% of business enterprises that carried out research and technological development declared that while they allocate special department, they do not carry out all of the research in this department but also in other departments (Measurement of R&D within Greek Business Enterprise Sector – Reference Year 2005, General Secretariat for Research and Technology).

From the survey results we conclude that the majority of enterprises which practice R&D allocates special department of R&D. Furthermore, from the total of enterprises which practice R&D, 45.08% conduct the survey in the R&D department.

Table 6.5 Special Department of Research and Development

SPECIAL DEPARTMENT OF RESEARCH AND DEVELOPMENT	
CATEGORIES	**PERCENT**
Enterprises with RND department	60,45%
Enterprises with RND department, in which of the RND Survey is conducted	45,08%
Enterprises with RND department, in which a part of the RND Survey is conducted	15,37%

Source: http://www.gsrt.gr/

Two factors reflecting the Greek scientific system's high productivity are publications factors and citations factors, especially if they are divided with the total sum of R&D expenses made by Tertiary Education Foundations. Greece overpowers all (selected) countries based on publications factor, while, when it comes to citations, Greece rates next to Ireland, Spain, France and above Japan, Germany, Portugal and Turkey.

Table 6.6: Productivity in Academic Systems

	Publications per $m[1]	Ranking[2]	Citations per $m[3]	Ranking[2]
Greece	16.4	6	36.5	18
Ireland	12.9	11	38.2	17
Spain	12.1	13	36.3	19
Sweden	11.3	14	52.3	10
Netherlands	10.3	16	48.7	12
USA	9.2	20	49	11

Portugal	7.2	23	17.9	24
Turkey	3.3	26	4.2	27
UK	16	7	70.5	4
Germany	7.9	22	31.9	22
France	9.8	18	38.3	16
Japan	3.6	25	11.7	25

Source: www.sussex.ac.uk/spru/

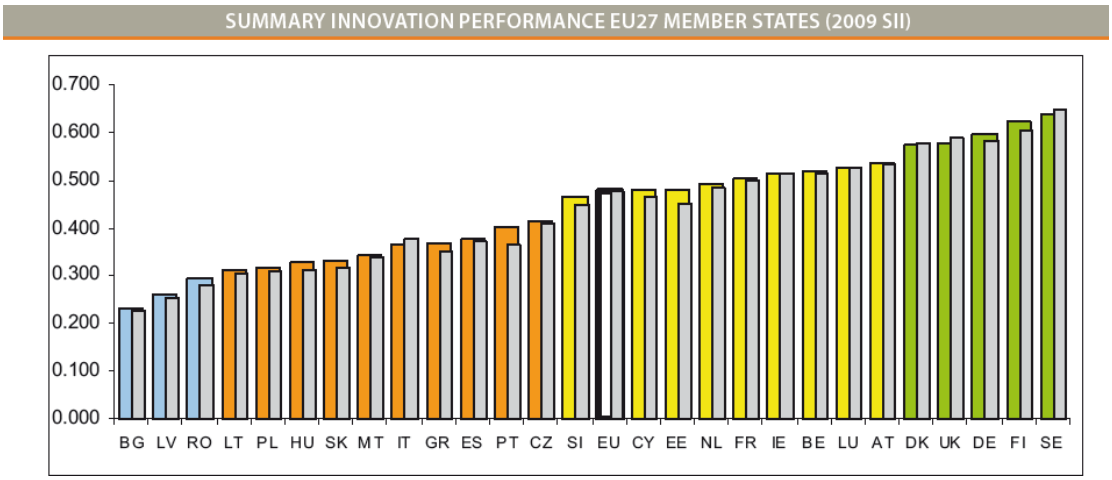
[1] On the basis of R&D expenditure in higher education institutions in 1997 at purchasing power equivalents

[2] Out of a total of 27 countries

[3] On the basis of the number of citations per publication from the ISI National Science Indicators on Diskette.

Furthermore, though it lacks size, Greek research system increasingly and successfully participates in European competing programs (Framework Programs). 0,5% of European research manpower belongs to Greece, though the budget percentage collected by Greek foundations in (FP) programs ranges from 1 to 8. Thus, it is clearly stated that Greek research is highly competitive (National Documentation Centre).

Figure 6.1 Summary innovation performance EU 27 members (2009)



Source: http://ec.europa.eu/enterprise/newsroom/cf/itemlongdetail.cfm?item_id=4139

Czech Republic, Greece, Hungary, Italy, Lithuania, Malta, Poland, Portugal, Slovakia and Spain are the Moderate innovators**,** with innovation performance below the EU27 average. The EIS 2009 Moderate innovators are a mix of 5 Member States which were Moderate innovators in the EIS 2008 and 5 Member States which were Catching-up countries in the EIS 2008.

Note: The Summary Innovation Index (SII) is a composite of 29 indicators going from a lowest possible performance of 0 to a maximum possible performance of 1. The 2009 SII reflects performance in 2007/2008 due to a lag in data availability. The grey colored columns show 2008 performance as calculated backward from 2009 using the next-to-last data for each of the indicators. This 2008 performance is not identical to that shown in the EIS 2008 as not for all indicators data could be updated with one year. The difference between the columns for 2008 and 2009 show the most recent changes in innovation performance.

Over the last decade, Greece has made significant improvements in research and technological development. Today, Greece is in a “catching up” phase, compared with the other EU Member States, with strong overall trends in improving research and innovation. The gross expenditure in R&D has been rising steadily from 0, 20% of GDP in the early 1980s to 0, 68% in 1999 and has experienced the highest annual growth rate in the EU since 1995. The number of people employed in the area of R&D overall, as

well as by occupational category (i.e., researchers, technicians and supporting staff) has increased dramatically between 1993 and 1999 by as much as 80%. Additionally, a significant percentage of R&D positions are held by women, thus making Greece one of the leaders in the EU in terms of the percentage of female researchers represented in the entire research workforce.

From the analysis of expenses it resulted that 58.51% of it (209.1 million Euros) concerned the coverage of needs with regard to the wage of personnel. This high percentage implies that living potential constitutes a basic element of inquiring activity. In this unit we examine in detail the size and the structure of personnel that deals concretely with the inquiring activities of business enterprises (either it is researchers or auxiliary personnel). The measurement of personnel took place based on the number of employees that was occupied in the sector of research and technological growth with point of report at 31/12/2005. An alternative measure for the determination of size of workforce which is occupied in the inquiring activity is Full-Time Equivalent (FTE) that expresses the complete time that was dedicated by each category of employees in the inquiring activity either per month or per year. (Measurement of R&D within Greek Business Enterprise Sector – Reference Year 2005, General Secretariat for Research and Technology)

After a thorough look on the data concerning personnel that was occupied in research and development, we notice that, in 2005, 12896 individuals participated in inquiring activity, from which 31.97% were women. The total time that individuals were occupied in inquiring activity during 2005 amounted in 11665 FTE per year.

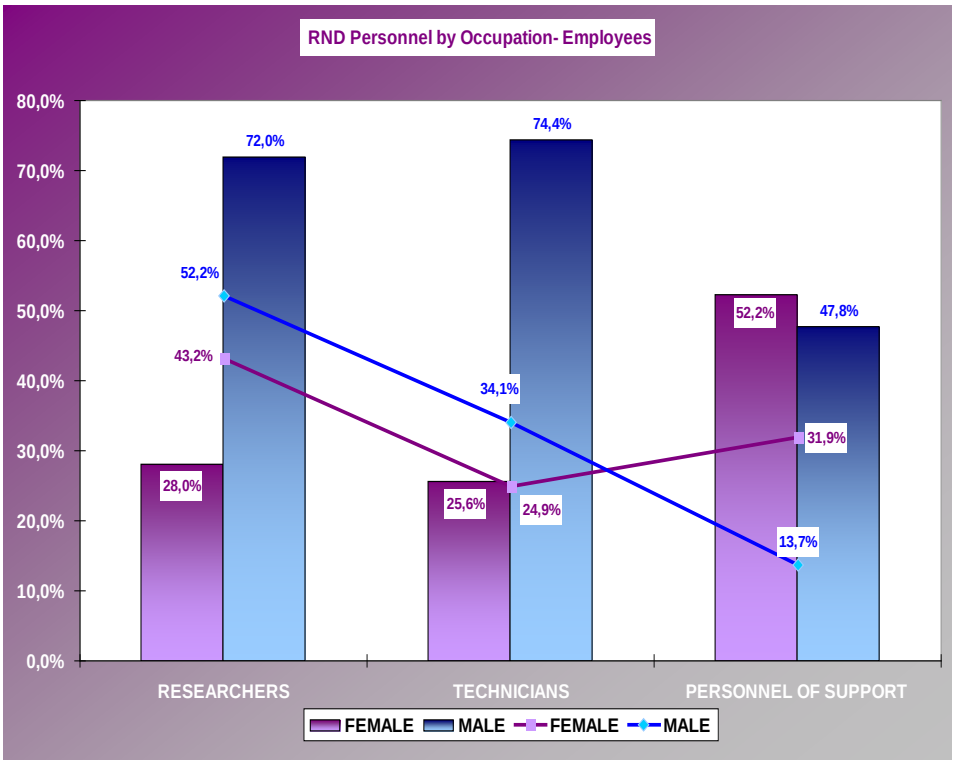
6.3 R&D DATA

The personnel of a company that deals with inquiring activities can be categorized in Researchers, Technicians and in Personnel of Support.The research results show that the higher percentage of employees concerns researchers (49.3%) followed by technical stuff (31.2%) while the percentage of personnel of support reaches 19.5%.

Taking into consideration the sex of employees, too, it is observed that both in researchers and in technical personnel, the majority are men. On the contrary, in the total of auxiliary personnel, women represent 52.2%. If we examine the distribution of

employees in every categorization for the type of personnel, per sex, we observe that the majority of men work as researchers (52.2%) then follow technicians (34.1%) and last comes the personnel of support (13.7%), as it was observed in the total individuals. Out of the total of women that were occupied in the sector of R&D, 31.9% belonged in personnel of support while 43.2% were researchers. Finally, 24.2% of women with specialty of technician worked in business enterprises with inquiring activity in 2005.

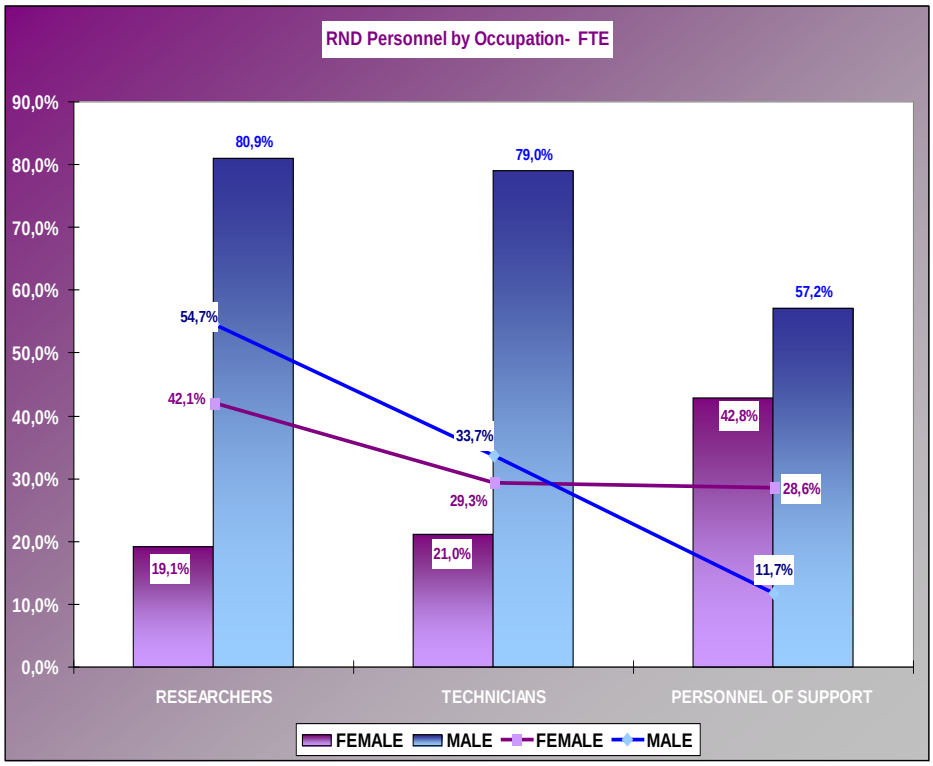
Table 6.7 R&D Personnel by Occupation-Employees



Source: http://www.gsrt.gr/

Regarding the analysis of personnel type per Full-Time Equivalent (FTE), similar results arise as the ones from the investigation of the number of individuals per type and sex.

Table 6.8 R&D Personnel by Occupation



Source: http://www.gsrt.gr/

The only differentiation is the fact that in men correspond more FTE per month than that in women in all the categories of personnel type.

Personnel by Field of Science

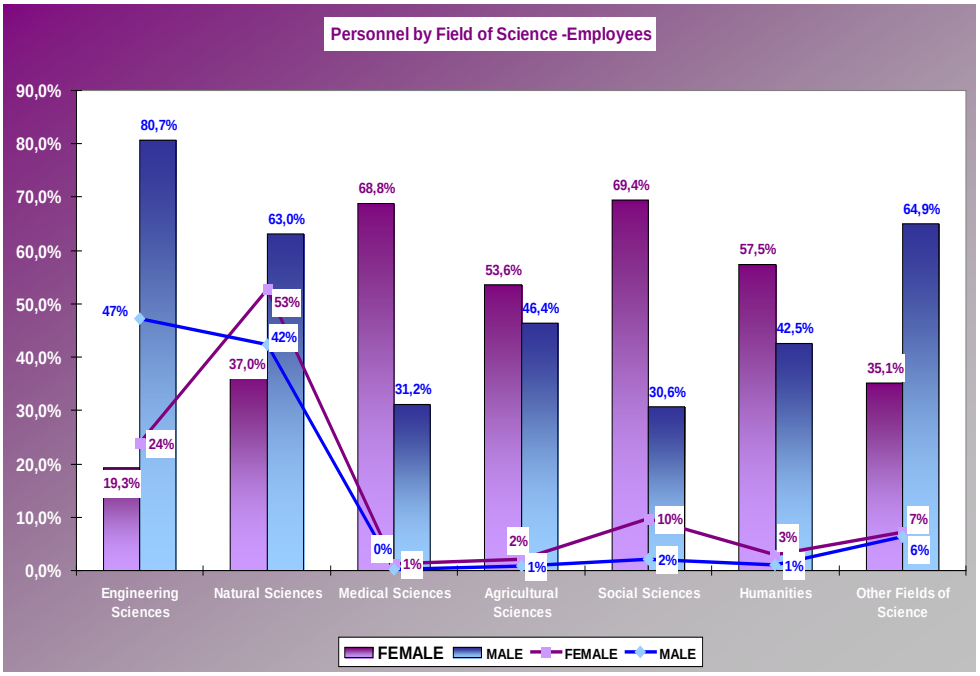
Completing the structure study of personnel in business enterprises, we examine the fields of specialization (science / technology), separated in seven categories, which are the following:

- Engineering Sciences
- Natural Sciences
- Medical Sciences
- Agricultural Sciences
- Social Sciences

- Humanities
- Other Fields of Science

The majority of employees (46%) belong to natural sciences, while the percentage of personnel, of which the object of work is related with engineering sciences (40%), is also important. Agricultural and social sciences is the subject of specialization for small percentages of employees (1% and 4% respectively). Even less are employees in humanitarian and medical sciences (2% and 1% respectively), while a percentage 7% is specialized in other fields of science.

Table 6.9 Personnel by field of Science-Employees

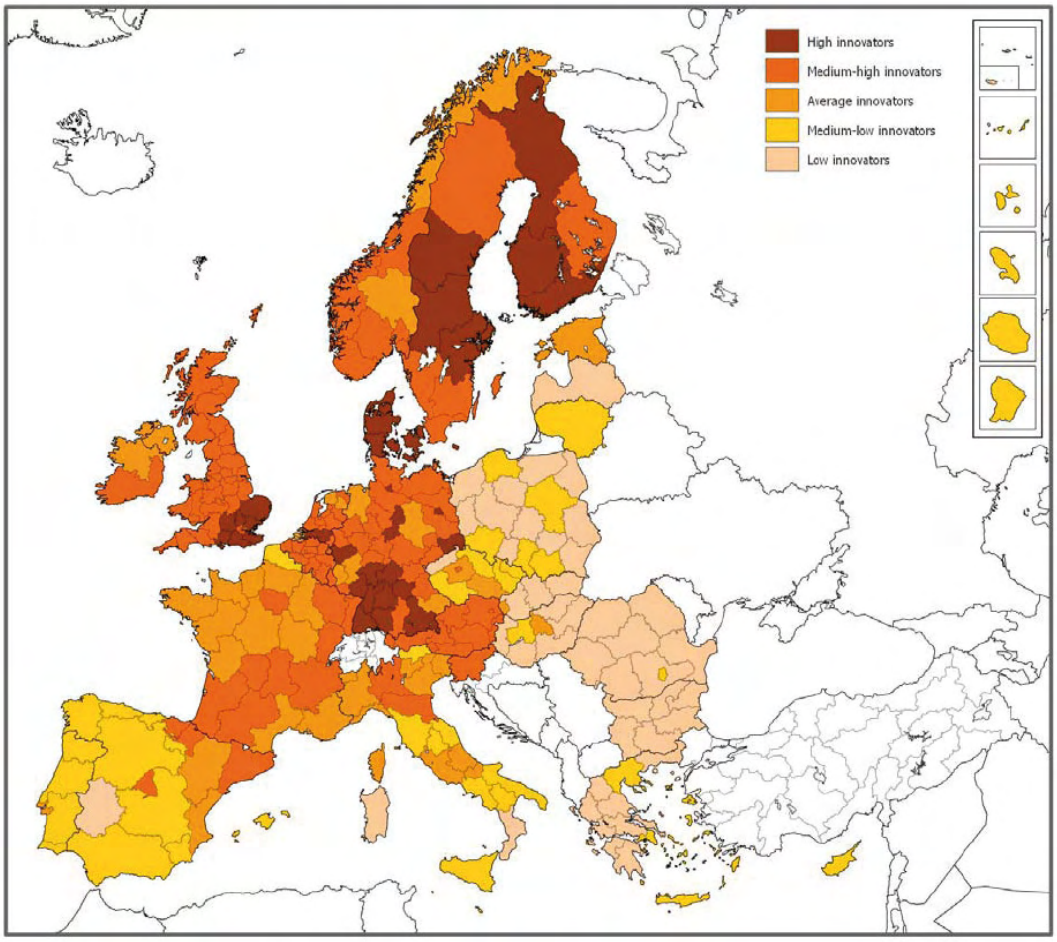


Source: http://www.gsrt.gr/

The study results concerning the sex of employees and the field of science, allows a detailed investigation of the situation with respect to the level of study of individuals that was occupied in inquiring activity during 2005. More analytically, it results that women constitute the majority in medical, agricultural, social and humanitarian sciences, while in the rest of the categories, men are the majority. The biggest difference between two sexes is presented in sciences of engineering where men constitute 80.7% of individuals that are specialized in this field of science, and then follows the field of social sciences where women amount in the 69.4% out of the total of employees.

The country's efforts have also helped raise awareness in the Greek industry for the need to improve competitiveness and reduce the gap with European industry. The result of these efforts is reflected in the increase in innovation both in the manufacturing and services sectors. Furthermore, there is an encouraging change in the business culture since newcomers seek to gain their competitive advantage through differentiation and innovation rather than relying on cheap products and low-cost production (http://www.ekt.gr).

Figure 6.2 European Regional Innovation Performance Groups

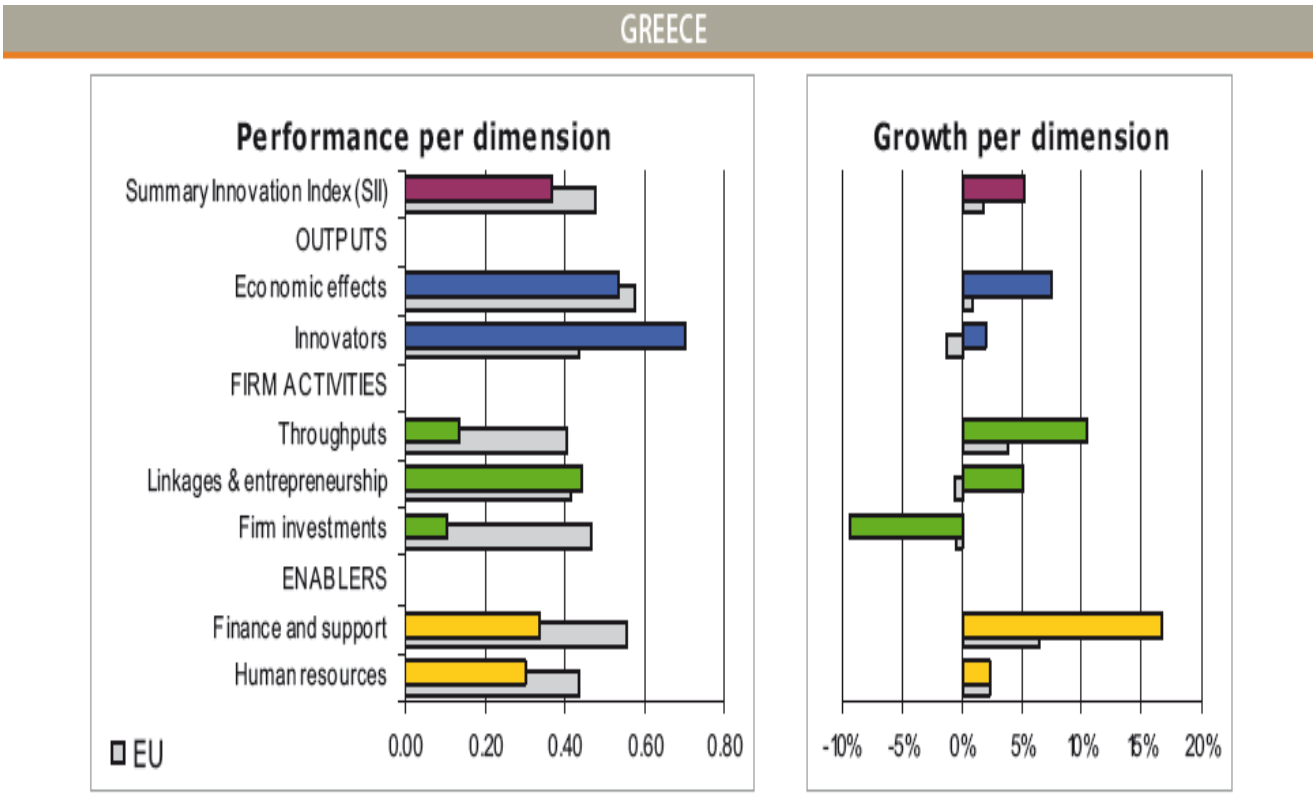


Source: European Innovation Scoreboard (EIS) 2009

There is considerable diversity in regional innovation performances. The results show that all countries have regions at different levels of performance. This emphasizes the need for policies to reflect regional contexts and for better data to assess regional innovation performances. The most heterogeneous countries are Spain, Italy and Czech Republic where innovation performance varies from low to medium-high.

The most innovative regions are typically in the most innovative countries. Nearly all the "high innovators" regions are in the group of "Innovation leaders" identified in the European Innovation Scoreboard (EIS). Similarly all of the "low innovators" regions are located in countries that have below average performance in the EIS.

Figure 6.3 Greece Innovation Performances.



Source: European Innovation Scoreboard (EIS) 2009

For Greece, one of the Moderate innovators, innovation performance is below the EU27 average and the rate of improvement is above that of the EU27. Relative strengths, compared to the country's average performance, are in Linkages & entrepreneurship, Innovators and Economic effects and relative weaknesses are in Firm investments and Throughputs. Over the past 5 years, Finance and support, Throughputs and Economic effects have been the main drivers of the improvement in innovation performance, in particular as a result from strong growth in Venture capital (24.1%), Broadband access by firms (35.4%), Community designs (34.2%) and New–to-market sales (32.8%). Performance in Firm investments has worsened, due to a decrease in Business R&D expenditures (- 4.5%) and Non-R&D innovation expenditures (-22.7%).(http://ec.europa.eu)

In this present study, innovation policy is seen to be the most important sector of regional competitiveness policy. Innovations are the most essential factor in promoting

regional productivity, which in the long run secures the absolute competitiveness and wellbeing for the citizens of a region. Earlier, the innovation policies have been very much equivalent to the science and technology policies emphasizing the science push effect in creating innovations. However, the causality between science and innovation has proved to be weaker than expected (Schienstock and Hämäläinen, 2001) creating a demand to foster other sources of innovation.

This present study has a highly endogenous approach to developing a regional innovation system. Nevertheless, it is worthwhile remembering that the regions are not isolated islands: they are parts of a global mosaic of regions. They are in continuous interaction with other regions and can profit remarkably from each other. Such interaction should not be understood as a purely exogenous factor in the regional assessment. It should be assessed as a normal interaction process between two endogenously developed actors in the network society.

CHAPTER 7
INNOVATION WASTE MANAGEMENT

7.1 WASTE MANAGEMENT IN GREECE

As waste management climbs the political and environmental agenda, bright sparks in the industry respond with innovation.

For more than 30 years, efforts to reduce and avoid the negative impacts of waste on the environment and human health have been central to EU environment policy. Significant progress has been made based on the principle of the waste hierarchy that priorities waste prevention and sees landfill generally as the least favorable waste management option for the environment (European Commission of Environment - http://ec.europa.eu/environment/waste/index.htm).

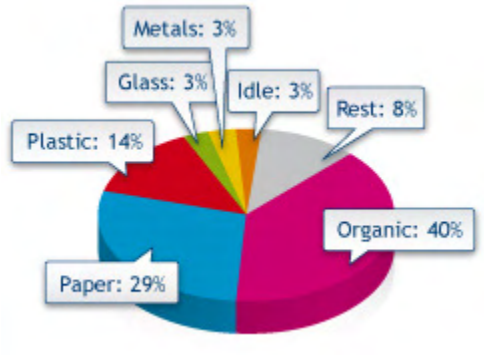
Waste management in Greece has reached a turning point. Unsatisfactory waste management practice, aggravated by public opposition, increasing waste volumes and high rates for the consumer, have come to a point at which changes have to be made. On the other hand, European Union policies are putting pressure for new waste methods to be followed, as far as legal and financial matters are concerned. The implementation and enforcement of waste management changes causes great difficulties. The objectives of EU waste policy are to reduce the negative impact of waste on the environment and public health and to ensure the most efficient use of resources, particularly natural resources. Towards these goals, it aims to improve and strengthen measures to prevent the disposal of waste and promote its re-use, recycling or recovery. (http://www.ypes.gr/el/).

Greece is embarking on a long-term plan to overhaul its waste management practices. New technologies are needed to deal with an increasing burden of waste and that meet the demand for disposal, energy generation, recycling, and building new, closed-loop systems that limit waste generation. According to EU directive (Directive 2004/12/EC of the European Parliament and of the Council of 11 February 2004 amending Directive 94/62/EC on packaging and packaging waste), all Member States, including Greece, should recycle 55-80% of packaging material by 2011 and decrease organic urban waste

by 25% through composting processes at source by 2010. This should increase to 50% by 2013 and 65% by 2020.

Since there is insufficient domestic capacity to meet the needs of the market, investment opportunities are exceptional. The Greek government, local waste management authorities, and private waste management service companies need the expertise of foreign firms to fill this significant gap. Investment opportunities in waste management are exceptional. The expertise of foreign firms to meet the demands of the local market is a necessity since domestic capacity to meet this need is insufficient. According to the Ministry of Interior Decentralization and E-government, Greece produces more than 5 million tons of residential and commercial urban waste annually. This is equivalent to 455 kilograms per person. The region of Attica produces almost 39% of Greece's urban waste, followed by the region of Central Macedonia (16%) and the city of Thessaloniki (9%).

Figure 7.1 Waste Compositions in Greece



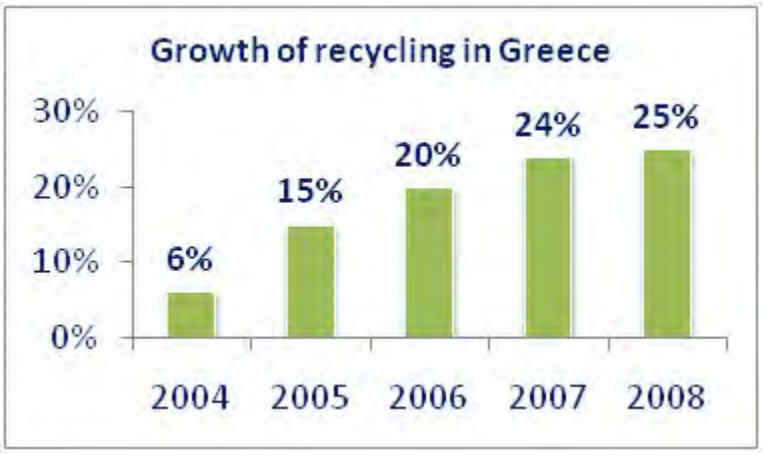
Source: http://www.minenv.gr/4/41/g4100.html

Contributing to the increasing amounts of urban waste are the growth in tourism, increased urban development, a shift in living standards, and a change in consumer habits and behavior. The quest for more efficient waste management has led to recycling programmes in a number of municipalities, and although these initiatives have shown increased participation and promising results, the demand for more comprehensive and effective programs remains.

In 2008, 525,000 tons of packaging materials were recycled-recovered from a total production of 1,050,000 tons. A total of 19 centers for sorting and recovery were

established in Athens, Thessaloniki, Heraklion, Chania, Kalamata, Patras, Zakynthos, Schimatari, Lamia, Karditsa, Corfu, Katerini, Magnesia, and Ioannina. (http://ec.europa.eu/environment/waste/index.htm accessed on 08-09-2010)

Figure 7.2 Growth of recycling in Greece



Source: http://www.minenv.gr/4/41/g4100.html

7.2 Waste Management Companies in Greece

The ten organized recycling facilities throughout Greece today deal in packaging material, vehicles, tires, lubricants, batteries, and electrical and electronic equipment. Currently, eighty one companies deal in the management of hazardous waste (http://www.eedsa.gr/Contents.aspx?CatId=445). The authority responsible for the planning and implementation of alternative waste management in Greece is the National Organization for the Alternative Management of Packaging Materials and Other Products (EOEDSAP) of the Ministry of the Environment, Energy and Climate Change.

A highly promising area is technology to transform waste to energy. Investors may cooperate with Greece's research and technology institutes and councils to develop effective solutions that foster sustainable development. Currently, Greece operates two wastes to energy facilities, one in Athens, the capital of Greece, at the Ano Liosia Hygienically Controlled Landfill and one in Thessaloniki, the second largest city of the

country, at the Tagarades Hygienically Controlled Landfill. The Ano Liosia facility produces heat and power from biogas and has an installed capacity of 23.5 MW. The Tagarades power plant produces electricity from biogas and has an installed capacity of 5 MW, capable of covering the energy needs of 80,000 residents.

For the purposes of our study we are going to use the example of a middle size firm called “Soukos Environmental” which after research involvement in waste management systems came up with an effective and environmental friendly method to collect urban wastes. The new worldwide patented (Patent No. Intellectual Property Organization of Greece 1005724) product “Robotic Bin for Waste Management” concerns a modern robotic system for the collection and management of urban waste. Soukos Environmental is chosen mainly because it is the only Greek firm that owns a patented application on waste management.

Modern requirements of European legislation impose an integrated municipal waste management system that includes the implementation of programs for optimization of the collection system, the limitation of waste production, the recycling of selected/sorted out materials, the implementation of transhipment systems for greater economic efficiency of the system, the use of treatment methods with the intention of energy use or the reuse of materials and the disposal of the final extract in modern sites of landfill residues.

According to the company the Robotic Waste Bin will answer the problem of the management of waste that today constitutes a complex and difficult problem faced in every modern society. This product is directed mainly to the world market. It is directed to the investors that will buy the rights of the exploitation and will undertake the growth and/or manufacture the management and economic exploitation of the product in the international market. This investor can be Multinational Companies, Banks, Advertising companies and businessmen.

The financial analysis that is presented chapter 11 provides an outlook of the possibilities of the exploitation of the product in a very small market such as that of Greece. Next are provided the breadth and the multiple possibilities that are predicted when the product is introduced into the large world markets. For the users of the product that are mentioned below, analytic research of the market was held that is presented in the fourth chapter proving the large possibilities also of the local markets. Along with the

environmental advantages and the priceless value of the product, it provides an economic competitive advantage particularly for the Organizations of Local Government. Indicatively it is reported that the financial requirements of the Robotic Waste Bin are limited to 50% with regards to the waste routes and 25% with regards to the working costs for the bins.

The financial analysis that is presented in chapter 11 proves that:

The investment for the foundation of the unit for its manufacture and commercial exploitation, is evaluated with the main methods of evaluation, and is judged as being absolutely a unit of interest as it presents a positive clean present value. Also, with the application of a very large interest-rate discount with the internal factor of output of the invested funds being 49.25%. The period of return of the invested funds is calculated in 3 years. According to the analysis, it can be argued that this product does not become a simple investment; rather it becomes an investment of large proportions with worldly dimensions that currently is impossible to display.

To achieve this aim and pursue our goal of continual environmental improvement Soukos Environmental will:

- Comply with and where possible exceed all legal and other environmental requirements relevant to our activities.
- Assess and control the environmental aspects of our activities and services to minimize their impact on the environment, including the waste management solutions we offer to our clients.
- Develop eco-efficient working practices by reducing resource consumption and waste generation. Where possible we will recover and recycle our and our customers' wastes.
- Understand and control the risks of our activities to minimize environmental pollution, damaging incidents and nuisance incidents to local residents and the environment.
- Ensure that employees and contractors have sufficient experience and training to enable them to meet their responsibilities in safeguarding the environment, including compliance with this policy and relevant procedures.

- Communicate on the environment with interested parties, including employees, customers and contractors

7.3 BACKGROUND AND COMPANY ACTIVITY

The SOUKOS ENVIRONMENTAL S.A. Company, founded in 2008, with the intention of activating in the field of environmental protection in Greece and abroad. From its foundation offers services and products for the settlement of modern environmental problems. The business policy focuses on the promotion and commercial exploitation of innovative products with environmental applications, of which the design, the development and manufacture supported by the SOUKOS ROBOTS S.A.

The SOUKOS ENVIRONMENTAL S.A cooperates with the Research Centre SOUKOS ROBOTS S.A. and utilizes its long-term experience and accumulated know-how in the field of research - study - development and manufacture of innovative technologies. Additionally, exploits the new planned technologies of SOUKOS ROBOTS in the field of environmental management, which are protected by many patents in possession of SOUKOS ROBOTS.

The well-designed premises of SOUKOS ROBOTS S.A. are appropriate-staffed by scientific and technical staff, who guaranteeing the excellent quality on the technological requirements of this area. All the proposed/proffered proposals and solutions of SOUKOS ENVIRONMENTAL to their customers, are complied with the requirements of the Greek and European environmental legislation, and are economically viable. The company SOUKOS ROBOTS was founded in 1997 with its current name whereas from 1979 till 1997 the firm was developed under the name of Konstantinos Soukos. The company participates in the following sectors:

-Research, planning and manufacture of robotic systems of high technology for defensive and industrial applications.

-Research, planning and manufacture of specialized electronic systems of war and communications.

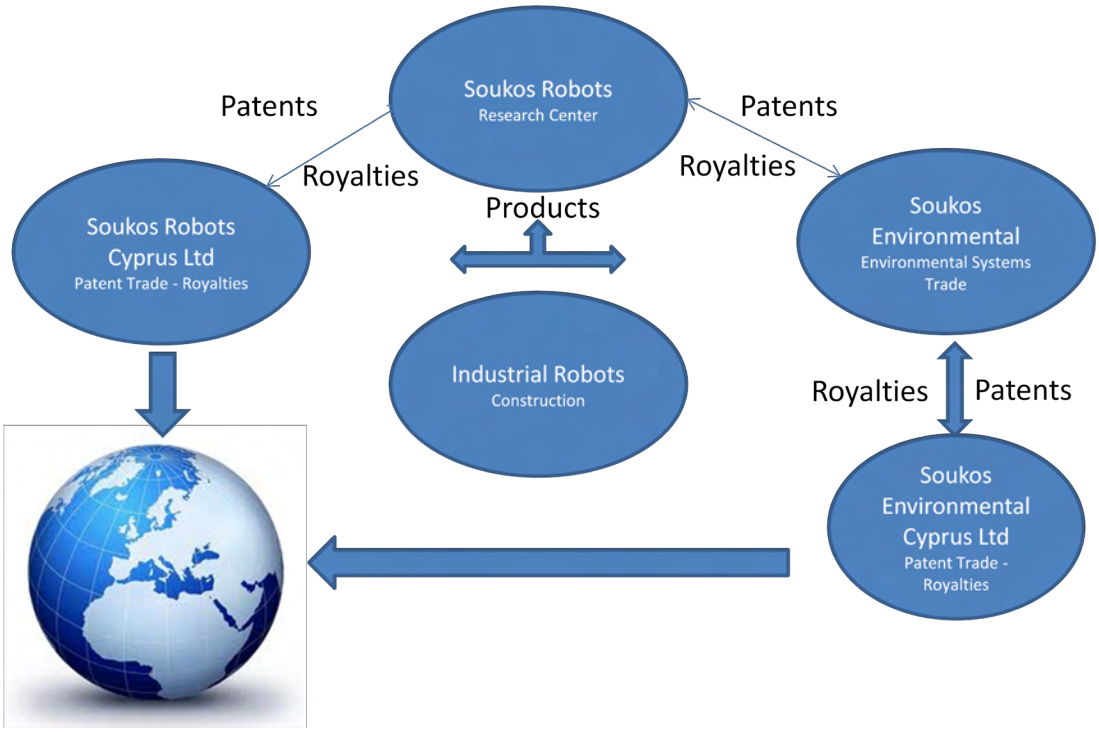
Below are a few of the robotic systems of defensive applications that are designed and manufactured by Soukos Robots:

- Protection system from Rocket-Propelled Grenades (RPG)
- Ecological ammunition disposal systems for any type of ammunition and mines
- Surveillance system for borders, military camps, airports and rocky islands in “Real Time”
- Robotic System “IRAKLIS” to detect, transfer and dispose improvised explosive devices, as well as biological or chemical substances
- Robotic metal vessel for the transportation of improvised explosive devises “Achillies”
- Robotic weapon bases for marine boats and vehicles
- Self-Cleaned Shooting Training Frame

Moreover, the main shareholders founded in 2006 a construction company called INDUSTRIAL ROBOTS S.A that functions in a new plant of 3.000 m2 on the 6 the km Larissa of .Ampelona road.

Looking on the following graph we can see the Soukos group of companies and how it works. Soukos Robots as a Research centre feed with patents and prototype technologies the Cyprus companies who transfer patent rights to potential investors and collect fees and royalties. Industrial Robots provides the hardware and any mass orders. Cyprus is used due to its low taxation on IP rights.

Figure 7.3 Company Activity



Source: Soukos Robots S.A.

7.4 ORGANIZATIONAL CHART

The company Soukos Environmental SA uses modern methods of organization and management.

Soukos Environmental SA is certified accordingly:

1. FOR the APPLICATION OF SYSTEM QUALITY ACCORDING TO THE MODEL EN ISO 9001
2. FOR the APPLICATION OF THE ENVIRONMENTAL MANAGEMENT ACCORDING TO MODEL EN ISO 14001

The System of Administration of Quality and Environmental management includes:

- The organizational structure of Company
- The written documentation (Handbooks of Quality and Environmental management, Forms, Directives)
- The models, the institutional texts and the relative bibliography on the support provided
- The educated and permitted personnel for the implementation of duties

Material and Technical Infrastructure

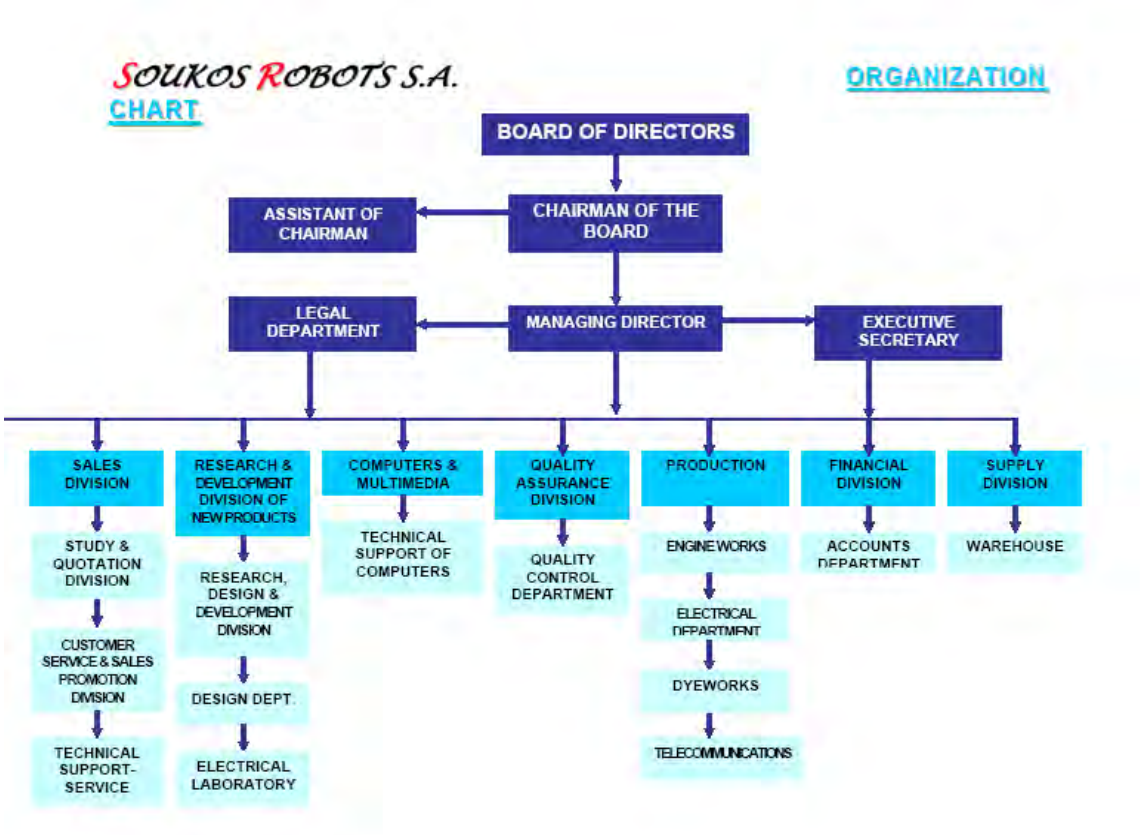
The factory of the company is located at the 9th km of the Larissa – Thessaloniki National Road on 40 acres of privately owned land. The building covers a surface area of 5.000 which includes departments such as research and planning, production, department of quality control storage areas, display area, customer service and the offices of the administration. The mechanical equipment of the factory and in the department of planning and qualitative control is of modern technology. Also the company uses modern tools of computerization and programs of resource management ERP and CRM (www.soukosrobots.gr).

Human Resources – Organizational Structure

Excluding the Administration, the company employs 80 individuals. The company is also staffed by scientific and technical personnel of high specialization and

know-how. The amount of personnel with graduate technological education amount to 35, and the remaining are technical personnel with many years of experience. The organizational structure is shown below.

Figure 7.4 Organization Chart



Source: www.soukosrobots.gr

7.5 CORPORATE STRATEGY AND OBJECTIVES

The strategic objective of the company is focused on the production and the promotion of innovation. This is also the basic characteristic that gives this company a powerful competitive advantage and the company thus ranks among the few and large enterprises, that because of its know-how is addressed in the International market. For the implementation of this strategic objective, the adequacy of the growth of human and material resources is required.

The shareholders of company offer technical sufficiency and the know-how, and can determine the needs for innovation. They also allocate the technical knowledge that is required in order to evaluate and focus their energies, in high quality products and a high scientific technological infrastructure, as well as in the attracting of specialised personnel and in the exploitation of technological know-how to foreign markets.

They further expect that through the programs of public subsidy, in the initiatives from the state for the aid of innovation, and in the creation of networks of innovation and in the practical reward of their efforts.

In summary, the company presents the following comparative advantages in comparison to other enterprises of the sector (Soukos Environmental):

- the shareholders of the company, possess the scientific sufficiency and the know-how (as was previously mentioned with the world patents and licenses, that are guaranteed), in order to have the competitive advantage in European and International markets
- The shareholders of the company offer an enterprising culture directed in the research and growth of new products, for the high requirements and high specifications of the markets.
- the company, provides high quality products and a high quantity scientific and technological infrastructure, with regards to human and material resources
- the company, provides high corporate social responsibility, which is granted to the local society

- The company has already made international contacts not only in Europe but also on the World level (for example the recent collaboration of SOUKOS ROBOTS S. A, with the American company Raytheon that is a pioneer in the industry that concerns itself with defence and the governmental products of electronic technology, space technology, and information technology)
- The infiltration in new demanding markets and mainly in International.

The Company Policy:

- The policy of this company is to offer innovative products and services that are arranged with the determined requirements of customers and the manufacture/delivery time that is determined in the contracts that are sign with its customers, offering simultaneously a competitive economic result for the Company and its customers.
- The objective of company is that it is at all times in compliance with being in effect with the legislation that concerns the Quality, the Safety and the protection of the environment.
- Moreover, the close collaboration with its customers and their aims lends to the continuous improvement of the quality of products and services.
- The policy of the company's Administration is it encourages its workers, to participate actively and creatively for the objective of the continuous improvement of the quality and the protection of environment.

CHAPTER 8

PRODUCT PRESENTATION

8.1 THE PRODUCT

The "ROBOTIC BIN of WASTE MANAGEMENT", confronts effectively the more reported disadvantages of common bins of waste.

It is suitable for the concentration of big volume of waste inside a limited space, for ecological, healthy management and storage of disposable waste inside for a long time interval until the automatic collection is necessary. Collection can be achieved with already existing waste trucks or from simple pickup truck vehicles without it being necessary that they have the ability to compact. Also the structure and its operation with the individual stages of process that take place, the provisions and the sub systems that it is composed of, are all designed with modern technology, and makes it a competitive product of its type.

Moreover it provides guarantees for the sure, economic and functional management of waste according to the associated national legislative acts mainly the K.Y.A.50910/2727/2003 "Terms and Conditions on the Management of Solid Waste and National and Regional Management Planning". As stated, planning operates at two levels. Firstly, the National Waste Management Plan, annexed to the 50910/2727/2003 Joint Ministerial Decision on «measures and conditions on solid waste management - National and Regional Management Plan», which sets out the general priorities in relation to waste management. The operational plan, however, is set at the regional level. J.M.D. 50910 on the management of waste transposed Directive 2006/12/EC (replaced by the Directive 2008/98) into the national legislation. It comprises to the following basic axes:

• Adaptation and approval of the National Solid Waste Management Planning so as to incorporate the major principles, goals, policies and actions for the rational management of urban wastes, according to the community legal framework and arising national obligations;

• Establishment of the Regional Solid Waste Management Planning as the executive action plan in the area of solid waste management, with specifications and goals in consistency with those of the National Planning. The objective of the RSWM Plan is to specify the general directions of the National Plan and identify priorities and measures to be taken at the regional level by Regions, Prefectures and WMAs. In the aforementioned J.M.D. the national targets regarding solid waste management are set in order:

1. To ensure a high level of protection for the environment and public health
2. To conserve natural resources, water, energy and earth surface
3. To reduce the air emissions contributing to the greenhouse effect

Source : www.soukosenvironmental.com

8.2 ANALYTICAL TECHNICAL DESCRIPTION- FUNCTIONS

The innovation of this product concerns the following operations:

- The automatic transport, compaction and storage of waste inside a special chamber of compaction
- The automatic disinfection of waste at point of storage
- The automatic opening of the waste door, so that there is no contact between citizen and the Robotic Bin (there also exists the possibility of manual operation).
- Constant compaction and holding of waste
- Automatic notification of fulfilment of bin to the Cleaning Service responsible
- Automatic disinfection of the waste compaction chamber
- The automatic recording of data, such as volume and weight of collected waste inside the robotic bin, the date of fulfilment, and date of evacuation etc, with direct notification through the "on line" wireless system to the Cleaning Service responsible of each Municipality.
- The sealing/locking of the waste disposal door when the robotic bin has filled
- Automatic evacuation of the bin via a remote control

Capabilities

The abilities of the ROBOTIC WASTE BIN are as the follows:

- The storage of a larger volume of waste in comparison to the common mechanical waste bins (capacity from 5 up until 10m3 – the mechanical waste bin can only hold 1m3), depending on the common waste bin dimensions.
- Automatic evacuation using the adjustable scoop with already existing vehicles of collection of the Municipalities in a fast and less noisy way
- Disinfection of the chamber where the compaction of waste takes place
- Disinfection of stored waste

- Cleaning of the chamber where compaction of waste takes place via the connection to the water network and/or internal reservoir of water
- Collection of waste that does not need compaction
- Connection with sewer for the removal of fluid remains after cleansing of the bin has taken place.
- Automatic detection and extinguishment of fire
- Designed in various shapes and dimensions so that it adapts harmoniously in any environment.
- Long-lasting storage of waste
- Airtight and water proof operation.
- The possibility for the use of its surface for Advertising purposes
- Operation as station for recycling, as it also provides the possibility for the segregation of up to four(4) sections for useful materials such as paper, glass, aluminium, batteries, plastic etc.

PLACEMENT AND AREA SUITABILITY

The modern Robotic bin of waste management can be installed in multiple areas that mass human activity exists such as:

- Central network of the city (historical, commercial, over-populated city centre)
- Areas where there are frequent visitors (central-squares, hotels, parks, athletic grounds, train stations, schools, areas of entertainment, offices, sidewalks),
- Tourist-archaeological areas etc
- Beaches

Thus, replacing the common, classic waste bins that are found all around us at the moment.

8.3 ECOLOGICAL MANAGEMENT

The management of the waste is concentrated in specifically shaped chambers for compaction. After the waste via gravity, falls into the chamber, it is led via a lifting system (disk of elevation) to the chamber of compaction, where it is constricted and is stored for long periods of time. With the special system of withholding and the controlled exit of compressed air from the waste, an absolute control of the situation of the waste disposal is achieved with a continuous guarantee of a complete leak/air-tight system. The evacuation of the chamber of compaction is achieved with the rotation of the moved trunk of the robotic bin in a rotating area, suitable each time for the precise evacuation for the means of collection (with use of waste truck). With the above system, any chance of the escape of wastes disappears, as well as absolute conditions of hygiene are ensured for the operator, after all they do not come in contact at any stage of the process with the waste.

Also the automatic cleanse and disinfection of the station occurs after the evacuation, also the station does not allow the leakage of gases, and is a completely ecological and environmentally friendly system for the management of waste. The evacuation of the bin can also take place with the use of any standard truck or vehicle without compacting capabilities.

8.4 ENVIRONMENTAL REPERCUSSIONS

The environmental effects from the defined process are none.

A) GASEOUS WASTE

The robotic bin of waste management, does not allow the emission of gases-odours into the atmosphere. Also, the automatic provision of disinfection that it brings, which is activated after the end of each evacuation, diminishes any chance of odours and toxic emissions. Alternatively, a special system of ventilation can be placed if it is required.

B) HUMID WASTE

From the reported process it is also possible that a concentration of humid waste and the liquids will remain from the cleansing and disinfection in the bottom of the robotic bin of waste management. As mentioned beforehand, after each evacuation is completed there is an automatic cleansing of the chambers, which in return produces the existence of humid remains. For this reason, the robotic bin of waste management allocates suitable provisions for its connection with sewers (sewerage) for the direct removal of these remains.

C) SOLID WASTE

Solid waste does not exist at the present process.

8.5 USEFULNESS AND PROFITABILITY

The usefulness of this product for its users is the following:

- It provides a long term solution to the problem of the collection and compaction of urban waste that constitutes a major problem, particularly in large urban centres, with a long term strategy but with no solutions, and also with a limited time frame. It becomes an economical and environmentally safe collection and compaction of urban waste
- The product contributes to the improvement of the aesthetics in public spaces and mainly to the prevention of dangers with regards to the improvement of public health
- It also contributes by the use of its exterior for advertising that will lend added value to the institutions that will invest in it.

According to a technical report (2008) from the Technical Chamber of Greece ordered by the company, the potential profits for the users are:

:

- Reduction of piles of waste that is left out of the common bins on pavements, in parks, central areas, public and private spaces, etc
- Reduction of required number of common waste bins, and consequently the creation of a pleasant city, where the waste and the bins of collection do not constitute piles of pollution
- Daily maintenance of the waste inside the robotic waste bin, without the probability of the creation of piles of pollution (including stenches, humid and solid substances)
- It offers large surfaces for advertising purposes, which each Municipality can rent to advertising companies.
- Reduction of the cost of waste collection. Indicatively it is reported that the functional requirements of the robotic bins, are limited to 50% with regards to the waste truck routes and 25% with regards to the working costs (man-hours) concerning the common waste bins Decongestion of regions from the circulatory pressures of waste trucks
- Collection of waste from standard trucks without compacting capabilities (Soukos Environmental SA accessed on 22-08-2010).

8.6 CASE STUDYS' AREA OF APPLICATION

Using the city of Larissa as an example of the application of this product we provide some general data on how the Municipality of Larissa manage urban wastes and what infrastructure it uses.

Larissa population details

Larissa is currently the commercial, industrial, communications and administrative centre for the entire Thessaly. Based on the National Statistical Service of Greece, for 2001, 47.2% of the active population in Larissa District is concentrated in the Municipality of Larissa.

Waste Management Details for the Municipality of Larissa

The volume of the transported wastes in the Municipality of Larissa is:

- For 2006: 64,539 tn
- For 2007: 66,036 tn

The above numbers, and due the population increase of the city of Larissa (approx.7% per annum for the past five years) equal to the production of 377 kg of wastes / resident * day, a value that is almost equal to the national average of 0.98 kg of wastes / resident * day.

Equipment

The Cleaning Authority, in order to collect the wastes, is equipped with the following:

- 33 garbage trucks
- 8 vehicles for washing the bins
- 7 sweeper vehicles
- 6 water-carrying vehicles
- 4 open trucks, small
- 5 open trucks, large

It is also equipped with:

- 6120 plastic and metal bins, of 1100 lt capacity
- 670 recycling bins
- 3000 fixed metal bins for small wastes

Collection schedule

- 14 garbage truck routes are performed during morning hours.

- Routes by 2 garbage trucks are performed during afternoon hours.
- 9 garbage truck routes are performed during night hours.

Recycling program

The Municipality of Larissa runs a paper - carton paper recycling program and collets 2,287 tn of paper/year. The recycling garbage trucks are usually active in the commercial centre and in the schools of Larissa city grid. Three routes are performed every day during the morning, 2 in the afternoon and 1 in the night.

CHAPTER 9

ANALYSIS OF EXTERNAL ENVIRONMENT

9.1 ENVIRONMENTAL – DEVELOPMENTS AND TENDENCIES

The environment constitutes the background of public health and the standard of living of all citizens. Simultaneously it also constitutes a basic pylon in the report of the qualitative significance "Growth" (development) and hence the central report in the character Viable (Sustainable) Growth.

The last three decades, the demand from citizens for the most optimal possible quality of urban environment (quality of atmosphere, potable water of high quality, sewerage, treatment of sewages, management of urban solid waste, urban and suburban green), has increased and simultaneously the protection of the natural environment appears continuously more imperative, as long as it increases the general cultural level. There is a continuous increase in demand for the requirement of urban environmental infrastructures of high quality.

Despite the resources that were allocated at the previous Programmatic Periods in the Sectors of the Basic Environmental Infrastructures, the relative deficit of our country remains to a large extent real. On the other hand, Greece has the possibility of incorporating effectively her developmental policy and more generally the planning of public policies, and the environmental objectives that are placed in the Community Legislation. Consequently for Greece, the objective is not only to nominally observe the European developments at the institutional level and adapted to them, but to really converge in the substance of the European environmental interests, and face its particular needs.

The natural environment thus, has the dimension of an economic "reserve" with the base and the beginnings of Sustainable Growth, as they were adopted by the Policy of the E.U (6th Action plan for the Environment, and the previous Action plans of the E.U) and were incorporated in the Legislation of the E.U with emphasis on the last decade.

According to the National Strategic Drawing of Growth - Sector Environment and Sustainable Growth – for the period 2007-2013 the Strategic Objectives for the Sector of Environment during the Period 2007 - 2013 are:

The Protection, Upgrade, and Sustainable Management of the Environment so that it constitutes the background for:

- The protection of public health
- The rise of the quality of life of citizens as well as,
- The basic factor for improvement of the Competitiveness of the Economy

In the direction this Sustainable Growth presupposes for our country five (5) Strategic Choices in the Sector of the Environment:

1. Re-establishment - Protection and Appointment of natural environment <>
2. Re-establishment and Upgrade of the quality the urban and structured environment
3. Complete growth of environmental infrastructures of management of waste and sewages
4. Protection - Rational use and management of natural resources (atmosphere, water resources, and soil)
5. The complete incorporation of environmental dimensions in sectored developmental policies (Energy - Industry, Agriculture, Tourism - Services, Transports).

9.2 LEGISLATIVE FRAME OF SOLID WASTE MANAGEMENT IN GREECE

The first the provision for the management of waste in Greece, was YA EIβ/301/64 “collection, transfer and disposal of waste", which determined also the technical specifications for the management of waste and for the areas of disposal.

Legislative regulations N. 703/1970, N. 25/1975, N. 429/1976, N. 1080/1980 determine the calculation of municipal dues of cleanness (collection of waste) with base the sq. meter per household, while even today the Regulations of Cleanness of Municipalities have not differentiated the way of cost accounting of municipal dues. The Law 1650 "on the protection of the Environment", placed the general frame but also the objectives and the means for the protection of Environment. According to article 12 responsible institutions for the management of solid waste, was fixed from the LOCAL AUTHORITY.

The first effort of adaptation of Greek Legislation on the management of waste KYA 49541/1424/86 "Solid waste in compliance with Directive 75/442/EOK". With

KYA formulated are the basic beginnings that should condition the management of waste, so that the Public Health is not placed in danger and there is no damage to the environment. In the beginning of the decade 1990, under increasing pressures for an environmental policy, the progressive sensitization of the public, but also pressures for incorporation of European directives and legislative regulations in the Greek legislation, an effort began to upgrade Greek legislation and the revision of the environmental policy.

In 1996 are the circular of 9/96/30-01-1996 MINISTRY OF ENVIRONMENT PLANNING AND PUBLIC WORKS, with which are determined the content of file of preliminary approval of the arrangement of installations of disposal of waste. The Law 2939/2001 shapes the institutional frame for the alternative management of packing and other products that are harmonised with the Directive 94/62/EU and determine the frame for the concretisation of programs of recycling, re-use, utilization of packaging and other products, with the establishment of concrete quantitative objectives and time limits for their approach.

In 2003 KYA 37591/2031/2003 for the management of waste from sanitary units was published. With its base the above KYA, compel the Sanitary Units to work out the Internal Regulation of Management of Dangerous Medical Waste. In 2003 are published KYA 50910/2727/2003 "Rules and Terms on the Management of Solid Waste. In the KYA the objectives and the beginnings of management of solid waste were determined, as well as the specifications of national but also regional drawings for the completed management of waste. Moreover, the indebted institutions for the management of solid waste as well as the rules for the re-establishment and exploitation of the areas for the disposal were determined.

Finally in 2006 with KYA 13588/725/2006 "Rules, terms and restrictions on the management of dangerous waste", the technical specifications for the management of solid waste as well as the content of national planning of management of dangerous waste were determined, which were worked out by the MINISTRY OF ENVIRONMENT PLANNING AND PUBLIC WORKS. Moreover are determined the obligations of producers and the institutions of management of dangerous waste.

9.3 LEGISLATIVE FRAME OF THE MANAGEMENT OF SOLID WASTE IN THE E.U

The Community policy for the protection of environment began substantially with the Summit of Paris in 1974. In 1981 until then scattered environmental services incorporates in General management XI (environment, nuclear safety protection of citizens) and is adopted the Single European Act (1 July 1987) and the 4th Action plan for the environment, with fundamental objective the effective application of Community legislation on the environment

In 1991 the European Committee began the program for the management of waste of priority in which they included:

- Waste from electric and electronic equipment
- Waste from manufactures and demolitions
- Vehicles in the end of their circle of life
- Accumulators
- Tires
- Packaging and waste of packaging
- Used Mineral oils
- Hospital waste

It followed the 5th Action plan for the Environment "to a sustainable growth" which established the beginnings of more energetic European strategy for the period 1992-2000. Henceforth runs the 6th Action plan for the Environment which determines the general objectives and determines the list of environmental priorities until year 2010.

Frame of Management

In 2006 the Directive 2006/12/EK on waste was established, which also replaces the Directive frame 75/442/EOK. The member states owes to work out as soon as possible, drawings for the collection and utilization of waste, but also for the restriction of waste production as well as the essential measures so that there are limited transports of waste.

With the effort for a common strategy in the subject of waste management, the European Committee adopted the European List of Waste with the decision 94/3/EK. The directive 91/689/EOK "on dangerous waste", formulates strict terms and conditions on the collection, transport, exploitation and disposal of the toxic and dangerous categories of waste, as well as special requirements that the States - Members are compelled to apply. With regard to in the transport of waste it is determined by the Regulation 259/93, which is in effect for transports of waste so much in the interior of Community what when they enter in the Community territory or come out from this. The Regulation in July 2007 will be suppressed provided that has come out new Regulation on the Cross-border transport of waste. The Regulation 259/93 is an established system of reciprocal and obligatory notification, as well as a single document of follow-up for the transport of waste. Moreover, it forecasts and differentiates between the waste that is intended for exploitation and that that is intended for final disposal, as well as it categorizes the waste that is intended for recycling in 3 categories (green, orange and red list).

A proposal for its revision was submitted on June 30th 2003. The objective of this proposal was to strengthen, to simplify and to clarify the processes that are applied today with regards to in the control of transports of waste.

More importantly, it would decrease the number of lists of waste from three that is today to two and replace the 3 existing processes of control in the following 2:

- The process of notification and the previous written consent regarding the transports of all waste that are intended for disposal, and the hazardous and semi-hazardous waste that is intended for retrieval.
- The process of transports that is accompanied by certain information with regards to the non hazardous waste that is intended for retrieval.

Methods of management of waste

The Directive 1999/31/EK on the sanitary burial of waste, aims at the prevention or the reduction of the negative repercussions of waste burial in the environment, and more specifically on the surface, in underground waters, in the soil, in the air or for the health of each person. The member states vow to shape national strategy for the reduction

of the quantity of bio destructive waste that results in areas for burial, and established concrete quantitative objectives. With regards to the incineration of solid waste, this is covered by the Directive 2000/76/EK. The objective of the directive is the prevention or restriction, of the repercussions to the environment from incineration and the combined incineration of waste.

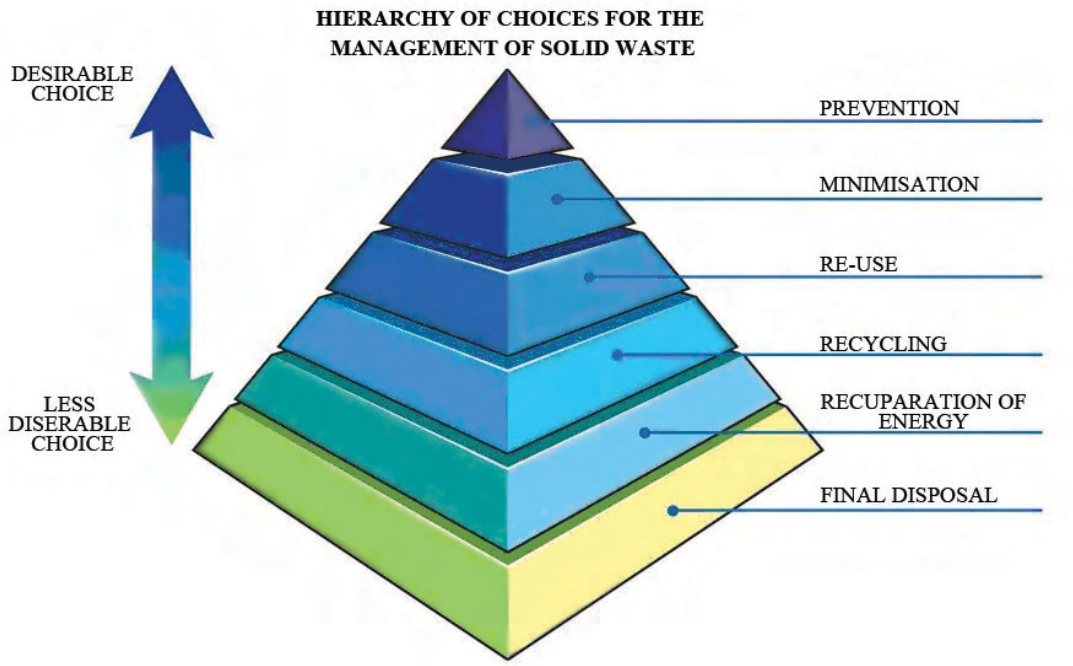
9.4 THE ENVIRONMENTAL POLICY OF THE E.U AND THE STATE MEMBERS.

The main points of the environmental policy of the European Union are the following:

- the prevention is preferable than the taking of corrective measures
- the environmental problems should be encountered at their source
- polluting should pay the cost of the measures that will be taken for the protection of environment
- The environmental policy should be taken into consideration and constitute the department of other policies of European Community.

Entirely, the environmental policy of E.U is based on "polluting pays". The payments can be actualized in the form of investments in order that conformity is achieved to stricter models or with the form of tax imposed in the enterprises or to the consumers to not use ecological products (e.g. certain types of packing).

Figure 9.1 Hierarchy of choices for the management of solid waste



Source: www.indicator.org.uk

When the dangers that threaten the environment are only potentially real despite and not real, the European Committee **applies the "beginning of precaution", that** is to say it proposes measures of protection if the danger appears real, even if it does not exist in scientific certainty. More specifically for the management of solid waste, this should be based on the following initiatives Fagerberg J.,Mowery C.D. edit (2005), Nelson R.R. 'The Oxford handbook of Innovation' OUP.

:

1) The beginning of prevention or even reduction of produced waste

The basic question in the prevention of the production of waste constitutes the estimate of repercussions from all stages of waste production such as from the export of raw materials, the treatment, transformation, transport and use. Up until today there does not exist - in a specific form – a method of analyses of the cycle of life for all different types of products, manufactures etc. Already decisions have been received that were formed by financing programs (e.g. LIFE), or the enactment of technical models, in the

frame of European Committee of Standardisation (CEN). In special cases the prevention can become possible by the restrictions or prohibitions of the use of concrete substances (e.g. heavy metals), so that is to anticipated the later stage of the creation of dangerous waste. Other ways of contribution in the prevention, are the programs of ecological controls, with parallel motives established or even distinctive economic institutions of the State or private sector (eco-label) and the encouragement of consumers to buy products that harm the environment the least.

2) The beginning of the re-use of materials.

It is primarily the responsibility of the producer, not only to limit the creation of waste (with prudent use of natural resources, renewable raw material and dangerous materials) but also to ensure the means for the creation of products that are facilitated for re-use and their renewal (Masini, E. 1993).

3) The beginning of recycling and exploitation of materials.

The retrieval of waste constitutes the core of its sustainable political management. This means that in the cases where its creation cannot be avoided, it must be reusable or they are submitted in processes of recuperation of materials. The basic process for the recuperation of materials begins with their segregation from the start. This requires the attention of the consumers and final users to become more sensitive for the need of the reduction of the production of waste. Important also is the condition this constitutes for the economic viability of the systems of recycling and the creation of markets for the products that will result.

4) The beginning of the reclamation of energy

In the cases where it is not possible to retrieve materials because of technical restrictions, the waste will be led with important thermal content to units of combustion a mining at the recuperation of energy, is sold finally only the fraction that is not able to be developed is sold.

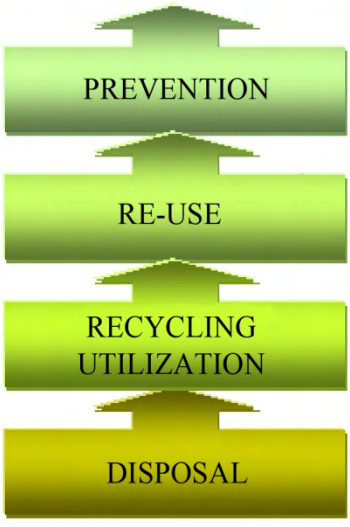
5) The beginning of safe disposal

The rejection of solid waste in areas of disposal has the largest repercussions on the environment and it ought to be selected as the utmost solution**.** It is an extensively used solution as it is the most economic solution, but the recent legislative provisions have a medium term aim to work out areas of disposal of the non retrievable and inactive waste.

9.5 OBJECTIVES OF GREECE FOR ITS ADAPTATION OF THE ENVIRONMENTAL POLICY OF THE E.U.

Today, the main support for the political management of urban solid waste in our country, is shaped in the agreement with the European Legislation and the modern scientific knowledge, and is determined hierarchically in the following way (www.europa.eu.int).

Figure 9.2: The 3s



Prevention of the production of waste

- new ways for production of products,
- the restriction of the use of dangerous substances, the reduction of consumption,
- the selective consumption for aiming at the reduction of waste that is intended for final disposal

Re-use of materials,

- where this is feasible

Source: http://www.recycling-guide.org.uk/rrr.html

In our country the process of recycling up until recently was put into practice on a limited scale, mainly in the business areas (specifically for the industrial area by-products – such as scraps, paper and glass) and initiatives of environmental organisations and sensitised social teams.

According to the requirements of Directive 99/31/EK as this was incorporated in the National policy:

- Up until July 16th 2010 the bio destructive urban waste that is intended for areas of sanitary burial should decrease itself to 75% of the total (at weight) quantity of bio destructive urban waste of that according to statistics that are available from EUROSTAT that had been produced in 1995 That means the waste should not exceed 1.950.000 tons.

- Up until July 16th 2013 the bio destructive urban waste that is intended for areas of sanitary burial should decrease itself to 50% of the total (at weight) quantity of urban waste that had been produced 1995. That means the waste should not exceed the 1.300.000 tons.

- Up until July 16th 2020 the bio destructive urban waste that is intended for areas of sanitary burial should decrease itself to 35% of total (at weight) quantity of urban waste that had been produced 1995. That means the waste should not exceed the 900.000 tons.

In order to achieve the objectives mentioned above, it will be assumed respectively, other methods of the management of solid waste will be applied.

CHAPTER 10

COMPETITION AND MARKETING

10.1 COMPETITIVE PRODUCTS

Today metal and plastic bins play a major role in the sector of waste collection mainly due to their low cost.

The capacity of the Metal bins of Waste 1100lt, the body is manufactured from galvanized sheet-metal and they are particularly durable when incorporated with arms for elevation and they do not require specific maintenance. They offer four wheels of the heavy type with the ability of rotation (Municipality of Larissa).

The plastic bins for mechanic collection of waste are manufactured in different sizes ranging from 660 until 1100 litres. The raw material of manufacture is polyethylene. It offers four wheels with the ability of rotation.

The system of underground collection of solid waste represents an alternative method against the traditional methods. The system of underground collection of solid waste is a more economic solution in comparison to the conventional methods of the collection of waste and has certain advantages, such as the saving of space and it being sanitary.

The largest advantage to the metal and plastic bins is their cost, for a plastic bin with the capacity of 1.000 litres the price is 250 in.

The basic disadvantages to these bins are:

- They remain open and usually overflow, causing an intolerable stench and dangers of contamination and of pollution.
- they lack in aesthetics and take up space, adding to the growth of the problem
- They have a short life span (10 years)
- the plastic bins have the potential to be destroyed by solar radiation, the abrupt changes of temperature and the chemical effects of the weather
- the metal bins are heavy in weight and are difficult to handle from the citizens and are emptied with difficulty
- moreover, they require emptying daily, which affects the functional cost of waste collection

The underground bins offer more advantages, such as:

- Due to the larger capacity of the bin, less frequent collection is required
- They subjected to distress, as they are placed permanently in the ground.
- The cost of maintenance is much lower.
- They require less waste truck visits, since less frequent collection is required, thus there is a lower consumption of fuel per waste truck.

They also however, have certain basic disadvantages:

- they require to be placed underground which involves a cost

- for this reason they are replaced with difficulty
- they have higher general costs
- For collection they require the use of crane or a waste truck equipped with a press and a hydraulic arm (small parrot).
- while the process of emptying requires less time, it is not leak-tight and the waste that remains for days creates problems of pollution and dangers to the public health

10.2 THE INNOVATION OF THE PRODUCT

According to the company, the uniqueness of product can be described in one sentence: "The modern Robotic bin for Waste Management is the product in the world market that alone faces radically the problem of the collection of waste compacting in the biggest possible economic cost of collection and providing the bigger added value".

A) It can receive various forms and dimensions and it is drawn with way in order that his exterior appearance - dimensions, form, colour, are adapted harmoniously in environment space.

Analytically:

The main trunk can receive for example the form a column when it is placed in archaeological spaces, as it shows Form 1.

This will have as result be the replacement of a common bin of waste with pleasant and a modern equipment of cleanness, and simultaneously being friendly to the environment.

There is also a possibility of receiving the form of bottle, e.g. a known beer or refreshment, which will constitute a large advertising projection for the particular companies (Picture 4).

With this way, the advertising companies appear in public as their product is presented on busy roads in 3D form and in dimensions of multiple in sizes, while simultaneously they

contribute in the big fight of for clean cities and for the safeguarding of public hygiene.

Source: www.soukosenvironmental.com

B) It offers large surfaces for advertising purposes, which Municipalities can rent to advertising companies.

Analytically:

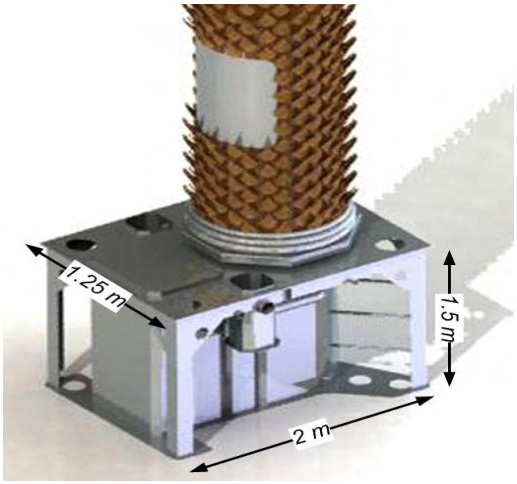
Knowing the importance and the value of advertising, these systems for the management of waste can also incorporate income in to the Municipalities or their holders. The available surfaces for advertising vary in sizes from 10 up to 20m2, without excluding other sizes, as it depends on dimensions of the system.

Also the modern system can bring luminous advertising to any area.

C) At the same time with its operation as a waste bin it can also be used as a lamp post.

With this way, is possible for the reduction of cost for the installation of a system of lighting or lamp post for each Municipality, as well as is achieving smaller aesthetic tax of space e.g. with the reduction of lamp posts.

D) It is easily and immediately installed in any area desirable and occupies minimal surface area for installation (1,30m2).



For the underground support base of the system an opening of 1.50 m in depth from the surface of installation is required.

- Placement and connection to a water supply, with an electrical network with a 220V current, connection with a sewage network and telephone line.
- The Station can be transported easily to another location with its base.

E) It allocates a large capacity for storage, which varies from 5 up to 10m3, not excluding other sizes, in comparison to the common mechanical bins of waste where their capacity is roughly 1m3.

Analytically:

The large storage capacity of this system has as a result the reduction of the piles of waste that is left outside of the bins on the sidewalks, in parks, in central squares, and public areas, etc. It also reduces the required amount of common mechanic bins of waste, and consequently, it creates pleasant picture of every city, where the waste and the bins for waste collection will not create hearths of pollution.

Also, the large storage space of the system decreases the frequency of the collection of waste which decreases the harmful effects of pollution from the frequent usage of waste trucks

F) Has a low maintenance cost and long life span

G) The operation of the automated robotic waste bin, via a central unit of control and handling.

Analytically:

The central unit of control and handling offers "on-line" notification to the Services responsible when the systems have filled and are ready for collection. This capability facilitates in particular the invoicing political for each Municipality, after all it becomes possible to determine the dues for cleanliness for specific users, so that the “polluting pays” approach can begin.

H) System for the Ecological and sanitary management of waste.

Specifically:

- The opening of the door for the disposal of waste is achieved automatically way via an approach detector. Thus no contact is required from the citizen with the system, and also provides easy operation for all age groups of citizens (children,

the elderly, and persons with special needs).

- Long term storage of the waste is possible inside the system, without creating environmental problems
- Odours and humid remains do not leak into the environment.
- The collection process takes place in a safe and sanitary way for all employees, as it is not required they come in contact with any waste from the system during the collection.
- After the collection is completed, the automatic washing takes place, cleansing the compartments of storage and compaction of the waste.
- Via the system of disinfection that is installed inside the system, disinfection is achieved of the compartments and also any waste left inside.
- It allocates provisions for the connection with sewers (sewerage), so that the fluid remains from the wash are removed from all compartments.

I) It possesses a system of automatic fire fighting and combustion for the safeguarding of safety the citizens from cases of fire.

- It offers a system of self-protection from vandalism. The placement of two cameras is possible to be installed to cover a small area of 10m2 around the bin on the surface. Their main role will be deterrent.

- In the case where a citizen disposes of a heavy object into internal bin, no obstruction is caused and there exists a possible way of notifying the persons responsible so that they can proceed with the removal of the object.

J) The robotic bin of waste management is suitable and as station of recycling of materials, contributing to the sensitive needs of citizens for recycling.

- It provides the possibility of bringing up to 4 compartments for the disposal and segregation of useful materials such as paper, glass, aluminium, batteries, plastic etc. With this attribute, the modern waste bin corresponds completely to the aim of K.Y.A. I.P. 29407/3508/2002 (the Reduction of bio destructive fractions of urban waste that is led for sanitary burial, according to the National Planning or

the Regional Planning's of Management Urban Solid Outcast), aiming at the better usage of waste (Institute of regional development (1996) –General Secretary of mainland (Regional innovation Strategies, Athens, Papazisis Editions).

10.3 MARKETS IN WHICH IT APPLIES

10.3.1 INTERNATION MARKET

This product is addressed mainly to the investors that will buy the rights (royalties) to exploit the patented product. The investors that can be Multinational companies, Banks, International Advertising companies and businessmen, and they will undertake the promotion and/or the manufacture, the management and the economic exploitation of the product, abroad. For the investors that will buy the rights of exploitation of product, their interest objectively will focus, on the possibility of the promotion of the product in the market providing that the financing analysis proves that a modern tool such as this investment has economic interest and the possibility of short damping The financial analysis that is presented in the 12 chapter, gives a clue of possibilities of exploitation of this product and financing results for investment, which concerns in a very small market as that of Greece. Next are proved the breadth and the enormous possibilities that will result, when the product is addressed in the world market.

This strategy of enterprise, it is addressed in the world market and in international investors, and constitutes a modern tool in the sector of marketing and the promotion of innovative products across borders, and in the frames of internationalised market. It is a strategy that the company successfully has applied guaranteeing in this way, international contacts not only in Europe but also on a World level.

10.3.2 ANALYSIS AND ELEMENTS OF MARKET

1. The immediate interested users of this product and potential customers are the following:

- Municipalities, Communities, or more generally Organisations of Local Self-government

- Hotels

- Super markets

- Hospitals

- Manufacturing Industries

- Companies

- Advertising companies and companies of communication of products

1.1 FINANCING ANALYSIS FOR THE MUNICIPALITIES

METHOD OF ANALYSIS

For the documentation of expediency of investment, that is to say the replacement of the conventional bins with the robotic bins becomes a comparison of the functional requirements between the conventional bins and the robotic bins.

The Method of economic analysis is based on the followings:

- For the comparison of conventional buckets with the robotic bins, begins with the reduction of the functional cost for each case, per 1 m3 of non compressed waste.
- The data that is used is based on studies and on the elements that were drawn from the Organisation of Local Self-government and concretely from the cleaning services of the Municipality Larissa

- Any divergence does not influence seriously the result, provided that this is on the one hand comparative and on the other hand is reduced in units (for example in m3 of litter)

COMPARISON OF THE FUNCTIONAL REQUIREMENTS OF COMMON WASTE BINS AND ROBOTIC BINS

Functional requirements

I. Data on the conventional bins

1. It is considered that a conventional bin, large in size (the common size in cities) has the capacity of 1.000 litres or 1 m3, (there also exists smaller bins with the capacity of 0,6 m3), for the needs of present study it will focus on the large size bins

2. a waste truck of a large size has the capacity of 16m3 litres and achieves compaction 1:5 (5 m3 non compacted – compacts to 1 m3)

3. In 8 hours, a waste truck, executes 2 routes* collecting roughly 150 bins (or 180 if they are not full), that contain 150 m3 litres of non compacted waste.

4. In the 8 hours, the waste truck requires 3 workers (1 driver and 2 workers), thus 24 man-hours

Table 10.1 Conventional Bins Requirements

m^3 of waste	**Bins**	**Waste truck routes*/day**	**Man-hours /day**
150	150	2	24
1	1	0,013	0,16

Source: http://www.ypeka.gr/

* Note: 1 route includes filling the waste truck, going to the landfill in order to empty and it returns, the time depends mainly from the distance of the land fill, or the transfer station.

II. Data on the robotic bins:

1. It is considered that a robotic bin has the capacity equivalent to 10 bins, that is to say 10.000 litres or 10 m3, that it means that 10 days are required in order for it to fill

2. With 2 waste truck routes each 10 days, they can empty 3 robotic bins or 30 m3 of waste (each waste truck has the capacity of 15 m3 of compressed waste). If for any reason for public health collection becomes every 5 days, that is to say half the capacity of the robotic bin, then the 2 waste truck routes, can empty double the robotic bins provided that they are not completely full, that is to say 6 robotic bins or 60 m3 of waste. Thus with a reduction to 0.4 routes/day

3. The personnel that is required is 3 workers (1 driver and 2 workers), however the time that is required for the 6 robotic bins is only 4 hours thus 12 man-hours, per 5 days (theoretically the process is much easier and is only one worker is required for the emptying). Thus a reduction of 2.4 man-hours per day

Table 10.2 Robotic Bins Requirements

m3 of waste	**Robotic Bins**	**Waste truck routes/day**	**Man-hours/day**
60	6	0,4	2,4 <>
1	0,1	0,0066	0,04 <>

Source: http://www.ypeka.gr/

In the next table the comparison of functional requirements of convectional bins and robotic systems is presented for each 1m3 of waste

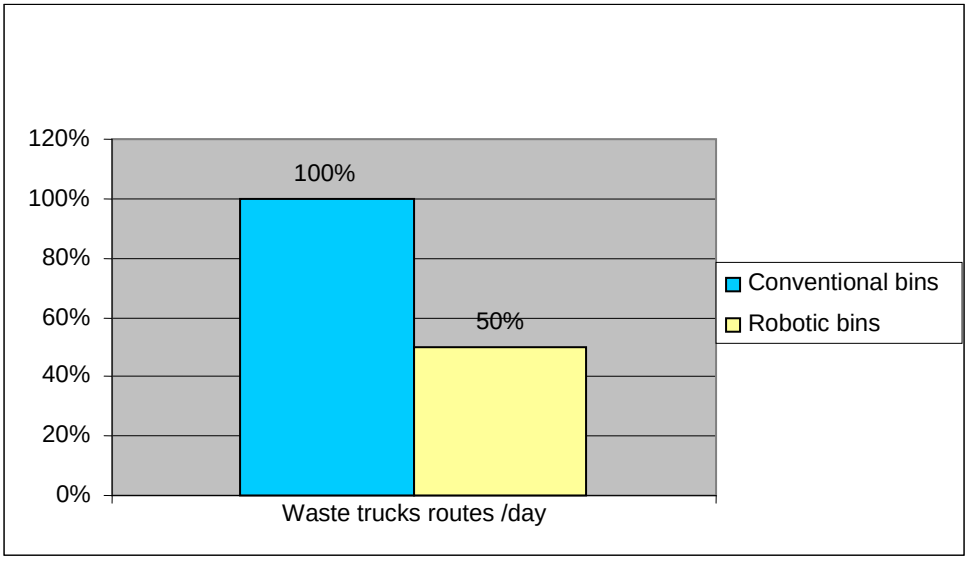
Table 10.3: Comparison of functional requirements of buckets-pylon

1m3 of waste	**Waste truck routes /day**	**Percentage**	**Man-hours/day**	**Percentage**
Conventional Bins	0,013	**100%**	0,16	**100%**
Robotic bins	0,0066	**50%**	0,04	**25%**

Source: http://www.ypeka.gr/

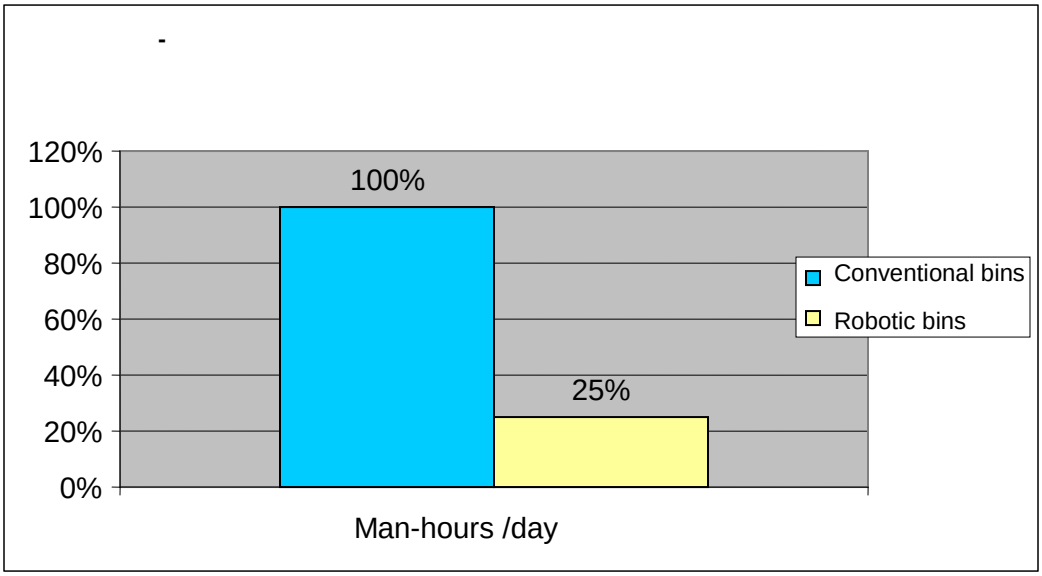
In the following diagrams the percentage difference between the functional requirements of conventional bins to - robotic bins is presented, with regards to the waste truck routes and with regards to the man-hours required

Figure 10.1: Comparison of the Percentage of functional requirements of the conventional bins-robotic bins, per route/day



Source: http://www.ypeka.gr/

Figure 10.2: Comparison of the Percentage of functional requirements of the conventional bins-robotic bind, per man-hours/day



Source: http://www.ypeka.gr/

Next the functional requirements of the robotic bins are reduced 50% with regards to in the waste truck routes and to 25% with regards to the working cost in comparison to the conventional bins. The comparisons that are of more concern above are the differences of the functional requirements of the conventional bins and the robotic bins for 1 m3 of waste. If these functional elements are discusses on a small sale, the economic profit is clear. From the elements that were reported in sec.3, each resident produces 430 kilos of waste annually or 1, 14 kilos/day. The density of the waste in the bins is 170-200 Kg/m3. As a result a typical city of 100.000 residents manages annually 41.000 tons waste or 250.000 m3.

If the possibility of commercial usage of the surfaces of the bins for advertising purposes also becomes an option, then it is obvious that the economic profits for the Municipalities are larger. This thus constitutes a larger advantage from the other environmental waste options, in order for this product to remain completely competitive, for the institutions of Local Self-government.

1.2 FINANCING OF INVESTMENTS OF MUNICIPALITIES

For the Municipalities that will decide against the large investment and provided that they face problem of waste, the can examine various alternative ways of financing, such as**:**

- Investment financing, with the grant for the commercial usage of advertising on the surfaces of the bins

- Plus-financing of the investment**,** lending with favourable terms and with concession of commercial exploitation of advertising on the surfaces of bins

In each case alternative ways can be determined, provided that a special business plan is defined with the policy of the company and the sale to the Municipalities.

2. Hotels - Archaeological areas

The hotels face a large problem with the collection and transport of their waste, with sacrificing sanitation hygiene and their aesthetic picture. The problem mainly focuses on the larger hotel units and in the tourist hotel units that are found on islands and in communities of extended municipalities, or because the bins and the frequency of collection do not suffice to cover the large capacity of waste, or because they are found in regions in which the Municipalities do not allocate the suitable infrastructure for fast and effective collection of waste. The same problem is also created in the archaeological / tourist areas of Greece that are numbered in hundreds and are found mainly far from the urban centres. The picture of overflowed bins and tossed waste, creates ugly picture, discredits the country and is finally non pleasant for the tourists. At the hotels and in the archaeological areas the placement of "the robotic bin of waste management", after

choosing an aesthetic form, would resolve the problem on the one hand because the system has ten times the capacity from the convectional waste bins and further does not require collection on a daily bases, on and on the other hand because it ensures the sanitary and environmental protection of space.

Moreover it adds multiple possibilities for its usage and function such a as means of advertising, as a means of lighting, or simply as a decorative means. The interest is focused on the 500 large hotel units that employ more than 20 persons and have a larger capacity (as shown on table 1B), but also on the thousands hotels on islands and removed tourist regions. If the archaeological areas that amount in the hundreds were included, the results would be a large enough big market for the disposal of the product.

Figure 10.3: Annual Statistical Of Business in the Tourism Sector (2005)

TABLE 1B: ANNUAL STATISTICAL ELEMENTS OF BUSINESSESS IN THE TOURISM SECTOR IN ORDER OF SIZE OF EMPLOYMENT 2002-2005

			YEAR			
SECTOR OF ECONOMIC ACTIVITY	VARIABLE	ORDER OF SIZE OF PERSONS EMPLOYED	2002	2003	2004	2005
HOTELS, , CAMPING GROUNDS, ANY OTHER ACCOMODATION LODGING BUSINESSES FOR A SMALL DURATION	11 11 NUMBER OF BUSINESSES	1	7.348	8.338	8.697	8.642
		2-9	8.677	8.623	7.444	7.786
		10-19	648	644	537	601
		20-49	233	211	245	322
		50-249	70	74	108	112
		250+	10	8	14	13
	TOTAL - 11 11 NUMBER OF BUSINESSES		**16.986**	**17.898**	**17.045**	**17.476**
	12 11 ANNUAL TURNOVER	1	192.181.228	226.003.974	248.964.331	305.058.974
		2-9	829.930.560	871.040.129	779.498.034	774.286.940
		10-19	348.353.506	362.941.843	332.449.285	356.014.327
		20-49	293.310.692	249.330.826	329.416.995	441.154.472
		50-249	331.343.655	350.810.683	516.279.325	552.983.881
		250+	233.544.088	161.239.182	311.532.399	298.223.257
	TOTAL - 12 11 ANNUAL TURNOVER		**2.228.663.729**	**2.221.366.637**	**2.518.140.369**	**2.727.721.851**
	12 15 FACTORS OF ADDED VALUE FOR COST PRICES OF PRODUCTION	1	106.428.052	116.480.807	118.395.034	162.421.385
		2-9	440.734.802	449.482.357	429.192.685	426.236.266
		10-19	211.271.842	215.228.634	180.484.219	198.360.546
		20-49	177.227.369	148.981.656	203.820.314	262.011.368
		50-249	203.999.320	212.090.432	320.492.138	333.404.754
		250+	158.395.475	101.441.377	218.604.482	182.853.377
	TOTAL - 12 15 FACTORS OF ADDED VALUE FOR COST PRICES OF PRODUCTION		**1.298.056.860**	**1.243.705.263**	**1.470.988.872**	**1.565.287.696**
	15 11 CRUDE INVESTMENTS OF MATERIAL GOODS	1	40.397.411	48.091.936	95.005.740	49.436.380
		2-9	126.041.448	117.664.633	151.022.105	252.977.636
		10-19	61.809.835	103.506.943	92.564.150	28.577.106
		20-49	56.321.447	61.667.258	56.418.106	108.820.724
		50-249	71.537.275	72.143.831	110.910.269	128.723.354
		250+	24.672.966	122.839.462	31.505.613	34.589.974
	TOTAL - 15 11 CRUDE INVESTMENTS OF MATERIAL GOODS		**380.780.382**	**525.914.063**	**537.425.983**	**603.125.174**
	16 11 NUMBER OF INDIVIDUALS EMPLOYED	1	5.953	6.570	6.942	6.438
		2-9	26.594	26.545	24.908	24.920
		10-19	8.184	8.418	7.304	8.055
		20-49	6.218	5.865	7.400	9.234
		50-249	6.474	7.038	10.195	10.451
		250+	3.992	3.266	5.318	5.171
	TOTAL - 16 11 NUMBER OF INDIVIDUALS EMPLOYED		**57.415**	**57.702**	**62.067**	**64.269**

Source: www.pox.gr

3. Department Store- Super market

In each big or small city, there are many Super markets or department stores. The problem of these stores mainly focuses on the daily accumulation of waste in large quantities and volume so that the conventional bins do not suffice. Moreover most waste is mainly packaging materials and by placing them in the conventional bins recycling is not achieved, since in most of the cities in Greece an organised sector of recycling has not been created. The Robotic bin of waste management, would resolve this problem, because on the one hand it has ten times the capacity from the conventional bins and can achieve complete recycling of all packaging (paper, plastic, glass etc), and on the other hand because it ensures the sanitation of the space. Moreover it adds many possibilities for the exploitation of its function, as a means of advertising, or as means of lighting.

If all department stores and super markets (mainly large multinational companies) are calculated in each city, the results are hundreds or even thousands of potential buyers suitable for the use this product. When the extension of networks is not enough in order to produce new turnovers, the super market enterprises are compelled to seek different methods of reinforcement of their income. One of most common one is though publicity.

For roughly the past two years the small retailer spends more of his available funds on publicity in the market attempting - and to a degree, achieving to convey the "battle of the prices" to the homes of the consumers, prompting them to buy, by taking into consideration the cheaper price. This is why most advertising messages are usually in the form of offers and gifts. This means that the publicity does not only constitute as an expense, but as an investment.

Lidl

It is important that last year the Lidl super market allocated 5, 2 million Euros for publicity, and their total annual expense was 5, 9 million Euros while the rest of programmed chalk-lines (0,7 millions of Euros) concerned first television spots.

Carrefour – Marinopoulos Super Market. This year the Carrefour - Marinopoulos Super Markets accent’s in their communication policy is the most expensive way in order to

convey their messages to its consumers. The cost of campaign was calculated between 3 and 4 million Euros, while the rest of the sum that will be spent this year in media will be proportional. The largest part of their advertising expense will be on television. Based on the 2004 statistics, 29.1% of Carrefour - Marinopoulos total expense went towards the media sector.

A. B. Basilopoulos

Constituting one of the larger organised players, it insists particularly on the electronic means to communicate with the public. The total of advertising expense amounted in the 1, 1 million of Euros, corresponded to the 7, 56% of total of advertising chalk-lines of thesector.

SUPER MARKET BEROPOYLOS

Around 2, 5 million Euros will be spent this year from the super market chain BEROPOYLOS on advertising mainly via radio and booklets. The strongest means of communication, the television, will only be selected exceptionally for the advertisement of possible offers in concrete time periods. However, the BEROPOYLOS communicates via the local media and booklets which in total absorb roughly the 40% of their annual expense. And in the mainland the main volume of capital will concern the radio communication. Regarding 2005, the chain threw its weight in the radio, spending a big part of the amount of 870.000 Euros allocated exclusively in media. BEROPOYLOS participated last year with 6, 19% in the total of advertising expense of sector.

4. Hospitals - Private Clinics

The hospitals public and private, as the private clinics constitute an important part of the market in which this product can be addressed. The problem of hospitals and clinics is that they accumulate waste in large quantities daily and thus the conventional bins do not suffice, resulting in consequences to public health. Excluding the hospitals infectious waste, the urban waste of hospitals and clinics can be faced effectively with the robotic bin. The market in this sector is large enough as shown in the following tables where the volume of the hospitals and clinics that are found in Attica, Thessaloniki and all over

Greece as communicated below. Moreover according to published facts there are 120 private clinics all across Greece. There are at least 300 hospital in which the company can present this product (www.infosociety.gr).

5. Manufacturing Companies and Industries

Most companies are either large multinational companies, or companies of local scope allocate large sums for their advertising. A large part of their advertising campaign includes posters and luminous signs. It is the said “Outdoor advertising”. It is forecasted that for the next years there will be an increase in advertising expenses, with regards to the **outdoor** or out of home advertising as they are named. In essence we have a rebirth of already existing traditional means which has elements an "alternative" type of communication that develops new technologies which are considered particularly "precise". The rate of increase of the advertising expense on the internet is expected to be the highest in comparison to the other means, but it is certain that immediately after the internet follows the outdoor advertising. All the companies could use the "robotic bin of waste management", for their advertising and proportionally with the same budget that is allocated for publicity; proceed in the corresponding investment for the bins of waste management. Moreover with the purchase and installation of the "robotic waste bin" in the Municipality, in which they belong, it will guarantee a space for advertising projection and the Municipal will also contribute to its social and environmental sensitivity, on the subject of the management of waste. The interest is focused on large companies, that the budget that allocates for advertising which can amount in hundreds of thousands of Euros. From statistics from market research the following companies allocate significant funds on advertising-such as:

- Mobile companies and telephone companies are indicatively reported COSMOTE, VODAFONE, WIND, FORTHNET, TELLAS, TELECOM, etc
- multinational companies of drinks, refreshments and foodstuffs, are indicatively reported Coca-cola, AMSTEL, HEINEKEN, IVI, AMITA, NESCAFE, etc
- Multinational and local tobacco industries, that at use the publicity of cigarettes, provided that is prohibited on television and radio publicity

MARLBORO, CAMEL. WINSTON, KARELIA,etc

- super markets, such as PRACTIKER, CARREFOUR, JUMBO, LIDL, BEROPOYLOS, BASILOSPOULOS, MARINOPOYLOS etc
- cars trade, are indicatively reported BMV, VW, HONDA, SEAT, FIAT, HUNDAI, KIA, FORD, etc
- chains of electronic and electrical shops, GERMAN, MULTIRAMA, E-shop, KOTSOBOLOS, etc
- chains of shops of furniture and equipment of home, are indicatively reported IKEA, SATO, NEOSET, BERLONI, BLACK AND WHITE, etc
- Banks
- Actuarial companies

6. Advertising companies and companies of communication of products

The Direct interest for the purchase and management of the product could, result directly from companies that undertake the advertising projection as advisers marketing. Since in each city are activated tens advertising companies, results a enough big potential market. These companies could invest for the purchase of robotic bins of waste management granting to them the corresponding Municipalities and exploiting the available surfaces, for the publicity of their customers, that as it was reported oscillates from 10 until 20m2 for the each station. The investment of each company will depend from its customers list and its budgets for advertising aims that it manages.

CHAPTER 11

FINANCIAL ANALYSIS OF INVESTMENT

FEASIBILITY/VIABILITY

11.1 INVESTING ORGANIZATION AND SCOPE OF INVESTMENT

The investing organization is SOUKOS ENVIRONMENTAL S.A., a subsidiary of SOUKOS ROBOTS S.A., of which SOUKOS ROBOTS S.A. owns 70% and the rest is owned by physical persons. We are going to use as an assumption a potential investment in a new centre of research, development and manufacturing of environmental applications. This case study can be used for any potential investor who is interested in buying the IP rights of the Robotic Waste Bin and exploit the product.

11.2 INVESTMENT COST

The Total Investment will be €6 million and is broken down as follows:

Table 11.1 Investment Cost

BUILDINGS - FIXTURES	3.500.000
MECHANICAL EQUIPMENT	2.000.000
TRANSPORT EQUIPMENT	500.000
TOTAL	6.000.000

THE FINANCING PLAN IS AS FOLLOWS:

TABLE 11.2 FINANCIAL PLANS

EQUITY CAPITAL	3.000.000
LOANS	3.000.000
TOTAL	6.000.000

Source: Own elaboration

In this plan, the possibility of funding the investment from Development Programs has not been estimated. The subsidy would cover at least 40% of the cost and is totally feasible, and reduce borrowing requirements.

11.3 TURNOVER PROVISIONS

SALES – PRICING POLICY

The scope of the company includes promoting other systems with environmental applications, already in the design phase, but in this plan income relates only to robotic bin sales. In this plan, the course of sales in the first six years of operation of the unit is recorded. Robotic bin sales involve mainly the local market as analyzed in the previous unit. Naturally, we can assume that part of the bins also addresses the foreign market or at least the Balkan market.

Selling price is considered fixed at 35.000,00€ for the basic model of the product. So, expenses (raw material, employee compensation etc.) are also considered fixed and without index adjustments. The production capacity of the unit will reach 600-700 items annually. The unit will operate in two shifts. If the demand increases, subcontractors will be commissioned to manufacture parts of the product.

It is worth-noting that: In sales, the main income is not recorded because in this stage it is hard to estimate it in total. This income will derive from achieving the company's strategic goal, i.e. product royalties paid by investors who will market the product in the global market

INCOME FROM MARKETING ADVERTISING SURFACES

Robotic bins can yield additional income from the marketing of advertisements on their surfaces. Based on data collected after a market research in outdoor advertising rates, rates range from €700 to €1500 fortnightly. The variation depends on the city and the place of the advertising media. In large cities (Athens – Thessaloniki) and in central places, rates can excess €1800/fortnight.

In this plan, this income is examined in the light of the most adverse conditions, namely:

- Income from advertising amounts to €700/month, reaching €8.400/year (submultiples of current market prices) for each robotic bin.
- Not all robotic bins are exploited as advertising surfaces either because marketing is granted to the customer or because they are placed in areas where there is no demand for such a service. In sales provision the estimate is to have operating income only from 25% of the robotic bins.
- The operating time horizon for the bins sold is at least 6 years.

Consequently, turnover for the first six years of operation of the unit is as follows:

<See table 11.3, Appendix A>

11.4 PERSONNEL EXPENSES BREAKDOWN

To operate the unit a 72-employee personnel in total is estimated to be required for the first year gradually increasing to 116 employees. The facilities will operate in two or even three shifts, if necessary.

In the following table monthly employee compensations, the annual cost per job and the course of staffing the Company in the first six years of operation are presented. The assumptions taken into account to estimate cost are illustrated in the Table 11.4 and Table

11.5 in Appendix A. Payroll cost has been estimated based on the current free labor market and the specializations available.

11.5 SALES COST BREAKDOWN

RAW MATERIAL EXPENSES – VARIABLE EXPENDITURE

Raw material and automation system costs amount to €23.000 per robotic bin.

Indirect material cost amounts to €500 per robotic bin.

Bin (those marketed for advertising purposes) maintenance amounts to €1.400 annually per robotic bin for labor costs and €900-€1200 annually per robotic bin for spare parts. Therefore, maintenance amounts to €2.500-€2.800 annually per robotic bin in total.

OPERATING COSTS OF THE UNIT

In operating costs the following have been included:

- Power supply with the assumption of 280 -380 KVA power installed and 1.200.000 -1.600.000 Kwh energy consumption annually for both shifts with the latter to increase scalarly and correspondingly to production increase.
- Oil has been calculated partly in the operating expenses (for heating, transport equipment, generators, reach trucks) and partly in selling expenses in the income statement.
- Maintenance costs have been calculated on the provision that new machinery will be installed, and, therefore, will increase after a three-year period.
- Consumables required for production.
- Spare parts for maintaining mechanical equipment.
- Charges for outside services involve mainly subcontracting services which burden the product with €4.000-€5.000 per bin in addition to raw material costs.
- Other expenses include fixed asset insurance expenses, product insurance, telecommunications, promotion costs, travel expenses, legal services,

industrial water, security and environment protection expenses, staff nutrition expenses, municipal taxes and duties etc.

Based on the above the Total Sales Cost is illustrated in Table 11.6, Appendix A.

11.6 FINANCIAL EXPENSES

LOANS

Financing the investment is expected to derive by 50% from equity capital, that is €3.000.000, and by 50% from bank loan, that is €3.000.000. We take into account that it will be a five-year loan, and assume that the interest rate is 7,50% for those five years and that debt service will take the form of six-month installments.

In the table 11.6.1 and 11.6.2, Appendix A, the borrowing terms and amortization installments for the payment of the loan are illustrated.

11.7 OPERATING RESULTS

In table 11.7.1, Appendix A the expected income statement of the Company and financial indices for the first six-year period of operation are presented.

11.8 WORKING CAPITAL ESTIMATE

Calculating the working capital has been based on the following assumptions. According to data from the operation of the company, it is estimated that raw material inventories should be kept to cover approximately 9 production days and semi-finished product inventories to meet order-related needs. With respect to credit to customers, it is approximately 3 months long whereas credits from suppliers are approximately 2 months long. Taking into account the above assumptions, it is estimated that the working capital

required for the first year of operation is approximately €4.720.000.See table 11.8.1 and 11.8.2 in Appendix A.

11.9 FINANCIAL INDICES - CHARTS

<See Table: 11.9.1 Appendix A>

<See Table: 11.9.2 Appendix A>

<See Table: 11.9.3 Appendix A>

11.10 INVESTMENT EVALUATION

11.10.01 INVESTMENT EVALUATION METHODS – CAPITAL COST

The main and widely used methods to evaluate investments are namely:

Net Present Value – NPV method

It is one of the methods that are recorded as Discounted Cash Flow – DCF. Evaluation with this method is based on a simple but fundamental principle that an investment is worth making when the yield for the investor is more than the amount to be invested.

To measure the net current value of an investment scheme initially all cash flows are calculated either positive, income, or negative, expenses incurred from that investment. Those cash flows are generated in future time spans, and this makes them non-comparable directly due to the time value of money.

With the method of discounted cash flows, cash flows are “transferred” to the same time span (specifically, to the time of investment initiation) so that they are made comparable. The sum of the present (i.e. discounted) value of all cash flows, both positive and negative (income – expenses), constitutes the net present value of the investment scheme, which can be either positive or negative.

So, the criterion provided by this method is: Acceptance of an investment scheme if there is a positive net present value that is if the discounted cash flow of its income is higher than that of expenses. An important parameter to determine net present value is the discount interest rate used during discounted cash flows. This is selected depending on the viewpoint of evaluation. So in the case where the question is to find the impact of

the investment on the net worth of the company in the form of discount interest rate, the cost of corporate capital is used, which in general terms is the return on equity required from the company by the shareholders, with a specified business risk. If the question is to find the impact of an investment on the total worth of the company, then the weighted average cost of capital – WACC is used as a discount interest rate. This weighted average cost comes from weighting the individual cost of each of the categories of corporate capital suppliers (net worth - shareholders and lenders) and the proportion they account for in the capital structure of the company.

Internal Rate of Return – IRR method

It is also one of the methods mentioned above (DCF). The internal rate of return on investment is defined as the discount interest rate whose use makes the net present value equal zero (NPV = 0) in order to discount all cash flows of the scheme. So, the criterion provided by this method is: Acceptance of an investment scheme when the internal rate of return is higher than the least required return determined by the investor (that is, higher than capital cost). In addition to the conventional approach, there is a variation of this method called modified internal rate of return, which compensates for the basic drawback of this method. This drawback stems from its silent internal hypothesis that all positive in between cash flows of the scheme are reinvested at a rate of return equal to the internal return rate on a specific investment. This, in cases of schemes presenting particularly positive internal rates of return, can lead to clear overestimate of the real rate of return.

Capital cost – Discount interest rate

To discount cash flows, as previously mentioned, the capital cost is used which is in fact the return on investment required by the investor. It is widely known that what determines the amount of the return required is the level of business risk of a particular investment. So what needs to be determined is the level of risk and the return expected for that level of risk. The relation between risk and return required is illustrated in the capital asset pricing model – CAPM:

Return required = Risk free rate + β * Risk premium

Where

Risk premium = Market rate of return – Risk-free rate of return

11.10.02 ESTIMATE OF INTERNAL RATE OF RETURN AND NET PRESENT VALUE

For this plan, the net present value has been determined on the assumption that it is a 6-year investment plan, taking into consideration the residual value in the end of this period. To calculate the net present value cash flows of the first 6-year operating period of the company have been calculated, for which there are analytic projections. The relevant calculations are illustrated in TABLE. 11.10.2 In Appendix A.The net present value has been calculated as the sum of the present value of all cash flows in the first 6 years (including initial investment cost) plus a residual value emerging from recovering the working capital and from the outcome of disposing the fixed assets constrained by the investment. In the above calculations, income from fixed assets disposed is considered to be 15% of the cost value of the total equipment. To discount cash flows a 13% discount interest rate was used, as previously calculated.

According to the Table 11.10.2 in Appendix A and taking into account the criteria of the net present value (NPV) which is positive, and the internal return rate which has been illustrated to be 49, 5%, the investment is deemed totally advisable. The net present value is also positive, i.e. inflows in the five-year period cover the initial investment cost and the internal return rate is much higher than capital cost (13%).

Furthermore, the company will be capable of serving its debt liabilities (amortization) with ease, as proved in the TABLE 11.10.02, Appendix A of net cash flows.

11.10.03 DISCOUNTED PAYBACK TIME

Based on the discounted cash flows, discounted payback time has been estimated 3 years (Figure 11.10.3, Appendix A).

11.10.04 BREAK EVEN POINT OF OPERATION

A sensitivity analysis addresses those parameters or assumptions which in case of modification can cause important changes in the results of the plan. In this context, a breakeven point analysis has been conducted, i.e. an analysis of the point of sales where the Company makes no profits but has no losses either.

In Table 11.10.04, Appendix A the breakeven point of the company is illustrated in items of products produced in every year of operation. The breakeven point of operation lags far behind the expected turnover for each year of operation. Expected sales are 140% in average exceeding the breakeven point.Therefore, achieving expected income goals ensures easy payment of the long- and short-term borrowing liabilities of the company**.**

11.11 INVESTIGATION OF VIABILITY UNDER ADVERSE CONDITIONS

Scenario 2

The investment should be examined under the most adverse conditions.

The assumptions involve sales and actually constitute the worst case scenario. In this scenario, it is assumed that robotic bins sales are much lower than market potential which has been presented in detail, and account for only 25% of sales illustrated in the plan.

11.11.1 TURNOVER PROVISIONS

PRICING POLICY

Product price is the same, i.e. € 35.000.

INCOME FROM MARKETING ADVERTISING SURFACES

Robotic bins can yield additional income from the marketing of advertisements on their surfaces.

Provisions are based on the following assumptions:

- Income from advertising amounts to €700/month (submultiples of current market prices) for each robotic bin.
- Not all robotic bins are marketed for advertising purposes – only ¼ of goods sold, either because there is no such agreement with the customer or because they are placed in areas where there is no demand for such service.
- The operating time horizon for the bins sold is at least 6 years.

Consequently, turnover for the first six years of operation of the unit is analyzed on table 11.11.1, Appendix A.

11.11.2 PERSONNEL EXPENSES BREAKDOWN

To operate the unit a 21-employee personnel in total is estimated to be required in the first year gradually increasing to 48 people in the sixth year, since only one shift will be required due to low sales. In the following table monthly employee compensations, the annual cost per job and the course of staffing the Company in the first six years of operation are presented. The assumptions taken into account to estimate cost are illustrated in table 11.11.2 and 11.11.3, Appendix A. Payroll cost has been estimated based on the current free labor market and the specializations available.

11.11.3 SALES COST BREAKDOWN

RAW MATERIAL EXPENSES – VARIABLE EXPENDITURE

Raw material and automation system costs amount to **€23.000**.

Bin maintenance (provided it is included in the sales agreement and is a contractual obligation) amounts to €1.200 annually for labor costs.

OPERATING COSTS OF THE UNIT

In operating costs the following have been included:

- Power supply with the assumption of 250 -350 KVA power installed and 530,000 -900,000 Kwh energy consumption to increase scalarly and correspondingly to production increase
- Oil has been calculated partly in the operating expenses (for heating, transport equipment, generators, and reach trucks) and partly in selling expenses in the income statement.
- Maintenance costs have been calculated on the provision that new machinery will be installed
- Consumables required for production.
- Spare parts for maintaining mechanical equipment and the bins.
- Other expenses include fixed assets insurance expenses, product insurance, telecommunications, industrial water, security expenses, staff nutrition expenses, municipal taxes and duties etc.

Based on the above the total sales cost is illustrated in table 11.11.4, Appendix A.

11.11.4 FINANCIAL EXPENSES

Financing the investment is expected to derive by 36% from equity capital, that is €2.000.000, and by 64% from bank loan, that is €3.500.000. We take into account that it will be a five-year loan, and assume that the interest rate will be 7, 75% for those five years and that debt service will take the form of six-month installments.

In table 11.11.5 and 11.5.6, Appendix A the borrowing terms and amortization installments for the payment of the loan are illustrated.

11.11.5 INCOME STATEMENT ACCOUNTS

In table 11.11.7, Appendix A the expected income statement of the Company and financial indices for the first six-year period of operation are presented.

11.11.6 WORKING CAPITAL ESTIMATE

Calculating the working capital has been based on the following assumptions. According to data from the operation of the company, it is estimated that raw material inventories should be kept to cover approximately 9 production days and semi-finished product inventories to meet order-related needs. With respect to credit to customers, it is approximately 3 months long whereas credits from suppliers are approximately 2 months long.

Taking into account the above assumptions, it is estimated that the working capital required for the first year of operation is approximately €1.046.000**.**See table 11.11.8, 11.11.9 & 11.11.10 Appendix A.

11.11.7 ESTIMATE OF INTERNAL RATE OF RETURN AND NET PRESENT VALUE

For the sake of this plan, the net present value has been determined on the assumption that it is a 6-year investment plan, taking into consideration the residual value in the end of this period. To calculate the net present value cash flows of the first 5-year

operating period of the company have been calculated, for which there are analytic provisions. The related calculations are illustrated in TABLE 11.11.11, Appendix A. The net present value has been calculated as the sum of the present value of all cash flows in the first 6 years (including initial investment cost) plus a residual value emerging from recovering the working capital and from the outcome of disposing the fixed assets constrained by the investment. In the above calculations, income from fixed assets disposed is considered to be 15% of the cost value of the total equipment. To discount cash flows a 13% discount interest rate was used, as previously calculated.

According to TABLE 11.11.11, Appendix A and taking into account the criteria of the net present value (NPV) which is positive, and the internal return rate which has been illustrated to be 25,70%, the investment is deemed advisable. The net present value is also positive, i.e inflows in the five-year period cover the initial investment cost and the internal return rate is much higher than capital cost (13%). Furthermore, the company will be capable of serving its debt liabilities (amortization) with ease, as proved in the Table of net cash flows.

11.11.8 DISCOUNTED PAYBACK TIME

Based on the discounted cash flows, discounted payback time has been estimated 5 years (Figure 11.11.12,Appendix A)

CHAPTER 12
CONCLUSIONS

Both cases examined prove that the investment, even the one made under adverse conditions, evaluated with the main evaluation methods are deemed totally sustainable, since the net present value is positive even when applying a higher discount interest rate. Combined the theoretical approach and the case study of this dissertation, the basic objective of the dissertation is answered. It can be concluded that investing in R&D, a company operated in a moderate innovator country can develop high innovative applications, which could provide viable solutions to regional problems such as waste management.

The internal rate of return, which in the first scenario is 49.25% and in the second scenario 25.70% is much higher than capital cost. The receipt period of equity invested is estimated to be in the first scenario 3 years and in the second scenario 5 years. The breakeven point lags far behind the expected turnover. Finally, with respect to possible repayment of borrowing liabilities as is concluded by the annual cash flows plan and taking into account that the breakeven point of each year lags far behind the expected turnover, it is estimated that the company will be capable of repaying its liabilities, based on the assumptions of this plan.

In the event that the investment is funded - and there is such possibility of subsidizing the investment through Development Programs (L.3299/2004) or Innovation Programs by 40% - borrowing requirements would decrease and results would be even more favorable. In the financial analysis the main income generated from achieving the company's strategic goal, i.e. royalties paid by investors who will market the product in the global market, has not been examined. In respect to the investors who are interested in buying royalties this financial analysis has proved that such an investment is financially feasible and offers the possibility of short-term amortization. Consequently, based on all the above, it is clear that this is not just an occasional investment but a strategic investment with global dimensions.

The present dissertation focused on five dynamic capabilities considered to be important in a networked regional innovation environment: (i) innovative capability, (ii)

learning capability, (iii) networking capability, (iv) leadership capability and (v) visionary capability. Also it is emphasized the interactive nature of the innovation process. Innovation is often a consequence of many kinds of learning processes embedded in various ordinary economic and social activities and, therefore, interaction seems to be crucial in promoting innovations. Future innovation policies should place more emphasis on the nature of these interaction processes than the old science and technology policies have done.

The demand for new innovation policies and strategies has been clear and widely accepted. It is, however, far from clear what kind of practical form these new policy applications should take. The regional policy-makers have been lacking practical step-to-step methods in reforming regional innovation environments in order to respond better to the demands of the new techno-economic paradigm.

DISCUSSION- AND FURTHER RESEARCH

Technology refers to scientific knowledge application results, aiming to create a practical object. At times, it refers to the methodology characterizing such a process. In recent times, there is a tendency to associate technology exclusively to high tech or informatics technology, even though it is not limited to these fields only.

Innovation covers a wide range and deals with knowledge and the tools and techniques usage. Technology has contributed in the development of state of the art economies and has enabled the "rise of a class with free time". Many technological processes produce waste, by polluting or exhausting natural environmental resources. New technology often raises new ethical questions. Nowadays there is no doubt whether man has conquered nature, but there is a doubt as to how much remaining to be conquered via technological progress.

In this dissertation we try to match the theoretical platform with a case study developed absolutely in Greece. It is very important for the Greek government to understand how innovation can be adapted to Greek business reality and finance business plans like the above presented. Several patents like the Robotic Waste Bin, developed in Greece, are sold in the global market for a small fee and low royalty rates and then we

import them from Germany or China as final products. Greece should take advantage of circumstances in order to move on the restructuring of the industrial sector and the development of small innovative cells.

The complex character of regional innovation systems makes the research of them a very challenging task. The research should combine theories and methods from many different disciplines. The interdisciplinarity is, thus, the dominating character in the research in this field. This present study has revealed the necessity of asking at least the following questions in the future research. What really are the regional dynamic capabilities? The characteristics of the dynamic capabilities in a regional context must be analyzed more thoroughly. They must be analyzed with more varied data. What is the role of regional innovation networks in the aggregate system of innovations? The significance of regional innovation networks should be thoroughly analyzed as part of regional, national, supra-national and sect oral innovation systems.

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APPENDIX A

TABLE 11.3 TURNOVER PROVISION FOR THE INVESTOR

	1st year	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
Robotic bin selling price	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00
Sales volume in pieces	500	700	900	1.000	1.000	1.000
TOTAL A	**17.500.000**	**24.500.000**	**31.500.000**	**35.000.000**	**35.000.000**	**35.000.000**
Annual advertising-related income for each bin	**8.400**	**8.400**	**8.400**	**8.400**	**8.400**	**8.400**
Quantity of bins marketed	250	500	700	800	1.000	1.200
TOTAL B	**2.100.000**	**4.200.000**	**5.880.000**	**6.720.000**	**8.400.000**	**10.080.000**
Turnover	**19.600.000**	**28.700.000**	**37.380.000**	**41.720.000**	**43.400.000**	**45.080.000**

Source: Own elaboration

Table 11.4 Assumptions of personnel cost estimate

Assumptions of personnel cost estimate		
S/N	Description	
1	Monthly salaries per year	14
2	Employer contributions	29,00%

Source: Own elaboration

TABLE 11.5: PERSONNEL COSTS

			1st year		**2nd year**		**3rd year**		**4th year**		**5th year**		**6th year**	
S/N	**Job description**	**compensation** *(gross pay)*	number	**Annual cost**	number	**Annual cost**	number	Annual cost	number	**Annual cost**	number	Annual cost	number	Annual cost
1	**Technical Manager**	**2.860**	**1**	**51.652**	**1**	**51.652**	**1**	**51.652**	**1**	**51.652**	**1**	**51.652**	**1**	**51.652**
2	**Financial Manager**	**2.750**	**1**	**49.665**	**1**	**49.665**	**1**	**49.665**	**1**	**49.665**	**1**	**49.665**	**1**	**49.665**
3	**Sales**	**2.850**	**1**	**51.47**	**1**	**51.47**	**1**	**51.47**	**1**	**51.47**	**1**	**51.47**	**1**	**51.47**

	Manager			**1**		**1**		**1**		**1**		**1**		**1**
4	**Engineers**	1850	5	**167.055**	6	**200.466**	6	**200.466**	**8**	**267.288**	**8**	**267.288**	**8**	**267.288**
5	**Office employees**	**840**	**2**	**30.341**	**2**	**30.341**	3	**45.511**	3	**45.511**	**3**	**45.511**	**3**	**45.511**
6	**Accountant**	**1.550**	**1**	**27.993**	**1**	**27.993**	1	**27.993**	1	**27.993**	**1**	**27.993**	**1**	**27.993**
7	**Assistant accountant**	**840**	**1**	**15.170**	**1**	**15.170**	2	**30.341**	2	**30.341**	**2**	**30.341**	**2**	**30.341**
8	**Sales persons**	**1.350**	**3**	**73.143**	**3**	**73.143**	3	**73.143**	3	**73.143**	**3**	**73.143**	**3**	**73.143**
9	**Foremen**	**1.560**	**2**	**56.347**	**2**	**56.347**	3	**84.521**	3	**84.521**	**3**	**84.521**	**3**	**84.521**
10	**Electrical engineers - Electricians**	1.080	10	**195.048**	**13**	**253.562**	14	**273.067**	14	**273.067**	**14**	**273.067**	**14**	**273.067**
11	**Designers**	850	2	**30.702**	**3**	**46.053**	3	**46.053**	3	**46.053**	**3**	**46.053**	**3**	**46.053**
12	**Technicians**	**980**	**19**	**336.277**	**24**	**424.771**	26	**460.169**	28	**495.566**	**28**	**495.566**	**28**	**495.566**
13	**Welders**	**1.080**	**3**	**58.514**	**4**	**78.019**	5	**97.524**	5	**97.524**	**5**	**97.524**	**5**	**97.524**

14	**Maintenance staff – Service**	**950**	**8**	**137.256**	**11**	**188.727**	17	**291.669**	20	**343.140**	**23**	**394.611**	**24**	**411.768**
15	**Assembling staff**	**950**	**12**	**205.884**	**15**	**257.355**	17	**291.669**	18	**308.826**	**18**	**308.826**	**18**	**308.826**
16	**Security guards**	**750**	**1**	**13.545**	**1**	**13.545**	1	**13.545**	1	**13.545**	**1**	**13.545**	**1**	**13.545**
	Total annual personnel costs		**72**	**1.500.064**	**89**	**1.818.281**	**104**	**2.088.458**	**112**	**2.259.306**	**115**	**2.310.777**	**116**	**2.327.934**
	Total production personnel costs		60	1.106.717	76	1.391.523	89	1.631.360	95	1.735.385	98	1.786.856	99	1.804.013
	Total administrative personnel costs		12	393.347	13	426.758	15	457.099	17	523.921	17	523.921	17	523.921

Source: Own elaboration

TABLE 11.6 TOTAL SALES COST

Sales cost	**1st year**	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
Raw material	11.500.000	16.100.000	20.700.000	23.000.000	23.000.000	23.000.000
Indirect material	150.000	280.000	360.000	450.000	450.000	450.000
Power supply of facilities	88.704	95.040	110.880	120.384	120.384	126.403
Fuel for facilities (less disposal)	50.000	70.000	91.000	109.200	131.040	163.800
Production personnel	1.106.717	1.391.523	1.631.360	1.735.385	1.786.856	1.804.013
Administrative personnel	393.347	426.758	457.099	523.921	523.921	523.921
Facilities equipment maintenance	70.000	98.000	140.000	175.000	280.000	490.000
Spare parts for facilities maintenance	30.000	54.000	60.000	75.000	150.000	240.000
Bin maintenance	250.000	700.000	980.000	1.120.000	1.600.000	2.100.000
Bin maintenance spare parts	150.000	350.000	560.000	720.000	1.200.000	1.500.000
Charges for outside services (subcontractors)	350.000	950.000	1.620.000	1.800.000	1.800.000	1.800.000

Industrial water	3.000	4.200	4.800	5.400	6.900	7.590
Fixed asset insurance	12.000	21.600	24.000	28.800	30.000	31.200
Product insurance	30.000	54.000	60.000	78.000	78.000	79.950
Legal services	17.000	20.400	23.800	30.600	34.000	37.400
Security expenses	6.000	9.000	10.200	10.800	10.800	11.232
Cleaning service expenses	8.000	8.000	8.000	8.000	8.000	8.480
Municipal taxes & duties	8.000	11.200	12.000	14.400	14.400	15.120
Staff nutrition	36.960	42.240	50.160	52.800	52.800	52.800
Environmental protection expenses	2.000	4.000	4.000	4.800	6.240	9.360
Other expenses (telecommunications, promotion-related costs, travel expenses etc.)	150.000	345.000	465.000	525.000	570.000	627.000
Total	**14.411.728**	**21.034.961**	**27.372.298**	**30.587.490**	**31.853.341**	**33.078.269**

Source: Own elaboration

Table 11.6.1 Borrowing Terms

Amount of loan	**3.000.000**
Interest rate	**7, 50%**
Loan duration	**5 years**

Source: Own elaboration

Table 11.6.2 Loan Analysis

Loan analysis in six-month periods	**1st six-month period**	**2nd six-month period**	**3rd six-month period**	**4th six-month period**	**5th six-month period**	**6th six-month period**	**7th six-month period**	**8th six-month period**	**9th six-month period**	**10th six-month period**
Capital subscribed	**2.747.216**	**2.484.953**	**2.212.854**	**1.930.552**	**1.637.664**	**1.333.792**	**1.018.525**	**691.436**	**352.081**	**0**
Amortization installment	252.784	262.263	272.098	282.302	292.888	303.872	315.267	327.089	339.355	352.081

Interests	**112.500**	**103.021**	**93.186**	**82.982**	**72.396**	**61.412**	**50.017**	**38.195**	**25.929**	**13.203**
Amoritzation	365.284	365.284	365.284	365.284	365.284	365.284	365.284	365.284	365.284	365.284

Source: Own elaboration

TABLE 11.7.1 OPERATING RESULTS

	1st year	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
TOTAL TURNOVER	19.600.000	28.700.000	37.380.000	41.720.000	43.400.000	45.080.000
Less: Cost of goods sold	14.411.728	21.034.961	27.372.298	30.587.490	31.853.341	33.078.269
GROSS TRADING PROFIT	5.188.272	7.665.039	10.007.702	11.132.510	11.546.659	12.001.731
Less: Administrative expenses	600.000	960.000	1.320.000	1.500.000	1.680.000	1.800.000
Less: Selling expenses	1.000.000	1.470.000	1.890.000	2.100.000	2.100.000	2.100.000
Less: Research and development	50.000	75.000	90.000	110.000	115.000	140.000

expenses						
Less: Taxes & duties (except for income tax).	15.000	18.000	21.000	24.000	27.000	27.750
OPERATING RESULTS BEFORE FINANCIAL TRANSACTIONS	3.623.272	5.292.039	6.866.702	7.618.510	7.854.659	8.213.981
OPERATING RESULTS BEFORE INTEREST, TAX & DEPRECIATION	3.623.272	5.292.039	6.866.702	7.618.510	7.854.659	8.213.981
Less: Interest of long-term investment loans	215.521	176.168	133.808	88.212	39.132	0
Less: Interest of short-term investment loans	283.299	406.934	527.127	586.758	599.300	612.251
OPERATING RESULTS BEFORE TAX & DEPRECIATION	3.124.452	4.708.938	6.205.766	6.943.540	7.216.227	7.601.730
Less: Depreciation	487.500	487.500	487.500	487.500	487.500	487.500

(total)**						
INCOME BEFORE TAX	2.636.952	4.221.438	5.718.266	6.456.040	6.728.727	7.114.230
Less: Income tax***	659.238	1.055.359	1.429.567	1.614.010	1.682.182	1.778.558
NET INCOME	**1.977.714**	**3.166.078**	**4.288.700**	**4.842.030**	**5.046.545**	**5.335.673**

Source: Own elaboration

* Interests of short-term loans refer to short-term loans as working capital.

** depreciations have been calculated with the method of fixed asset depreciation, a small residual value and a coefficient of 10% for mechanical equipment, 5% for buildings and fixtures, and 15% for transport equipment

***income tax has been calculated with a 25% coefficient.

TABLE 11.8.1 ASSUMPTIONS

S/N	Description	Assumptions
1	Credit to customers	90 days
2	Raw material inventories	9 days
3	Semi-finished product inventories	90 days

4	Credits from suppliers	60 days

Source: Own elaboration

TABLE 11.8.2 WORKING CAPITAL ESTIMATE

Description	**1st year**	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
Inventories	**2.223.611**	**3.113.056**	**4.002.500**	**4.447.222**	**4.447.222**	**4.447.222**
Credit to customers	**4.900.000**	**7.175.000**	**9.345.000**	**10.430.000**	**10.850.000**	**11.270.000**
Credits from suppliers	**2.401.955**	**3.505.827**	**4.562.050**	**5.097.915**	**5.308.890**	**5.513.045**
Working capital (less disposables)	**4.721.657**	**6.782.229**	**8.785.450**	**9.779.307**	**9.988.332**	**10.204.177**
Annual working capital variation	2.060.572	2.003.222	993.857	209.025	209.025	215.845

Source: Own elaboration

Table: 11.9.1 Performance indices

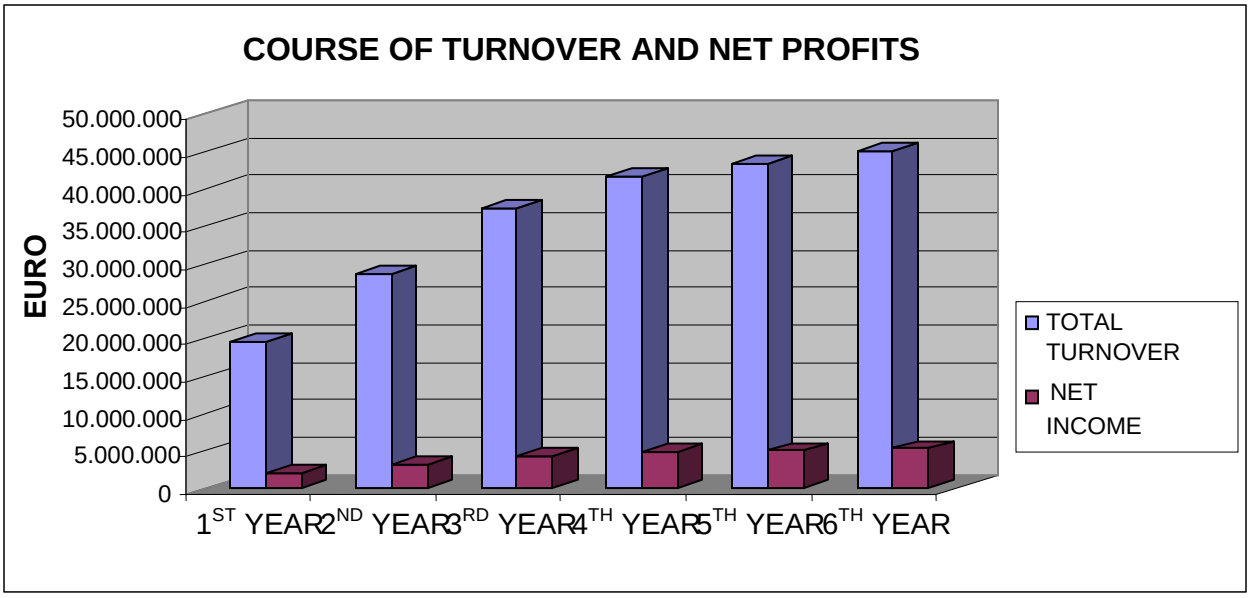
Gross profit margin	Gross profits / Sales	26,47%	26,71%	26,77%	26,68%	26,61%	26,62%
Profit margin (before depreciation)	Profits before depreciation / Sales	15,94%	16,41%	16,60%	16,64%	16,63%	16,86%
Net profit margin (before tax)	Profits before tax / Sales	13,45%	14,71%	15,30%	15,47%	15,50%	15,78%
Equity fund performance	Profits before tax / Equity capital	87,90%	140,71 %	190,61 %	215,20 %	224,29 %	237,14 %

Table: 11.9.2 Indices of financial Burden

Interest payment	Profits before tax and interest / Interest charges	5,29	7,24	8,65	9,56	10,54
Debt service	Profits before tax, depreciation and interest / Interest charges + Amortization installment	3,08	4,29	5,28	5,83	6,26

Source: Own elaboration

Table 11.9.3 Course of turnover and net profits



- Source: Own elaboration

TABLE 11.10.02 ESTIMATE OF INTERNAL RATE OF RETURN AND NET PRESENT VALUE

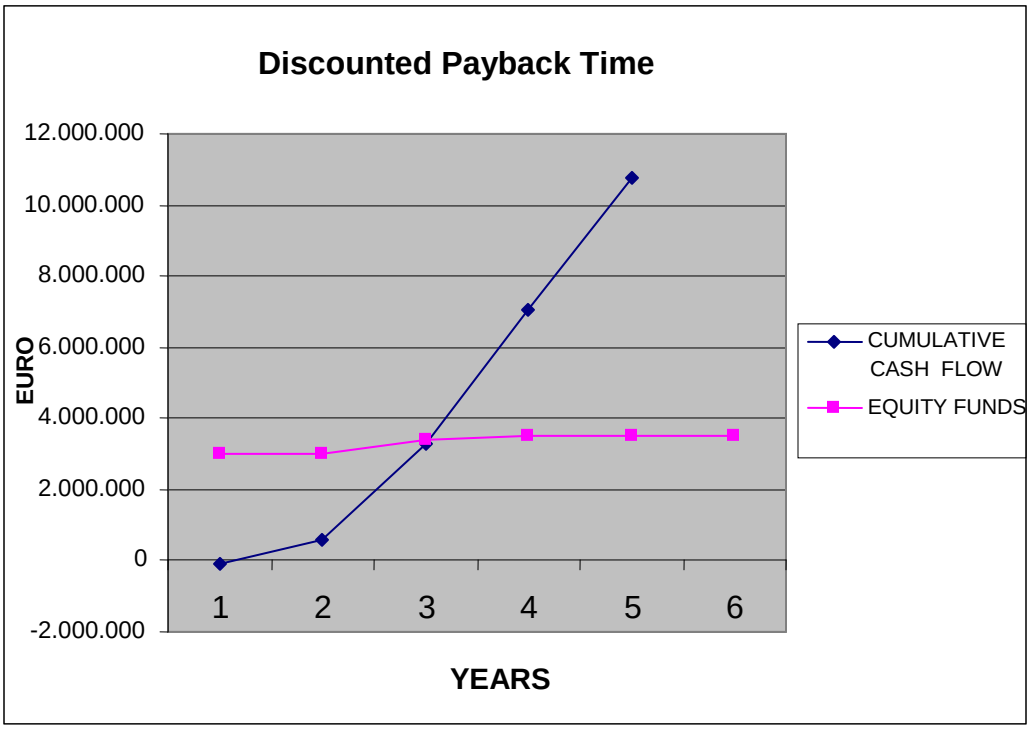
	Description	Construction period	**1st year**	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
	Equity capital contributed	**3.000.000**						

	Net income before tax		2.636.952	4.221.438	5.718.266	6.456.040	6.728.727	7.114.230
LESS	Income tax		659.238	1.055.359	1.429.567	1.614.010	1.682.182	1.778.558
PLUS	Depreciations		487.500	487.500	487.500	487.500	487.500	487.500
LESS	Amortization installments		515.047	554.400	596.760	642.356	691.436	0
LESS	Annual fixed asset investment			400.000	500.000	700.000	900.000	900.000
PLUS	Income from fixed assets disposed		0	0	0	0	0	900.000
LESS	Working capital variation		2.060.572	2.003.222	993.857	209.025	209.025	215.845
PLUS	Working capital recovery							2.000.000
	Annual net cash flow		-110.405	695.956	2.685.583	3.778.149	3.733.584	7.607.327

	Cumulative net cash flow		-110.405	585.551	3.271.134	7.049.283	10.782.867	18.390.195
	Discount interest rate		0,13					
	Total cash flows (Discounted)		-96.053	443.204	2.154.052	4.038.517	5.374.407	9.166.058
	Net present value (NPV)		**7.306.165**					

Source: Own elaboration

Figure 11.10.03 DISCOUNTED PAYBACK TIME



Source: Own elaboration

TABLE 11.10.04 BREAK EVEN POINT OF OPERATION

Description	1st year	2nd year	3rd year	4th year	5th year
Fixed annual expenses	**2.911.728**	**4.934.961**	**6.672.298**	**7.587.490**	**8.853.341**
Amortization installments	**515.047**	**554.400**	**596.760**	**642.356**	**691.436**
Total fixed annual expenses	**3.426.775**	**5.489.361**	**7.269.058**	**8.229.846**	**9.544.777**

Total variable expenses per unit of product	23.500	23.500	23.500	23.500	23.500
Selling price of product	35.000,00				
Break even point of operation (items of product)	**298**	**477**	**632**	**716**	**800**
Rate of expected sales	**168%**	**147%**	**142%**	**140%**	**130%**

Source: Own elaboration

Scenario 2

TABLE 11.11.1 TURNOVER PROVISION

	1st year	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
Robotic bin selling price	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00	35.000,00
Sales volume in items	100	180	260	340	400	450
TOTAL A	**3.500.000**	**6.300.000**	**9.100.000**	**11.900.000**	**14.000.000**	**15.750.000**
Annual advertising income for each bin	**8.400**	**8.400**	**8.400**	**8.400**	**8.400**	**8.400**
Quantity of bins	50	140	270	440	600	700

marketed						
TOTAL B	**420.000**	**1.176.000**	**2.268.000**	**3.696.000**	**5.040.000**	**5.880.000**
Turnover	**3.920.000**	**7.476.000**	**11.368.000**	**15.596.000**	**19.040.000**	**21.630.000**

Source: Own elaboration

Table.11.11.2 Assumptions of personnel cost estimate

Assumptions of personnel cost estimate		
S/N	Description	
1	Monthly salaries per year	14
2	Employer contributions	29,00%

Source: Own elaboration

TABLE 11.11.3 PERSONNEL COSTS

		1st year		2nd year		3rd year		4th year		5th year		6th year	
Job description	**compensation** *(gross pay)*	number	**Annual cost**	number	**Annual cost**	number		number	**Annual cost**	number		number	
Technical Manager	**2.460**	**1**	**44.428**	**1**	**44.428**	**1**	**44.428**	**1**	**44.428**	**1**	**44.428**	**1**	**44.428**
Head accountant	**1.440**	**1**	**26.006**	**1**	**26.006**	**1**	**26.006**	**1**	**26.006**	**1**	**26.006**	**1**	**26.006**
Sales Manager	**2.450**	**1**	**44.247**	**1**	**44.247**	**1**	**44.247**	**1**	**44.247**	**1**	**44.247**	**1**	**44.247**
Engineers	1550	2	**55.986**	2	**55.986**	2	**55.986**	**3**	**83.979**	**3**	**83.979**	**3**	**83.979**
Office employees	**840**	**1**	**15.170**	**1**	**15.170**	2	**30.341**	2	**30.341**	**2**	**30.341**	**2**	**30.341**
Sales persons	**1.250**	**3**	**67.725**	**3**	**67.725**	3	**67.725**	3	**67.725**	**3**	**67.725**	**3**	**67.725**
Foreman	**1.470**	**1**	**26.548**	**1**	**26.548**	1	**26.548**	1	**26.548**	**1**	**26.548**	**1**	**26.548**
Electrical engineers - Electricians	980	3	**53.096**	**4**	**70.795**	5	**88.494**	5	**88.494**	**6**	**106.193**	**6**	**106.193**

Technicians	**980**	**4**	**70.795**	**5**	**88.494**	6	**106.193**	6	**106.193**	**10**	**176.988**	**10**	**176.988**
Maintenance personnel	**950**	**1**	**17.157**	**5**	**85.785**	7	**120.099**	10	**171.570**	**14**	**240.198**	**16**	**274.512**
Welders – Assembling staff	**1.080**	**3**	**58.514**	**3**	**58.514**	3	**58.514**	4	**78.019**	**4**	**78.019**	**4**	**78.019**
Total annual personnel costs		**21**	**479.674**	**27**	**583.699**	**32**	**668.581**	**37**	**767.550**	**46**	**924.672**	**48**	**958.986**
Total production personnel costs		15	293.836,20	21	397.861,80	25	467.573,40	29	538.549,20	38	695.671,20	40	729.985,20
Total administrative personnel costs		6	185.837,40	6	185.837,40	7	201.007,80	8	229.000,80	8	229.000,80	8	229.000,80

Source: Own elaboration

TABLE 11.11.4 TOTAL SALES COST

Sales cost	**1st year**	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
Raw material	2.300.000	4.140.000	5.980.000	7.820.000	9.200.000	10.350.000
Indirect materials and consumables	30.000	72.000	104.000	136.000	160.000	180.000
Power supply of facilities	39.600	55.440	60.192	63.360	68.112	72.000
Fuel for facilities (less disposal)	15.000	22.000	25.000	30.000	40.000	55.000
Production personnel	293.836	397.862	467.573	538.549	695.671	729.985
Administrative personnel	185.837	185.837	201.008	229.001	229.001	229.001
Spare parts	25.000	84.000	216.000	440.000	720.000	840.000
Bin maintenance	20.000	168.000	378.000	660.000	900.000	1.050.000
Machinery maintenance	20.000	30.000	42.000	50.000	70.000	105.000
Charges for outside services	10.000	23.000	35.000	38.000	42.000	45.000
Other expenses	69.000	95.600	128.500	176.900	231.000	260.000

Total	**3.008.274**	**5.273.739**	**7.637.273**	**10.181.810**	**12.355.784**	**13.915.986**

Source: Own elaboration

TABLE 11.11.5 Borrowing terms

Amount of loan	**3.500.000**
Interest rate	**7,75%**
Loan duration	**5 years**

Source: Own elaboration

TABLE 11.11.6 LOAN ANALYSIS

Loan analysis	1	2	3	4	5	*6*	*7*	8	9	10
Capital subscribed	3.206.788	2.902.213	2.585.837	2.257.201	1.915.830	1.561.231	1.192.892	810.279	412.840	0
Amortization installment	293.212	304.574	316.377	328.636	341.371	354.599	368.340	382.613	397.439	412.840
Interests	135.62	124.26	112.46	100.20	87.467	74.238	60.498	46.225	31.398	15.998

	5	3	1	1						
Amortization	428.837	428.837	428.837	428.837	428.837	428.837	428.837	428.837	428.837	428.837

Source: Own elaboration

TABLE 11.11.7 INCOME STATEMENT

	1st year	2nd year	3rd year	4th year	5th year	6th year
TOTAL TURNOVER	3.920.000	7.476.000	11.368.000	15.596.000	19.040.000	21.630.000
Less: Cost of goods sold	3.008.274	5.273.739	7.637.273	10.181.810	12.355.784	13.915.986
GROSS TRADING PROFIT	911.726	2.202.261	3.730.727	5.414.190	6.684.216	7.714.014
Less: Administrative expenses	80.000	120.000	160.000	240.000	280.000	336.000
Less: Selling expenses	100.000	360.000	520.000	680.000	800.000	900.000
Less: Taxes & duties (except for income tax).	5.000	7.000	10.000	12.500	15.000	19.000

OPERATING RESULTS BEFORE FINANCIAL TRANSACTIONS	731.726	1.722.261	3.050.727	4.494.190	5.604.216	6.478.014
OPERATING RESULTS BEFORE INTEREST, TAX & DEPRECIATION	731.726	1.722.261	3.050.727	4.494.190	5.604.216	6.478.014
Less: Interest of long-term investment loans	259.888	212.662	161.705	106.722	47.396	0
Less: Interest of short-term investment loans*	81.867	121.643	186.832	256.327	310.367	420.000
OPERATING RESULTS BEFORE TAX & DEPRECIATION	389.971	1.387.955	2.702.190	4.131.141	5.246.453	6.058.014
Less: Depreciation (total)**	380.882	380.882	380.882	380.882	380.882	380.882
INCOME BEFORE TAX	9.089	1.007.073	2.321.308	3.750.258	4.865.570	5.677.132
Less: Income	2.908	302.122	696.392	1.125.078	1.459.671	1.703.139

tax***						
NET INCOME	6.180	704.951	1.624.915	2.625.181	3.405.899	3.973.992

Source: Own elaboration

* Interests of short-term loans refer to short-term loans as working capital, as estimated in par. 5.8

** Depreciation has been calculated with the method of fixed asset depreciation and a coefficient of 10% for mechanical equipment, 6% for buildings and fixtures, and 15% for transport equipment

*** Income tax has been calculated with a 32% coefficient for the first year and 30% for the following years.

TABLE 11.11.8 ASSUMPTIONS

S/N	Description	Assumptions
1	Credit to customers	90 days
2	Raw material inventories	9 days
3	Semi-finished inventories	90 days
4	Credits from suppliers	60 days

Source: Own elaboration

TABLE 11.11.9 WORKING CAPITAL ESTIMATE

Description	**1st year**	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
Inventories	**544.722**	**530.500**	**766.278**	**1.002.056**	**1.178.889**	**1.326.250**
Credit to customers	**980.000**	**1.869.000**	**2.842.000**	**3.899.000**	**4.760.000**	**5.407.500**
Credits from suppliers	**501.379**	**878.957**	**1.272.879**	**1.696.968**	**2.059.297**	**2.319.331**
Working capital (less disposables)	**1.023.343**	**1.520.543**	**2.335.399**	**3.204.087**	**3.879.592**	**4.414.419**
Annual variation of working capital	497.200	814.855	868.688	675.504	675.504	534.827

Source: Own elaboration

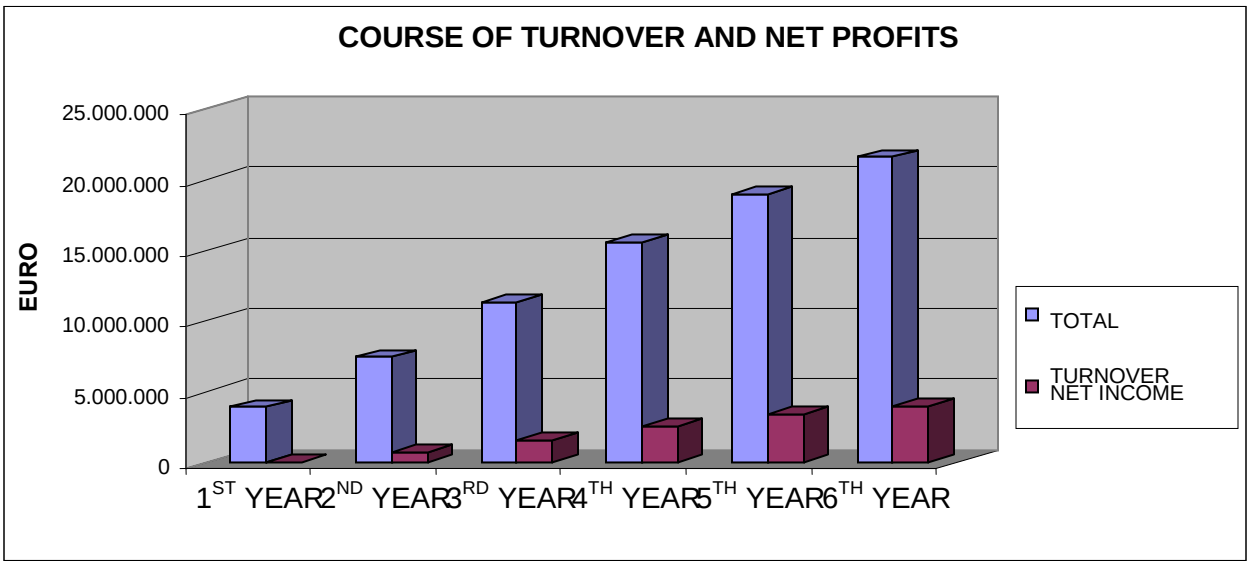
TABLE 11.11.10 FINANCIAL INDICES

Gross profit margin	Gross profits / Sales	23,26%	29,46%	32,82%	34,72%	35,11%	35,66%
Profit margin (before depreciation)	Profits before depreciation / Sales	9,95%	18,57%	23,77%	26,49%	27,55%	28,01%
Net profit margin (before tax)	Profits before tax / Sales	0,23%	13,47%	20,42%	24,05%	25,55%	26,25%
Equity fund performance	Profits before tax / Equity capital	0,45%	50,35%	116,07 %	187,51 %	243,28 %	283,86 %

Source: Own elaboration

Financial Burden Indices

Interest payment	Profits before tax and interest / Interest charges	0,03	3,01	6,66	10,33	13,60
Debt service	Profits before tax, depreciation and interest / Interest charges + Debt installment	0,42	1,49	2,86	4,30	5,49



Source: Own elaboration

TABLE 11.11.11 ESTIMATE OF INTERNAL RATE OF RETURN AND NET PRESENT VALUE

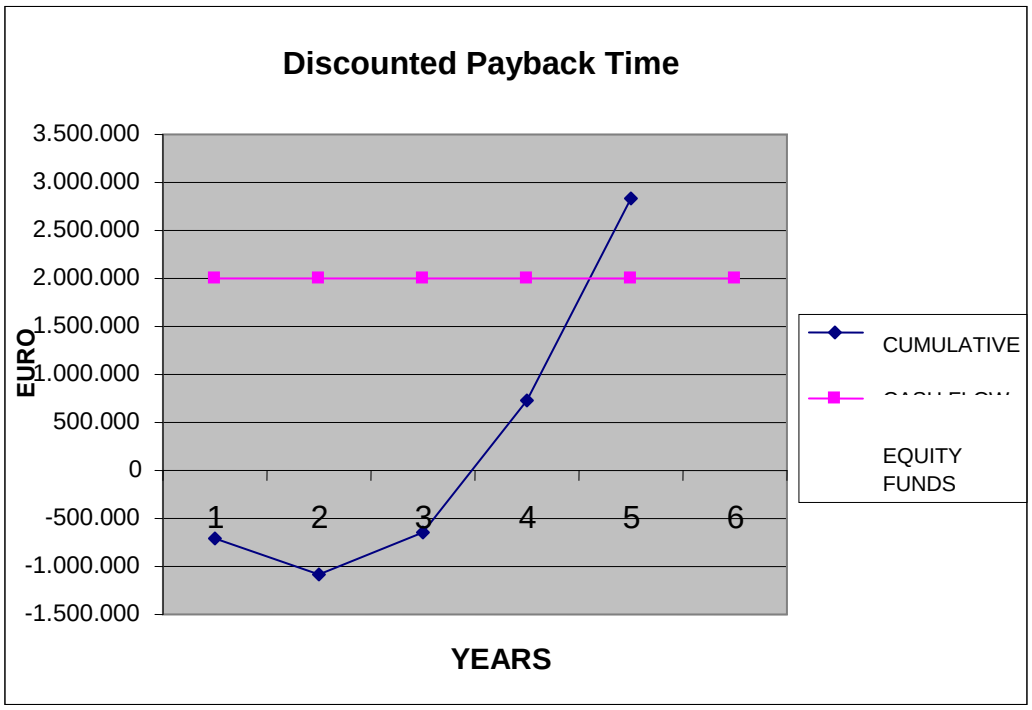
	Description	Construction period	**1st year**	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**
	Equity capital contributed	**2.000.000**						

	Net income before tax		9.089	1.007.073	2.321.308	3.750.258	4.865.570	5.677.132
LESS	Income tax		2.908	302.122	696.392	1.125.078	1.459.671	1.703.139
PLUS	Depreciations		380.882	380.882	380.882	380.882	380.882	380.882
LESS	Amortization installments		597.787	645.013	695.970	750.952	810.279	0
LESS	Annual fixed asset investment					200.000	200.000	300.000
PLUS	Income from fixed assets disposed		0	0	0	0	0	825.000
LESS	Working capital variation		497.200	814.855	868.688	675.504	675.504	534.827
PLUS	Working capital recovery							1.000.000
	Annual net cash flow		-707.924	-374.035	441.140	1.379.607	2.100.999	5.345.047

	Cumulative net cash flow		-707.924	-1.081.959	-640.819	738.787	2.839.786	8.184.833
	Discount interest rate		0,13					
	Total cash flows (Discounted)		-615.894	-1.081.959	-640.819	738.787	2.839.786	8.184.833
	Net present value (NPV)	1.940.128						
	Internal rate of return	**25,70%**						

Source: Own elaboration

Figure 11.11.12 DISCOUNTED PAYBACK TIME



Source: Own elaboration