ΣΠΟΥΔΑΙ / SPOUDAI

ΕΤΟΣ 1992 ΑΠΡΙΛΙΟΣ - ΙΟΥΝΙΟΣ ΤΟΜΟΣ 42 ΤΕΥΧ. 2

YEAR 1992 APRIL - JUNE VOL. 42 No 2

EVALUATION OF EFFECTS OF INFRASTRUCTURE ON THE LONG TERM VIABILITY OF AN INVESTMENT

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Abstract

In this paper a quantification is attempted of those qualitative factors that determine the attractiveness of the wider area in which an investment is to be located. Based on this quantification, a methodology is proposed for the evaluation of an investment viability on a long term basis and the relevant model is applied in the North Aegean Region. In the proposed model the viability of an investment, on a long term basis, is determined by three basic indices: the economic and social indices that form the two coordinates of the basic image of the area accommodating the investment and a third one that expresses the financial image of investment.

1. Introduction

The viability of an investment, on a long term basis, does not depend solely on the financial indices that describe it but is, also, significantly influenced by a number of qualitative factors, such as the level of economic and social infrastructure of the area under consideration. These factors have not yet been satisfactorily integrated in the location/ spatial models, a fact that is mainly due to the difficulty of appropriately quantifying and correlating them with the rest financial variables.

In this work we attempt a quantification of all those qualitative factors that determine the attractiveness of the wider area in which the investment is to be located and apply the proposed model in the region of North Aegean.

For each candidate area a relative degree of attractiveness ("basic image") is calculated in relation to the whole population (both employees and employers). The basic image is then broken into two "special images":

(i) the attractiveness of the image of the area as perceived by employees
(ii) the attractiveness of the image of the area as perceived by employers.

Note, at this point, that the basic image of an area is a function of two basic indices (variables):

(i) the economic index that expresses (quantifies) the economic infrastructure of the area
(ii) the social index that expresses the social infrastructure of the area.

For an analysis of the theoretical background of the basic and special image notions as well as a related application in the N.E. Aegean see Angelis (1990).

In the proposed model the viability of an investment, on a long term basis, is determined by 3 basic indices: the economic E(a) and social S(a) that form the two cordinates of the basic image of area a accommodating the investment and a third one R(i) that epxresses the financial image (return) of investment i. The long term viability V(i, a) of an investment i located in the area a, is taken to be the weighted sum of those indices:

$$V(i, a) = weE(a) + wsS(a) + wrR(i) \qquad (we+ws+wr= 1)$$

The values of the above weights express the attitudes and considerations of the decision makers (employers) on a national level.

2. The Image of an Area

On a long term basis, the rate of development that an area can achieve, and in particular the viability of investments in it, depends mainly upon its ability to draw and sustain economic activities (investments) as well as the human resources that will manage them.

According to Perloff and Wingo (1970), the development of an urban area depends upon the exchanges of labour and capital between this area and the surrounding space. These exchanges are often influenced by so an abstract variable as the "image" transmitted by the particular area.

The elements that form the image of an area are numerous and are related to each other in a complex and dynamic way. On the other hand, from studies that have been conducted by Townroe (1971, 1979) and Hunter and Reid (1968), one can conclude that, in most countries of W. Europe as well as in the USA the

people candidate for movement (eg. employees and employers or investors) react in a similar manner to a group of basic conditions. That is, certain elements among those forming the image of an area, have a special weight for all groups involved in decisions regarding movement. These elements form what we call "basic image" of the area.

The attractivity of the basic image of an area is a necessary condition for a decision to move inside this area. Nevertheless, this condition is not sufficient. The people candidate for movement (abbr. people c.f.m.) after they have examined, in a first phase, and accepted the basic image of the area, they will consider, next, and analyze a number of side conditions that are different for each one of the various groups or people c.f.m. This analysis will lead to the identification of a series of particular elements in the image of the area (beyond those already present in the basic image) that carry a special weight for each one of the groups c.f.m. These elements, in combination with those of the basic image, form the "special image" of the area in relation to each one of the groups under consideration (see figure 2.1).

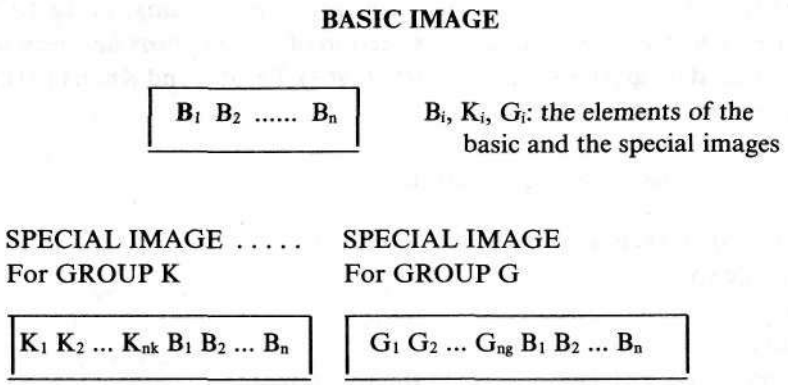

Figure 2.1. The Relation Between the Basic and the Special Images

Conclusively, whereas the basic image expresses the general conditions (applicable to all groups of decision makers) that characterize an area, the special images enrich it with certain specialized indices (factors) that express the particular economic and social return to be enjoyed by the members of the various groups as a result of the selection of the particular area (see Angelis, 1988).

In this work we will focus our analysis on the two groups that form the

manpower basis of the industrial units, namely the employers (investors) and the employees.

2.1. The Formation of the Basic and Special Images

Any effort related to the improvement of an area image should take into account two basic characteristics in the movement of people and industrial units. First, that these movements are voluntary ones and second, that they are the result of personal subjective, and some times antidiametrically different attitudes of the various people or groups in relation to a set of economic and social factors widely accepted as characterizing the profile of an area.

The basic image, defined as a set of indices that express conditions common for all groups c.f.m., could form the basic framework for the development of an area. Furthermore, care should be taken so that the weights the various groups assign to the indices of the basic and special images, are appropriately integrated in this framework.

The list that follows presents the main factors composing, in the form of indices, the basic image. Note that, the selection of those factors has been based upon empirical data given by Gullingworth (1969), Rhodes and Khan (1971) and Townroe (1979).

KEY FACTORS COMMON FOR ALL GROUPS

B1. Vicinity to markets and raw material sources.
B2. Available space.
B3. Housing conditions.
B4. Quality of environment.
B5. Economic and social conditions in the wider area.

We give, next, a concise presentation of those special factors that mainly influence the decision for movement of the two groups under consideration. An analysis of those factors can be found in Townroe (1971).

KEY FACTORS FOR EMPLOYERS (INVESTORS)

E1. Availability of labour.
E2. Quality of labour.
E3. Economic incentives.

KEY FACTORS FOR EMPLOYEES (MAINLY AT A MANAGERIAL LEVEL)

M1. Availability of employment opportunities.
M2. Working conditions.
M3. Economic incentives.

Figure 2.2 depicts the elements and relations between the basic and special images using the above introduced abbreviation symbols Bi, Ei and Mi.

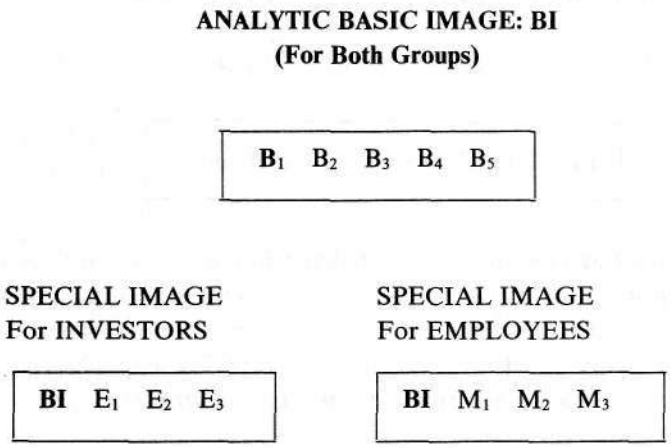

Figure 2.2. The Basic and Special Images for Investors and Employees

The above form of basic image, comprised by the indices (factors) Bi i= 1, 2, ..., 5, will be called thereon "analytic basic image" in contrast with another simpler form that will be introduced later.

At this point it is noted that, the attractivity of an area image can be expressed both in absolute and relative terms. On the other hand, the people, in deciding about their movement, take into account the relative merits and advantages of an area with respect to a wider area of reference (abbr. w.a.o.r.). This w.a.o.r. may be a region, or a province or a state itself. On this work we consider Greece as the w.a.o.r. and the regions of it ("peripheries") as the particular areas that will be compared to each other. In relation to this w.a.o.r., all image indices are taking values in the interval [0,1] where 0.5 represents the national mean (or typical) value for all indices used here.

3. The Attractivity of an Area Image

The complexity of the structure of an area image depends upon the level of analysis (detailed or not) we are aiming at. In its simplest form the basic image could have two elements:

- the economic index and
- the social index

We call the above form of image "elementary basic image".

ELEMENTARY BASIC IMAGE

Economic Index	Social Index

The basic image attractivity, considered as a function of its indices, could be defined in a plethora of alternative ways. Angelis (1978) proved that the graph of the basic image attractivity. considered as a function of the economic and social indices, exhibits discontinuities taking the form of "catastrophe of the edge surface". As a consequence, the value x of the basic image attractivity of an area is the solution of the foolowing equation:

$$x^2 - bx - a = 0 \qquad (3.1)$$

$a = m(e-e_0) + (s-s_0)$ and $b= (e-e_0) - m(s-s_0)$ if $m \leqslant 1$

where

$a= (e-e_0) + (1/m)(s-s_0)$ and $b= (1/m)(e-e_0) - (s-s_0)$ if $m>1$

In the above basic image equation, e and s express, correspondingly, the values of the economic and social index (equiv. the level of economic and social profile) of the area under consideration, whereas e_0 and s_0 the mean or typical values of the corresponding indices with respect to the w.a.o.r. The pair (e_0, s_0) corresponds to the vertex of the above mentioned edge whereas m gives the slope of its axis (see Isnard and Zeeman (1976).) This slope represents the relative weights attached to the above two indices. In the equation 3.1, e and s are taking values in the interval [0,1] where 0.5 represents the mean or typical value of the index with respect to the w.a.o.r. Furthermore, the basic image attracticity (variable x) takes values in the interval [-1,1]. Areas associated with a positive basic image attractivity could be considered as the possible final selection for a

large portion of people c.f.m. Angelis (1990), in an application of the above methodology in the Region of North Aegean, has calculated a value 0.47 for parameter m. It should be noted at this point that, the evaluation of parameter m is based upon the comparative analysis of a series of economic and social factors concerning the area under consideration.

For the evaluation of the specific image attractivity, Angelis (1990) proposes the following "multiplicative" model:

ATTRACTIVITY OF THE SPECIAL IMAGE FOR INVESTORS (Ae)

$$Ae = \sqrt{(BIM)\,(LAM)\,(LQM)\,(EIM)} \qquad (3.2.a)$$

where

BIM: is the Basic Image Multiplier
LAM: is the Labour Availability Multiplier
LQM: is the Labour Quality Multiplier and
EIM: is the Economic Incentives Multiplier

ATTRACTIVITY OF THE SPECIAL IMAGE FOR EMPLOYEES (Am)

$$Am = \sqrt{(BIM)\,(EOM)\,(ECM)\,(EIM)} \qquad (3.2.b)$$

where

BIM: is the Basic Image Multiplier
EOM: is the Employment Opportunities Multiplier
ECM: is the Employment Conditions Multiplier and
EIM: is the Employment Incentives Multiplier

Note that, in equations 3.2 (a and b) Ae and Am take values in the interval [0,2] with 1 representing the mean or typical value for the w.a.o.r.

The above rules (3.1 and 3.2) for the calculation of the attractivity of an area image exhibit the following disadvantages:

- The form of equation 3.1 does not allow an immediate or simple generalization for cases of more complex image structures (ie as that of fig. 2.2).

- The non-homogeneous manner of calculation of the various image attractivities complicates the comparative analysis of the structure of the basic and special images.

- Finally, the most important disadvantage is that, he above rules do not take into account the weights assigned to the various factors of an area image by the decision makers (in this case the investors and employees).

We could accept with a relatively large degree of certainty that, there is a set of critical factors common to all (or some) groups involved in a movement decision. Actually, it is these factors that would determine the basic and special images of an area. But it is also certain that, the people, both on a personal level or as a result of group common interests, assign their own (many times highly differentiated) weights to the importance of those factors. Consequently, these weights should be taken into account when determining the form of the image attractivity function.

Given that

$$F(a) = (F_1(a), F_2(a), ..., F_n(a))$$

is the vector of factors (indices) Fi(a) of the image F(a) of an area a, and

$$w(g) = (w_1(g), w_2(g), ..., w_n(g)) \qquad (w_1 + w_2 + ... + w_n = 1)$$

is the vector of the weights assigned by a group g to the above factors, then we define the "weighted image attractivity" A (a, g), of an area a in relation to a group g of (movement) decision makers, to be the inner product of vectors F(a) and w(g):

$$A(a,g) = w_1(g)\, F_1(a) + w_2(g)\, F_2(a) + ... + w_n(g)\, F_n(a) \qquad (3.3)$$

The use of linear models is, of course, subjected to a number of constraints, most important of which is the linearity of the relation and the independence of the variables involved, in our case of the factors forming the area image. On the other hand, practical reasons, as the simplification of the analysis and the interpretation of the results, and also the necessity for an approximate knowledge of the general trends and laws in a first level of a system's analysis, have led to a plethora of successful applications of linear models, even in cases where the factors (variables) of the system are not fully linearly independent. In our case, although some of the factors (mainly that of the elementary basic image) are correlated to each other, nontheless their structural and especially their spatial and intratime differentiation (see table 2) justifies to a considerable degree the use of linear models. Notice at this point that, the gradual increase of the image complexity through the breaking down of its elements into more elementary and simpler ones, decreases, in general, the level of interdependence among them.

This process makes the tracing of the factors (or groups of factors) characterized by a relatively high degree of independence simpler, furthermore, it is these factors that will form the basis for the development of more specialized images.

Given relation 3.3 the elementary, Ael, and analytic, Aam, basic image attractivities are defined as follows:

$$Ael(a) = weE(a) + wsS(a) \qquad (we + ws = 1) \qquad (3.4.\alpha)$$

$$Aan(a)=w_1B_1(a) + w_2B_2(a) + w_3B_3(a) + w_4B_4(a) + w_5B_5(a) \quad (\sum_i wi=1) \quad (3.4.b)$$

where E(a), S(a) are the economic, social indices, respectively, of the area a, Bi i= 1, ..., 5 are the indices of the analytic image of this area and w_e, w_s w_i, i= 1 ... 5 (see fig. 2.2) are the corresponding weights assigned to the above indices by both groups of decision makers.

Finally, the investors and employees special image attractivities of an area a, A(a,e) and A(a,m) respectively, are given by the following formuli:

$$A(a,e)= w_{ia}A(a) + w_{i1}E_1(a) + w_{i2}E_2(a) + w_{i3}E_3(a)$$

$$A(a,m)= w_{ma}A(a) + w_{m1}M_1(a) + w_{m2}M_2(a) + w_{m3}M_3(a) \qquad (3.5)$$

where Ei(a), Mi(a) are the indices of the investors and employees special image, respectively (see fig. 2.2), and A(a) is the basic image (elementary or analytic) attractivity of the area a.

3.1 The Methodology for the Evaluation of Image Indices

The methodology fot the evaluation of the image indices proposed and discribed by Angelis (1988, 1990) presents a specialization, for the case of Greece, of methodologies and techniques that are widely accepred in the literature (Rhodes, Khan (1971), Townroe (1971)) as reliable and suitable for dynamic models that describe the development process of an area. On the other hand, the factors selected for inclusion in the basic and analytic image of an area are representative of the dominant motivation behind the employers (investors) decisions regarding the selection of a site for their investments and they are routinely apllied in studies of this Kind (Gullingworth (1969)).

3.1.1.Vicinity to Raw Material Sources and Markets

As Angelis (1988) points out, the measurement of this factor excibits significant difficulties. The discovery of new deposits of raw materials, the develop-

ment of new markets and above all the change of the content of the notion of "distance" (as a result of the introduction of new technologies in the transportation systems) pause significant difficulties in our efforts to measure (quantify) this factor. For a given area a "vicinity index" (abbrev. VI) is defined to be its distance from the most important markets and raw material sources. It is composed by two sub - indices, the VI to raw material sources and the VI to markets. Here, we analyze only the methodology for the evaluation of the first sub - index because the second sub-index is evaluated in a similar way.

First, the 5-6 greater urban sites (cities) of the country are considered as representing the most important markets. For each one of them a "magnitude coefficient" is defined taking the value 1 for the largest market (city) and proportionaly decreasing values for the rest ones. Next, the wider geographical area around each market is divided into a number of co-centered zones of "cyclical" form, each zone containing all sites that are roughly at the same distance from the center (eg. zones of 10, 20, 30, ... km). To each cyclical zone a coefficient is assinged expressing the influence exerted on the various areas of the zone by the corresponding market. Having defined the magnitude and influence coefficients of the main markets, the VI of an area is taken to be the product of the magnitude coefficient of the market (influencing the area) and the influence coefficient that corresponds to the zone that this area belongs to. In the case where the specific area is under the influence of two or more markets the VI is taken to be the sum of the corresponding products.

3.1.2. Available Space

The measurement of the space that is available for future expansion of an economic (mainly industrial) activity is a delicate problem. If, for example, the total available area is well determined (as it is the case with an area which is encircled by a "green zone") then the available space at a given time can be expressed as the percentage of the total area which is free for furure expansion. Note that, in most cases an area is expanding to meet continuously arising development needs. Although the expansion capabilities of an area are not unlimited, the measure of the available space as was defined previously is not suitable. A more suitable measure is the population density in the wider area. High density is an indirect expression of dense urbanization that pauses difficulties to further expansion, without of course detering this possibility completely. Special local conditions that influence the development of a specific area should be also taken into account when defining the measure of the available space.

3.1.3. Housing Conditions

The measurement of an area's housing conditions should take into account the quantitative sufficiency as well as the quality of its houses. A simple measure of the quantitative sufficiency is the ratio of the population of an area (or the number of its families) to the number of available houses (or rooms) for the measurement of the houses quality. Angelis (1988) proposed the following method. The total number of houses in an area is divided in the following 4 categories with relation to the year of their construction:

(1) houses that were constructed prior to 1919
(2) houses that were constructed during the period 1919-1945
(3) houses that were constructed during the period 1945-1965
(4) houses that were constructed during the period 1965-

Next, a quality scale for the houses is defined which is a function of their age. According to this scale the grades 1,2,3 and 4 are assigned to the above defined categories 1 to 4 respectively.

3.1.4. Quality of Environment

For the deternination of the quality of environment we should follow a hollistic approach that would take into account the various distinct elements that contribute to it (noise, solid and fluid wastes, degradation of the physical and built environment, atmospheric pollution). The last two elements can be easier measured and could form the basis for the measurement of an area's quality of environment. Abandoned industrial installations are probably the most characteristic example of the degradation of the built environment and a measure of this degradation could be the ratio of the abandoned old industrial installations or industrial ruins to the total number of the industrial installations of an area.

On the other hand, the excessive and uncontrolled industrial activity, as Angelis (1988) points out, is the main cause of atmospheric pollution and consequently a measure of the quality of the atmospheric conditions could be the ratio of the annual consumption of electric power for industrial activity to the total annual consumption. A combination of these two measures that describe the quality of the environment (degradation of the built environment and atmospheric pollution) could form a general measure of it.

3.1.5. Economic and Social Conditions in the Wider Region

The investors candidate for movement in an area are influenced not only by the conditions that prevail in the specific area but also by the economic and social conditions of the wider region in which the specific area belongs to. Among the factors that shape these conditions, the most important ones regard the infrastructure of the wider area and are:

(a) The general industrial infrastructure of the wider region as expressed by the level of the current industrial activity (eg. annual consumption of electric power directed to industrial activities).

(b) The general social infrastructure of the wider region. A measure of it should cover the sectors of health (eg. number of inhabitants per physician), education (eg. number of students per teacher) and recreation (eg. vicinity to the nearest large urban site).

4. Long Term Viability of Investments and Financial Indices of the Manufacturing Sector of the Greek Economy

4.1. The Proposed Investment's Viability Model (IVM)

The viability of investments, on a long term basis, does not depend solely on the conventional financial indices that describe it but, it is also influenced by a number of qualitative factors such as, the level of economic and social infrastructure of the area under consideration. These factors have not yet been satisfactority integrated in the spatial models, a fact mainly due to the difficulty of appropriately quantifying and correlating them with the rest financial variables.

In this work an attempt is made for the integration of those factors in a model evaluating the long term viability of investments. The basic parameters of the proposed model are:

(a) The attractivity A(a) of the basic image of an area a.
(b) The index R(i) that describes the financial image (return) of the investment i.

The long term viability, V(i, a) of investment i in the area a, is then defined as the weighted sum of the above indices:

$$V(i,a) = W_a A(a) + w_r R(i) \qquad (w_a + w_r = 1) \qquad (4.1)$$

where w_a and w_r are the weights assigned to A(a) and R(i), respectively, by the group of investors.

4.2. Financial Return Indices for the Manufacturing Sector of the Greek Economy

Alexakis and Tjokas (1989) presented a wide, spatial and sectoral, analysis of the financial return indices of the Greek Manufacturing Firms. In their study, the authors analyze a sample of 61 firms out of a total of 536 firms that were financed in the context of the development act 1262/82, during the period 1982-1987. Effort was made so as the sample to be representative of the dispersion both, on a intra-spatial as well as on an intra-sectoral level.

The results of this study with regard to the index of the invested capital return (net profit over invested capital) are summarized in the following table (table 1):

AREA	INTRA-SECTORAL RETURN	TRADITIONAL SECTORS	MODERN SECTORS
Central Greece	4.1	4.1	4.1
Northern Greece	0.2	-1.1	3.4
SW Greece	1.7	4.1	0.1
N. Aegean Region	2.9	2.2	4.8
Typical Area	3.2	3.4	2.9

Table 1. Return of Invested Capital for the Manufacturing Sector of the Greek Economy

A first, basic, conclusion from the above table is that, the indices exhibit strong deviations, both on a sectoral as well as on a spatial basis. To a considerable degree, these deviations are the result of large differentiations in the level of economic and social infrastructure among the various regions of the country, especially the border ones. For a long time, the incentives introduced by the various regional development acts, there were either apospasmatic (act 289/76 aimed at the development of certain regions and sectors) or put emphasis to capital and rates subsidies and tax relief incentives, that were spatially diferentiated (act 1262/82). In both the above acts, no emphasis was given to incentives promoting the infra-structure development of the various regions of the country. This policy resulted in artificially high return indices for a number of indutries operating in certain regions of the country that were characterized by low level infra-structure. In the long term, and under the continuously increasing influence of the low level infra-structure of those regions, a fast deterioration of their

productivity and viability strength was recorded. As a result, many of those industries collapsed.

In the next section (section 5) we will aplly the above introduced model (formula 4.1) to evaluate the effects of infrastructure of Northern Aegean Region on the viability of investments in it. For this reason, the invested capital return indices of table 1 are transformed so as to conform with the range of the indices of the basic image which is the interval [0,1].

4.3. The system of Weights in the Image Attractivity and Viability Models

The role of (personal or group) weights in the regional development and locational models, expressing the attitudes and significance attached by decision makers to the various factors determining the investment image of an area has been widely analysed and pointed out in the literature (Isnard & Zeeman (1976), Rhodes & Khan (1971), Townroe (1971, 1979) and De Meirleir (1988)).

In order to evaluate the weights attached to the various factors composing the basic and analytic investment image of an area an extensive survey was conducted in the N. Aegean Region. The survey included individual employers of the industrial sector as well as local boards of industry and government offices involved in the decision process regarding approval of investment schemes or promotion and application of investment policies. The sample, that included 25 individuals was of considerable size if compared to the number of units of considerable size operating in the 3 prefectures of the N. Aegean Region (in 1984 there were 47 industrial firms employing 10 or more workers in this region). Furthermore, effort was made so as the sample to be representative of the dispersion of the firms on an intra-spatial as well as on an intra-sectoral level. The main results of the above survey are presentes in table 1a.

FACTORS OF THE GENERAL INVESTMENT IMAGE		weight
Economic Index		0.63
Social Index		0.37
	total:	1.00

FACTORS OF THS ANALYTIC INVESTMENT IMAGE		weight
Vicinity to Markets and Raw Material Sources Index		0.35
Space Availability Index		0.23
Housing Conditions Index		0.27
Quality of Environment Index		0.15
	total:	1.00

FACTORS DETERMINING INVESTMENT VIABILITY		weight
Investment Image Index		0.43
Financial Return Index		0.37
	total:	1.00

Table 1a. Investors Weights Attached to the Factors of General Investment Image (GII) and the Analytic Investment Image (AII) of an Area.

5. The effects of Infrastructure on the Long Term Viability of Investments. Application in the North Aegean Region

5.1 The Image of North Aegena Region

A detailed presentation of the methodology for the evaluation of image indices as well as an application in the North Aegean Region can be found in Angelis (1988, 1990).

Recall from section 3 that, the basic image of an area is formed, in its analytic version, by the following five factors (indices):

- the vicinity to markets and raw material sources index (VM)
- the space availability index (SA)
- the housing conditions index (HC)
- the quality of environment index (QE)
- the economic conditions (EC) and social conditions (SC) indices

The values of the above indices for the three prefectures of the North Aegean region are given in the following table (table 2):

AREA	BASIC ECONOMIC INDEX			EC andSC	BASIC SOCIAL INDEX		
	VM	SA	EC	combined index	SC	HC	QE
Lesbos	0.250	0.500	0.300	0.332	0.365	0.275	0.300
Samos	0.250	0.500	0.350	0.345	0.340	0.275	0.275
Chios	0.250	0.500	0.300	0.335	0.370	0.275	0.275

Table 2. The Values of the Basic Indices for the North Aegean Region

Note that, all above indices are taking values in the interval [0,1] where 0.5 represents the typical value on a national level.

Recall at this point that, the elementary basic image represents a summary of the analytic basic image, in which only two basic indices are used, the economic and social ones. The economic index E(a) of an area a is formed by the first 3 indices of table 2 whereas the social index S(a) is formed by the last 3 indices of this table. Angelis (1988, 1990) uses the following multiplicative model for the evaluation of the basic indices:

$$E(a) = \sqrt{(VM)(SA)(EC)/2} \qquad (5.1.a)$$

$$S(a) = \sqrt{(SC)(HC)(QE)/2} \qquad (5.1.b)$$

It should be noted, at this point, that the author introduces a kind of indirect weighting for the above indices. In this context, the range of index VM is doubled, the range of indices HC and QE is increased by 20% whereas the range of the rest is reduced by 33%. But the above way of indirect weighting is completely static in contrast with basic image attractivity of an area which is a profoundly dynamic variable. The values that this variable takes are the result of the interaction of the characteristics of the area image and the continuously changing attitudes of the people involved in the relevant decision process.

Aiming at a more realistic representation of this complex and dynamic environment, we introduce two weighting coefficients in the image attractivity evaluation process (formula 3.3.a). The values of the weighting coefficients w_e and w_s of the economic and social index, respectively, for the North Aegean region are:

$$w_e = 0.63 \qquad w_s = 0.37 \qquad (5.2)$$

and express the significance attached to the corresponding factors by the decision makers on a national level.

Introducing the values of table 2 and the above weights in model 5.1 we get the following values for the social and economic index of North Aegean Region (table 3):

AREA	BAIC ECONOMIC INDEX	BASIC SOCIAL INDEX
Lesbos	0.33	0.31
Samos	0.35	0.29
Chios	0.33	0.29

Table 3. The Values of the Basic Indices for the North Aegean Region

A first, basic, conclusion from tables 2 and 3 is that for all three islands under consideration, the basic movement decision factors are not attractive if compared to the typical factors on a national level. Notice also that, the economic infrastructure of those islands is slightly better than the social one, with the spatial differentiations being relatively small.

The basic image attractivity forsc the three islands under consideration is, then, evaluated by the introduction of the relevant data (table 3 and 5.2) in the model 3.4.a. The results of this evaluation are given in the following table (table 4).

AREA		Lesbos	Samos	Chios	Mean Value for
BASIC					N.Aegean Region
IMAGE	proposed model: 3.4:	0.323	0.328	0.315	0.322
AT/TY	model 3.1:	0.198	0.186	0.187	0.190

Table 4. The Basic Image Attractivity Indices for the North Aegean Region

The main conclusion, from table 4, is that the basic image of all three islands is not attractive if compared to the typical, on a national level, area. Furthermore, as we shall show in the next section, the values that model 3.1 gives probably underestimate the real infrastructure capabilities of these islands.

5.2. Expected Investment Viability. Application in the North Aegean Region

As it was stressed in the previous sections, the infrastructure of an area plays an important role in the viability of investments on a long term basis. The following table (which combines tables 1 and 5) strongly depicts the general trend of this relation, for the case under consideration.

AREA	BASIC IMAGE ATTRACTIVITY	RETURN OF INVESTED CAPITAL
Typical Area	0.500	3.2
N.Aegean Region	0.322	2.9

Table 5. The Relation Between the Return of Invested Capital and the Infrastructure Attractivity for the Region of North Aegean

In order to systematicly analyze the effects of the infrastructure of an area a on the long term viability of investments in a branch k of the economy, we introduce the notion of the "expected investment viability" (abbr. EIV), V(k,a), which is defined as follows:

$$V(k,a) = w_a A(a) + w_r R(k) \qquad (w_a + w_r = 1) \qquad (5.2)$$

where:
- A(a) represents the basic image attractivity as the area a,
- R(k) is the average (on a national level) return of invested capital in the branch k of the economy, and
- w_a, w_r are the weights attached to the above factors by the investors.

Note that, both variables, A and R, are taking values in the interval [0,1] with 0.5 denoting the typical value of those variables on a national level.

The results from the application of the above model in the North Aegean Region, for the manufacturing branch of the Greek Economy are summarised in the following table 6. The values of the weighting coefficients for this application are:

$$w_a = 0.43 \qquad \text{and} \qquad w_r = 0.57 \qquad (5.3)$$

AREA	BASIC IMAGE ATTRACTIVITY	RETURN OF INVESTED CAPITAL	EXPECTED INVESTMENT VIABILITY DIFFERENTIAL
N. Aegean	0.322	0.450	0.424
Typical Area	0.500	0.500	0.500

Table 6. Real and Expected Return of Invested Capital in the Region of North Aegean

From 5.3 it is apparent that the significance attached by the candidate investors to the quality of infrastructure on the investments viability is strong. Furthermore, the above analysis leads to the following basic conclusions.

If a typical investment in the manufacturing branch of the Greek Economy is exposed to the infrastructure of the North Aegean Region then, its (relative) longterm return will be reduced from 0.500 to 0.450, that is by as much as 10%. On the other hand, the value that model 5.2 gives for the EIV (value 0.424) appears to be a relatively good approximation of the value (0.450) of the invested capital return. Consequently, the proposed model evaluates, with a relatively high degree of accuracy, the effects of infrastructure on the long term viability of investment, for the case of North Aegean Region. The value of the EIV that model 5.2 gives for attractivity level 0.190 (which is evaluated according to model 3.1) is 0.367. This value deviates significantly from the real level of return of invested capital (0.450). This is due to the underestimation of the basic image attractivity by model 3.1.

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