

## **A THEORETICAL AND METHODOLOGICAL APPROACH OF «FRAGILE» AREAS: THE CASES OF GREEK REGIONS CROSSED BY THE EGNATIA ROAD**

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### **Abstract**

Rural areas so-called ‘fragile’ have rarely been object of theoretical and methodological approach, aiming at delimiting the concept of fragility and at specifying his components. As well as there is no theoretical approach to define these milieus, there is no either general agreement on the notion of fragile space. Numerous are the authors who use this notion without specifying contents, or defining its outlines. Arise then the question to know, what is really meant by this concept. This is the first task of this article which seeks to trace the history of the concept and its use by authors. If the concept of fragility seems to have obvious filiations with the concepts of periphery, marginal and underprivileged space, we propose to show that this concept refers to a more complex reality and in any case, a fact.

Assuming that the fragility is not a state but indeed a process, the question is then, in one hand, to specify-it through its multiple constituents and on the other hand to translate these last ones on a set of appropriate and quantifiable indicators.

By taking as study area, the northern region of Greece which has recently benefited from a great highway infrastructure (*Via Egnatia*), we propose using the methods of multicriteria analysis, to highlight the types and degrees of fragility of the subregional areas of northern Greece. The use of factor analysis methods and classification confer us the possibility to make a typology of these areas well beyond traditional approaches of disadvantaged areas, marginal or peripheral.

**Keywords:** Fragility, typology of spaces, multi-criteria analysis, Greece

**JEL classification:** O18, O21, P25

### **Résumé**

Les milieux ruraux fragiles ont rarement fait l'objet d'une approche conceptuelle et méthodologique, visant à délimiter le concept de fragilité et en préciser ses composantes. De même qu'il n'existe pas d'approche théorique propre à définir ces milieux, il n'existe pas non plus de consensus sur la notion d'espace fragile. Nombreux sont les auteurs qui emploient cette notion sans en préciser le contenu, ni définir ses contours. Se pose dès lors la question de savoir ce qui est réellement entendu par ce concept. C'est la première tache de cet article qui s'attache à retracer l'historique du concept et son utilisation par les auteurs. Si le concept de fragilité semble avoir des filiations évidentes avec les concepts de périphérie, d'espace marginal et défavorisé, nous nous proposons de montrer que ce concept renvoie à une réalité plus complexe et en aucun cas, à un état de fait.

Partant de l'hypothèse que la fragilité n'est pas un état mais bien un processus, il s'agit alors d'une part, de le spécifier au travers de ses multiples composantes et d'autre part de traduire ces dernières en un ensemble d'indicateurs appropriés et quantifiables.

En prenant pour terrain d'étude, la région Nord de la Grèce qui a récemment profité d'une grande infrastructure autoroutière (*Via Egnatia*), nous nous proposons à l'aide des méthodes d'analyse des données multicritères, de mettre en exergue les types et degrés de fragilité des

espaces infrarégionaux du Nord de la Grèce. Le recours aux méthodes d'analyse factorielle et de classification permet en effet de procéder à une typologie de ces espaces qui dépasse largement les approches traditionnelles d'espaces défavorisés, marginaux ou périphériques.

**Mots clés :** Fragilité, typologie des espaces, analyse multicritère, Grèce

## 1. Introduction

The objective of this research is to contribute both conceptually and methodologically to a better understanding of the space called 'fragile'. This notion of fragile space has emerged in the 1980s to define rural areas neglected by the 'productivist model', suffers from, many ambiguities that it is necessary to overcome.

In a first phase, we trace the origin of the concept of fragile space. Emphasis is given to the willingness of researchers who worked on this concept, to go beyond the traditional approaches in terms of peripheral spaces, marginal and disadvantaged spaces. In a second phase we try to show that the approaches that have attempted to apprehend the fragility do not allow us to clearly define and delimit this concept. For this reason, we propose to adopt a territorial approach, putting in the center of the definition, the difficulties of coordination of actors, evaluated in terms of internal and external proximity relationships, the low level of valorization of resource, and finally, the objective disabilities. It is thus a quite different approach that in terms of methodology, requires the construction of new original indicators.

Our method for assessing the fragility of rural areas is therefore based on a range of fifteen indicators in total. The extent of the information is synthesized by applying a factor analysis and then a classification method, which allows us to propose a typology of rural areas according to their degree of fragility.

Our study area concerns all the municipalities of the eleven provinces crossed by the new highway *Via Egnatia*. By characterizing the nature of the economic dynamics observed in these territories, it will be thus possible in the future to assess the contribution of the *Via Egnatia* to the development of the region north of Greece.

## 2. Origin of the concept of fragile space

The concept of fragile space is difficult to define and quantify. It is often employed by researchers without giving a precise definition. Specifically, the concept of fragility has been used by "many European authors" (Simard, 2003), as P. Houée, H. Gumuchian, F. Bret, Ch. Mignon and many researchers of CERAMAC (P. Estienne, A. Fel, J.P. Diry, L. Rieutort,...) worked for a long time on this notion. The emergence of the concept of fragility in the writings of geographers and the studies of the planning organizations (formerly DATAR, SEGESA and SEDES) dates back to the 1980s. The concept of fragile space takes over notions of peripheral space, marginal space and then underprivileged spaces, which were already used to qualify the "regions that do not go well" (Rieutort, 2006) or those distant clusters growth.

Very early in fact, economists interested by space issues have stipulated that the organization of space is based on a dualistic model center - periphery. The theory of center / periphery is indeed one of the first theories of spatial analysis (Hypergeo, 2004). It begins with an empirical observation that the space is not homogeneous; it is the place where many multiscale spatial differentiations are produced, attributed to various forces. The Marxist model center-periphery appears first in the writings of the German economist and sociologist Werner Sombart in 1902 (modern capitalism), before being retaken by the theorists of imperialism (Luxemburg, Bukharin), then by development economists such as Prebisch (1950), Emmanuel (1969) and Samir Amin (1973) and finally authors that propose to relativize the model, to go beyond (the economy of archipelagos P. Veltz) focusing on the balance of centripetal and centrifugal forces (new economic geography of Krugman). The eminent French historian F. Braudel in his book "Material civilization and capitalism, fifteenth-eighteenth century" (1979), also had recourse to the notion of periphery or marginal

space to qualify the structure of world economy, composed by nested or juxtaposed space but interconnected, the heart, the center and periphery.

The model Center/Periphery describes the later as the result of unequal exchange relations between the center and the periphery. Underdevelopment, we should say today the low dynamics of a space is attributed to the nature of its relations with the central poles. Between the center and periphery the exchanges relations are asymmetrical and of various natures: people, goods, capital, information, etc. The center that benefits more from these relationships dominates the periphery which is then down in the spatial hierarchy.

This approach in terms of center and periphery is very limited and places the peripheral areas always in a situation of dominance by the center. It's certainly useful to explain in part the causes of this structuring of space. It is however not sufficient to apprehend all the complexity of the spatial system at different scales. It is necessary to relativize this model and this was done by number of authors (Cattan, 2006, Grataloup, 2009), highlighting other structured components of space (archipelagos economy) and other forces in effect (economies of agglomeration and dispersion, integration into networks, information ...). The center periphery model needs to evolve to be able to explain the different forces that cross the spaces.

The concept of marginality (*espace marginal*) is associated with the notion of periphery "as a limit or boundary, as a march or area, the marginal is always at a certain distance from the center" (Roux, 1992). However, even if the concept of marginal is often associated with the couple Center / Periphery, the meaning attributed to it is different. Marginality is primarily considered in terms of space, distance and isolation from the center. For Bailly (1986), "The marginal is a state of isolation in a relationship (whether wanted or not) that generates a specific spatial practice which contributes in turn to exclude interaction process. This is not only the unequal relations which are a problem but the remoteness, isolation and specifically the lack of these relationships that explain the marginality. This recent years have seen the emergence of new approaches inspired by the sociology and psychology to explain the marginality not only from the spatial point of view but also from the social and cultural one. Authors like E. Durkheim consider the marginality as a need for change and the evolution of society (Roux, 1992).

The approach in terms of marginal space suffers like the model center/periphery from several limits. To reduce the concept of marginality to a question of distance or remoteness from the centers is an unsatisfactory approach of spatial dynamics. There are many other factors involved in the marginality of spaces. We must therefore go beyond this approach in terms of distance, especially today, with the improving of accessibility and mobility which reflects the relativity of the notion of distance. There are many other approaches of marginality that take into account various causes. However, they suffer from the absence of a precise definition (Dugas, 1988).

The notion of underprivileged space appears in the years 1975 (Rieutort, 2006) with the beginning of the European CAP for underprivileged areas in which the mountain areas occupy a great place (Directive 75/268 of European Union). This recognition is based on a definition of an underprivileged space taking into account its intrinsic characteristics. It is therefore regions with a range of disabilities "imposed from the beginning by the nature (climate, slope, poor soil ...), making them fragile and uncompetitive in a global environment increasingly competitor. Contrary to the notions of periphery defined by the nature of its relationship with its environment and marginality defined by the absence of structural relationship with the poles, the notion of underprivileged space is defined relatively to its internal characteristics. Space is classified as underprivileged when it is less well endowed with factors propitious to development.

It is finally through geomorphologic disability (relief, slope) that disadvantaged areas are

defined at European level. These objectives handicaps are supposed have a direct influence on the agricultural economy (low productivity) of these areas. A weakness in agricultural activity generates the population decline (low density) and difficulty in preservation of environment. This approach is restrictive as it mainly underlines the "agro-economic approach of the rural spaces" (Duquenne, 2009). The association "agricultural and rural" is more and more outdated with the emergence of new functions (consumption spaces) and new activities in these areas (tourism, residence ...). Moreover, the approach based on physical disabilities tends to limit the concept of disadvantaged space to the rural areas (Goussos, Duquenne, 2006) while disadvantaged spaces are also present in urban areas.

After 1985, the concept of fragile space is more and more bring up, especially in France where different studies, implemented by institutions as DATAR, SEGESA and SEDES, try to detect the contours and the contents of this type of space and defined it as a predominantly agricultural area, where farms have been less modernized and diversified, and the other sectors of activity underdeveloped (Simard, 2003). For the Ceramac<sup>1</sup>, the comprehension of fragile space requires to identify all its contours that overstep the agricultural components and include demographic structure as well as tourism, industry, transports, policies. The definition of the fragile space is nevertheless vague and according to J.P. Diry, refer to "rural areas of developed countries, confronted to integration problems into a modern economy, which results in demographic (in particular the decrease of population), economic and sociological original characteristics". These areas classified as fragile or sensitive "often occur in the uplands. But the rule is not absolute: some mid-European mountains have known for decade's sustained development while the plains and uplands suffer economic and social lethargy and are therefore stored in fragile areas". The complexity of the phenomenon justifies precisely, as mentioned by the researchers of Ceramac, the necessity "to develop appropriate methods for an appropriate approach" of the fragile space.

### **3. Conceptual approaches of fragility: Towards a territorial approach**

In the 1990s, rebelling against the overly optimistic visions of rural renewal (Kayser, Chapuis, Datar ...) F. Bret (1991) proposes to review the concept of fragility. He defined the latter as "a complex system that cannot be summarized through the analysis of population trend ... the fragility is expressed through three components: the human, the economic and the spatial one ... this leads to think about indicators to be used (analytical approach), required information and assessment of degrees of fragility (synthetic approach)". He proposes a geographical approach, which from his point of view is the most comprehensive and facilitate the identification of all the facets of fragility. In order to avoid the duplication of the various analysis of fragility phenomenon, F. Bret offers a new vision based on the three components of fragility and takes care to eliminate false tendentious indicators. He suggests new parameters taking into account the true mechanisms of fragility as well as a transversal lecture of the problems in order to eliminate partial approach, and finally a systematic retrospective applied for indicators. The author argues that it is necessary to take into account the basic principles of geography to understand the fragility. These principles are five: the notion of limit (which geographical limits to the fragility), the concept of degree (extent of fragility), the concept of mutation and disruption (evolution of fragility), the concept of recurrence (is it a cyclical or long-term phenomenon) and finally the concept of relativity (the fragility is relative). It is also necessary in the definition of the fragility to distinguish the difference between the result, the process and the problem of fragility (Piveteau, 1995).

It is therefore a **geographical approach of fragility** that is proposed by F. Bret but this approach has its own limits due to the fact that it is difficult to apply this method at a large scale as region or province. This approach is very interesting for the study of small rural or urban areas by attempting to identify and understand how society is evolving over time

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<sup>1</sup> Ceramac = Centre d'Etudes et de Recherches Appliquées au Massif Central, à la moyenne montagne et aux espaces fragiles

toward a state of fragility. The rigor of such an approach makes it difficult indeed to go beyond the municipal level, or sub-communal. Moreover, this approach neglects the role of actors and capacity of local actors to impulse actions. F Bret does not refer to the problems of coordination and valorization of resources. Beyond the objective handicaps that may limit the development of a territory or increase its fragility, the failures of actors coordination, their inability to build close relationships and latent resources or participate in the specification of the latter, are all criteria necessary for understand the fragility.

Despite the numerous work and publications on fragile rural areas, some difficulties still remain in terms of theoretical but also empirical views. Theoretically, there is no specific conceptual approach to define fragile space (Rieutort, 2006, Couturier, 2005). That is why Couturier proposes two approaches:

A **systemic approach of fragility** which consider fragile areas as a systems that ' components and relationships between these components are marked by a low stability in the short or medium term "and strongly" dependent on external factors themselves labile and are not likely be influenced by the local systems'. This approach is like the model Centre / periphery that consider the dependency relations as fundamental to explain the phenomena of peripherality.

A **dynamic – action approach of fragility** "to which the initiatives of local actors are deployed in an environment unfavorable to their success and their synergy." So it is the environment in which the actions of local actors are deploying which is in question. This approach is considered as deterministic (Rieutort, 2006).

Nowadays, there is a "limit" to these theoretical approaches, as new dynamics in the fragile regions are ongoing, they result in part from mutations in the world context with globalization, and in the local context with the emergence of local (Guigou, 1997, Pecqueur, 2006). Moreover, in the last two above mentioned approaches, the very important temporal dimension is absent. Indeed it helps to understand how the process of fragility settled and how it is possible to be transformed from the state of fragile to the state of emergence or dynamism.

Wanting to go beyond the limits of both approaches in terms of peripheral, marginal and underprivileged space on the one hand, and the three approaches of fragility in terms of geographical, systemic and action perspective in the other hand, we propose a territorial issue putting in the center of this phenomenon the question of coordination between actors and construction of resources. Such an approach supposes to take into account the temporal dimension. Thus, if fragile areas exist today, this has not always been the case. The example of the highlands is significant. While some plains overvalued today were synonymous in the past of swampy areas infected by epidemics of all genres and mountain inhabited by high densities of population, and a remarkable flourishing economic activity, nowadays, the relationship was reversed (Sivignon, 1999). This transformation process takes years to settle, as the fragility or the dynamics of a space.

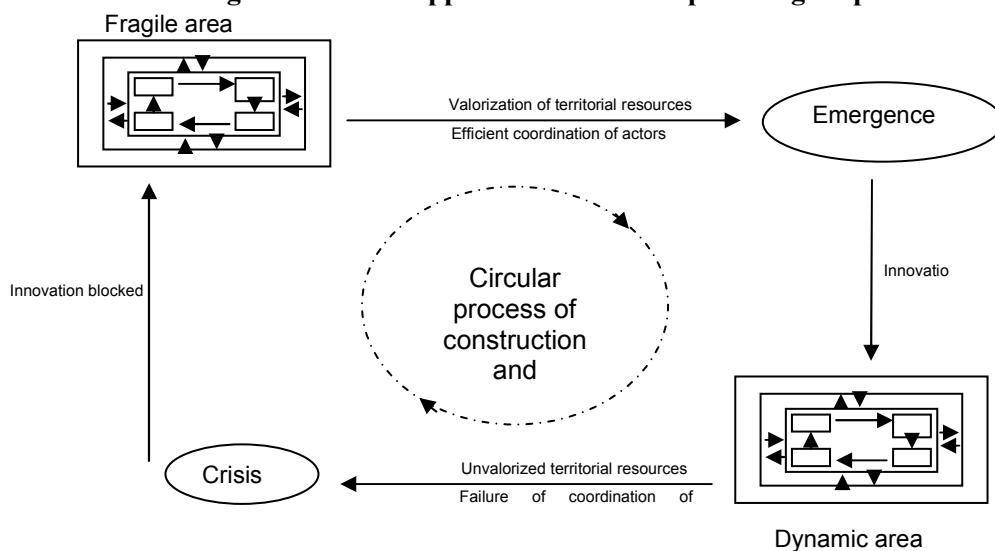
Thus our conception of fragile space attempts to introduce a dynamic dimension. The fragility of a space is not conceptualized as a state, as is the case of disadvantaged areas, or as the result of a set of relations of subordination to a dominant space. We define it as a complex process, a movement in time that has transformed space formerly well-integrated, to space today devitalized. This temporal dimension is important, because it removes all forms of determinism to this definition. In other words, if there is fragility, it is due to unfavorable conditions inside and outside the territory. This conception means as well, that a fragile space or become fragile can be transformed into a dynamic space, if the internal and/or external conditions are transformed and become favorable.

Fragility is for us a complex process of failure of internal and/or external coordination and

deconstruction of resources. By coordination internal/external we mean really the type of relationship between actors within and outside the territory. Reformulated otherwise, the fragility is the result of a non irreversible process of deconstruction of resources and relationships between the different actors, due to mutations in the internal as well as external environment. Even if objective handicaps are important to detect the unfavorable conditions (state of fragility), the two dimensions of internal and external coordination are determinant for the better understanding of the process in itself and its different degrees (Duquenne M.-N, 2009). Moreover, coordination requires proximity between actors and local societies which is not exclusively a geographic one. Consequently, it is necessary to take into account the level of proximity internally within the territory and then externally with the environment and therefore, propose appropriate indicators to identify these two facets of proximity. In definitive, to the objectives handicaps, our approach includes two others dimensions of fragility: the coordination between actors and the construction of resources.

Fragile areas are not condemned because the same process that affects them can be transformed to reconstruct both new resources and new forms of coordination. In this case, we must speak of innovation and innovative environments. The transition from a fragile state to a state of less fragility or dynamic is related to the action of actors - at various spatial scales -, especially as regards their ability to construct endogenous or exogenous resources and promote innovation. So it is a territorial approach that is underlying our definition based on the resources, coordination of actors and innovation. We can represent this by two design patterns, one reflecting the internal and external relations of the fragile space, the other circular, a loop of actions that can be positive or negative.

**Fig1. Territorial approach to the concept of fragile space**



The relevance of this loop (Fig1.) passing the territories from a state of fragility to a state of emergence or at least of new dynamic is illustrated through numerous studies (Kayser, 1993) and INSEE data on the new realities of fragile areas. From the fragile mountainous areas in the Massif Central to the small isolated rural area, Ryedale in North Yorkshire in the UK, new positive trends are evident everywhere in Europe. Globalization seems to challenge the dominant development model based on intensive agriculture, which is especially in disadvantaged areas. Farming is changing, new requirements appear, and they are benefit to fragile areas that have seized this opportunity. New offerings in terms of products of quality, and guaranteed quality label participate in the rehabilitation of agriculture in fragile areas. The global society propagates new values, new concerns (environment) as well as a new positive perception of the fragile rural areas. The low density, natural landscapes, rural amenities, lifestyle and even the isolation of fragile areas, especially mountainous strengths and become even resources that urban society wishes to consume. The service sector with tourism, small industries and handicrafts offer new opportunities and adapt to globalization. The low level of population in fragile areas seems to reverse at least in some territories. Also, there is "new

uses of space, combined with new socio-spatial practices (mobility, multi-residence), demonstrating a 'natural need' from urban populations" (Rieutort, 1997). It is clear that, those mutations transform certain fragile areas in emerging territories. These changes confirm our approach of fragility as a process not irreversible, but in constant mutation and the importance of both resources and coordination of actors that turn opportunities into new applications and projects.

The emerging new forms of rurality are very different from each other. The type of resources used and the nature of the coordination lead generally to varied models of rural societies (Houée, 1990). The fragility of these spaces is also changing, since according to the development model adopted, rural societies suffer more or less the constraints inherent in these models. Also to demonstrate the relevance of the loop action / feedback fragile rural areas, remember that 30-40 years old, fragile rural areas have experienced major changes, breakups, crisis and rebirth (Kayser, 1993). The demographic crisis has reduced the population of the French countryside from 40% of the total population in 1950 to 20% in 1994 (John, 1995). Perceived as structural (Beteille, 1981) this demographic crisis is fading, however, in the 1980s and 1990s and 2000s have witnessed a turnaround since the campaigns are gaining new residents (Diry, 1995), including campaigns fragile. The farm crisis then, which had influence greatly farmers is considered by Hervieu (1993) as a crisis of society and of civilization. Farm households that represent 48% of total households in 1950 are only 20% of the total (John, 1995). This agricultural crisis let however for the development of an industry "by specialized labor pool: the wood industry (Jura, Alps, Vosges), textiles and clothing (*Bas-Dauphiné, Vosges, Aube, Choletais, Vendée, Roanne, Sud Ardèche, Nîmes, Castres, Céret*), furniture, mechanical, food, stationery (Charente Valley), leather, footwear (Rochechouart Notron) etc.." (John, 1995, p. 20), industry which in turn enters into crisis in the 1980s. Finally, a third transformation in the countryside is the way to live and work. There is a separation between place of residence and work that generates part of demographic and economic renewal of rural areas from new residents. The rural fragile areas are transformed from territories of especially agricultural production to territories based on residential economy. The income received by the campaigns from their new permanent residents (commuters, retirees, new residents ...) and temporary (Tourists) dominate their new economic structures (Davezies, 2005, Talandier, 2007).

An approach that is complementary to what we propose is that of Laurent Rieutort (2006), which depend the fragility of «representations of each other». This conception is joined by B. Prost (2004) "About the territorial margins, which are" a transitional element in the perception and organization attributed by men to the territory they represent, and P. Couturier (2005) for whom "the marginal areas are not subject to collective practices or representations, that may be embedded in processes of construction of their identity. "Now these imaginary are also put forward by local actors steeped in pejorative perceptions and wish to underline the fragility of their situation, or express a feeling of abandonment." This approach is quite complementary to our territorial approach of the notion of fragile space that, in the process of construction or deconstruction, the nature of the representations that are conveyed in the territory are crucial. They allow the awareness of disabilities but also the potential that may generate a new dynamic.

#### **4. The evaluation of fragility: methodology and tools**

From the methodological point of view, it is first necessary to highlight the lack of work about the concept of rural fragility. When they exist, they are limited and varied. Several authors also employ the term of fragility without giving a precise definition. The physical criteria (topography, slope ...) are often most used with demographics variable. Both are supposed to have direct effects on employment and incomes of rural areas. The analysis often focuses on the agricultural sector since it dominates the countryside until the last decade. The proposed method aims to overcome these limitations by taking into account two fundamental characteristics of fragility as defined above: the complexity and temporality. They are

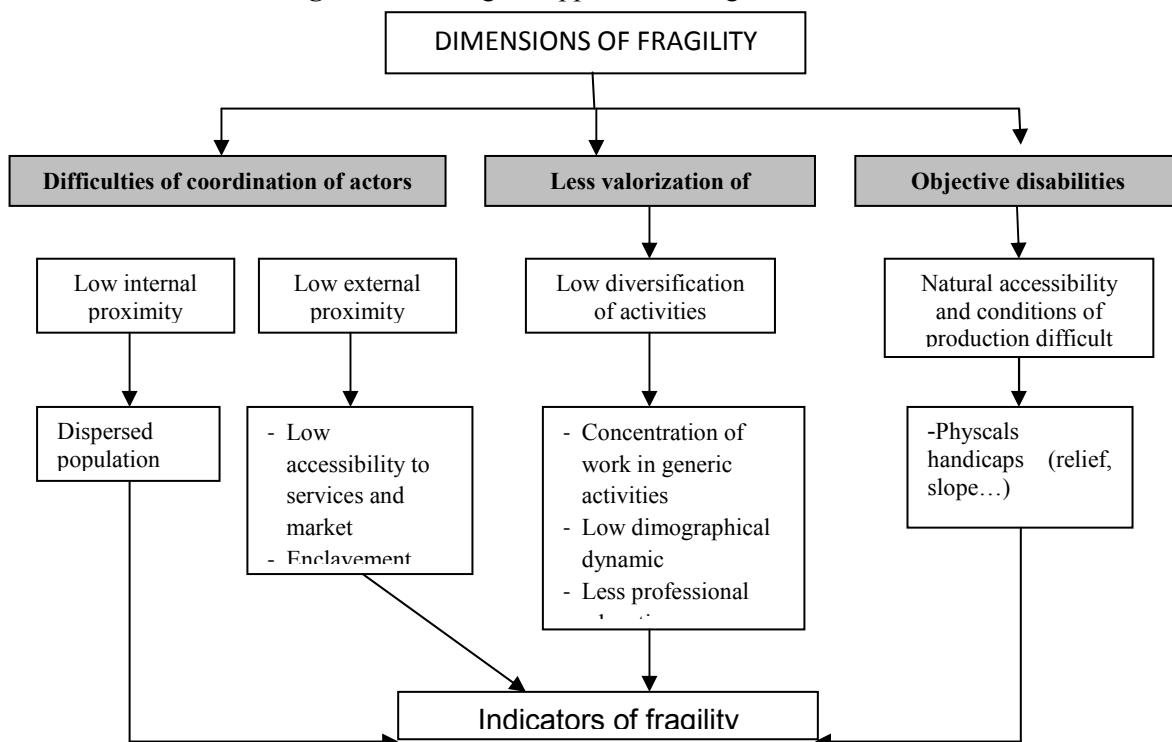
nevertheless interesting approach to define the fragile rural by authors like Gumuchian (1990), Bret (1991) and Simard (2003). These approaches are all trying to construct a summary measure of fragility.

This work is an effort in modeling and understanding the multiple facets of fragility by constructing a definition essentially operational. The method we propose is far from canalizing all the complexity of the phenomenon of the fragility of rural areas in some indicators. They suffer from two major constraints: lack of data on some phenomena at the local level, and the difficulty to transcribe some qualitative variables into quantitative data (perceptions). It is useful to propose new tools to better understanding the complexity of the rural fragility. We use original indicators built specifically to identify the phenomenon. However, the proposed indicators must be regarded as indirect measures of the three dimensions of fragility taking in account in this article. The use of sophisticated methods of factor analysis and k-means classification will allow us to achieve a typology that goes beyond traditional approaches in terms of underprivileged areas, marginal or peripheral.

The approach presented below is a macroscopic approach, applied to Greece. It is therefore based on geographical and socio-economic data at relatively disaggregated territorial units, namely the Greek demes. The demes are the primary components of administrative regions (LAU1 the European classification). In fact, at this scale can be collected in a systematic way, many data while the analysis at the second level of administrative units (Dimotiko diamerisma, LAU2) reduces substantially the field of study, because of lack of data. Most of the data are related to the last population census of Greece (2001). Moreover, the macroscopic approach requires that the chosen indicators are "clear", thus directly or indirectly quantifiable, easily interpretable and allowing to transcribe the various components of the phenomenon in space and in time.

In order to evaluate the three dimensions of rural fragility: objective handicaps, difficulties of coordination and degree of diversification of resources (see fig. 2), we have selected 15 indicators that can be considered at least as approximated measures that reflect the components of fragile areas.

**Fig2.** Methodological approach of fragile rural areas



**a.** The **objectives disability** referring to the mountainous terrain and physical disabilities that impede mobility and proximity. To evaluate these handicaps, we selected four (**4**) indicators:

- **Id1:** The average height of DD forming each deme, weighted by their respective population;
- **Id2:** the average height of the same DD weighted by their respective area;
- **Id3:** the part of population of deme living in a mountainous DD, as defined by the National Office of Statistics;
- **Id4:** the part of the area of the deme classified as mountain area by Esey.

**b.** The **coordination problems** although difficult to assess, the weakness of coordination can be approached by using indirect indicators. Coordination is evaluated in its internal and external dimension. The **internal proximity** or face to face, even if it is not sufficient to encourage people to cooperate, is a permissive condition for Coordination (Rallet, 1995). If the capacity of cooperation and coordination cannot be evaluated directly, we suggest using indirect measures reflecting the permissive condition. Two (**2**) indicators can reflect more or less the internal proximity:

- **Id5:** population density (inhabitants per km<sup>2</sup>), this indicator is generally very used in the analysis of the rural fragility;
- **Id6:** the part of population living in DD characterized by the National Office of Statistics, as urban. These are districts whose main town has a permanent population of more than 2,000 inhabitants.

The **External proximity** captures the degree of integration or marginalization of rural areas. It refers to accessibility to services that are largely concentrated in the center of the department and local employment areas. It is here approached through four (**4**) indicators are:

- **Id7:** the degree of contiguity of order k at the administrative center of the department. This level corresponds to the number of borders (k) to cross to go from one deme to the main town in the department;
- **Id8:** intensity of road infrastructure, measured by the number of km of roads to 10 km<sup>2</sup>. This ratio refers directly to the notion of accessibility;
- **Id9:** the intensity of alternant migrations between home and work. This indicator measures for each deme, the weight of alternate migrations compared to total assets residing in the same deme. Although this kind of mobility occurs mainly in and around urban areas, it was shown that it also presents in the rural areas, a high variability, reflecting a differential of spatial proximity that is not negligible (Duquenne, Kaklamanis, 2009);
- **Id10:** the autonomy of the labor market measures the ability of the deme to use its own assets. This indicator gives us the number of jobs of the deme provided by the active non-mobile for 100 reels jobs within the deme (jobs covered by the non-mobile assets and mobile assets whose place of residence is in another deme). It is between 0 and 100. A strong autonomy tends to be a failure in integrating the deme in regional economic activity, often coupled with a lack of attractiveness.

**c.** The **degree of diversification of economic and human resources**. Five (**5**) indicators have been selected to consider the capacity of valorization of local resources:

- **Id11:** the population change, measured between the two last population censuses (1991-2001). A net loss of population reflects the lack of attractiveness of the deme and therefore its difficulties to maintain the local workforce and the economic activities;
- **Id12:** the standard index of employment concentration (entropy). Calculated from the distribution of employment in the branches of economic activity, it evaluates the degree of diversification of the economy. Because this indicator has been normalized,

- it is between 0 (absolute concentration) and 1 (equal distribution of assess between branches);
- **Id13:** The indicator of aging, ratio giving the number of persons aged 65 years and over per 100 inhabitants of the deme.
  - **Id14:** The indicator of youth ratio giving the number of persons under 15 years per 100 inhabitants of the deme. This indicator permit to discuss about the issue of keeping young families in the deme, so that coupled with the previous indicator, it may reflect a permissive condition for future dynamics.
  - **Id15:** The degree of higher education of the population at age of working. This indicator gives the number of persons who have acquired a higher education per 100 inhabitants aged 20 years and older. It can allow - at least indirectly – evaluating the ability of local population to valorizes its resources and know-how.

From all this indicators, we propose to conduct a principal components factor analysis. This gives us the possibility to synthesize voluminous and complex information by producing composite indicators of fragility (factor axes). From these new composite variables, it is possible to realize a classification of all demes studied according to their more or less pronounced fragility.

The approach presented below is a macroscopic issue, applied to Greece. It is therefore based on data collected at relatively disaggregated territorial units, namely the Greek demes. The demes are the primary components of administrative regions (LAU1 in the European classification). In fact, at this scale can be collected in a systematic way, many data while the analysis at the second level of administrative units (Dimotiko diamerisma, LAU2) reduces substantially the field of study, because of lack of data. Moreover, the macroscopic approach requires that the chosen indicators are "clear", thus directly or indirectly quantifiable, easily interpretable and allowing to transcribe the various components of the phenomenon in space and in time.

## **5. Implementation of the proposed methodology: the case of the provinces crossed by the new highway Via Egnatia in the Northern of Greece**

Factor analysis and especially Principal Component Analysis has been implemented in order to detect the structure in the relationships between the selected 15 above indexes and to reduce the number of initial dimensions. The analysis concern the 200 local administrative units (LAU1), located in the North of Greece around the new Egnatia Road (see Fig. 3).

Using the Kaiser criterion (1960) which is the one most widely used, four (4) factors - with eigenvalues greater than one - have been retained. With a percentage of total variance accounted for by these 4 extracted components around 76%, the complexity of the initial dataset has been considerably reduced. The solution obtained can be considered as a satisfactory one: from 15 correlated dimensions, the dataset has been reduced to 4 uncorrelated dimensions. Moreover, the sampling adequacy measured by the Kaiser-Meyer-Olkin index is verified ( $KMO = 0,743$ ) while extraction communalities that estimate the variance of each variable taking into account in the final solution, are all pertinent (more than 60% of the variance for 13 variables while the two other are higher than 46%).

Consequently, the degree of fragility relative to the 200 examined municipalities can be explained by the following uncorrelated components:

- The first one, which by itself explained over 43% of the total variance in the 15 variables, had high correlation with the 4 variables related to objective handicaps and can be interpreted has a measure of marginality due to **geomorphologic disability** and mountainous character.
- The second one, corresponding to 15% of the total variance, had high correlation 5 variables related with the capacity to diversify economic activities and valorize the local resources and consequently to offer to local population, perspectives of employment

(propensity for a municipality to employ its own labor force). Considering also the high correlation with labor mobility, this component can be interpreted as a **degree of economic diversification and integration** in the regional economy. In fact, developed home-to-work commuting from and to the municipality (Out and in flows) reflects the strength of functional linkages between this municipality and its regional environment.

- The third one, which explained 10% of the total variance, is correlated with 3 variables related to the demographic structure and the degree of urbanization of the municipalities and communes. There is an especially high correlation with the ageing index and the percent of young population less than 15 years old. This component can be interpreted as a **measure of human resources and demographic dynamics**.
- The last one, which explained around 8% of the total variance, is highly correlated with population density and density of road network and to some extent, with contiguity level of municipalities and communes with the main urban center of the province. This component can be interpreted as a **measure of proximity and permissive condition for coordination** between actors.

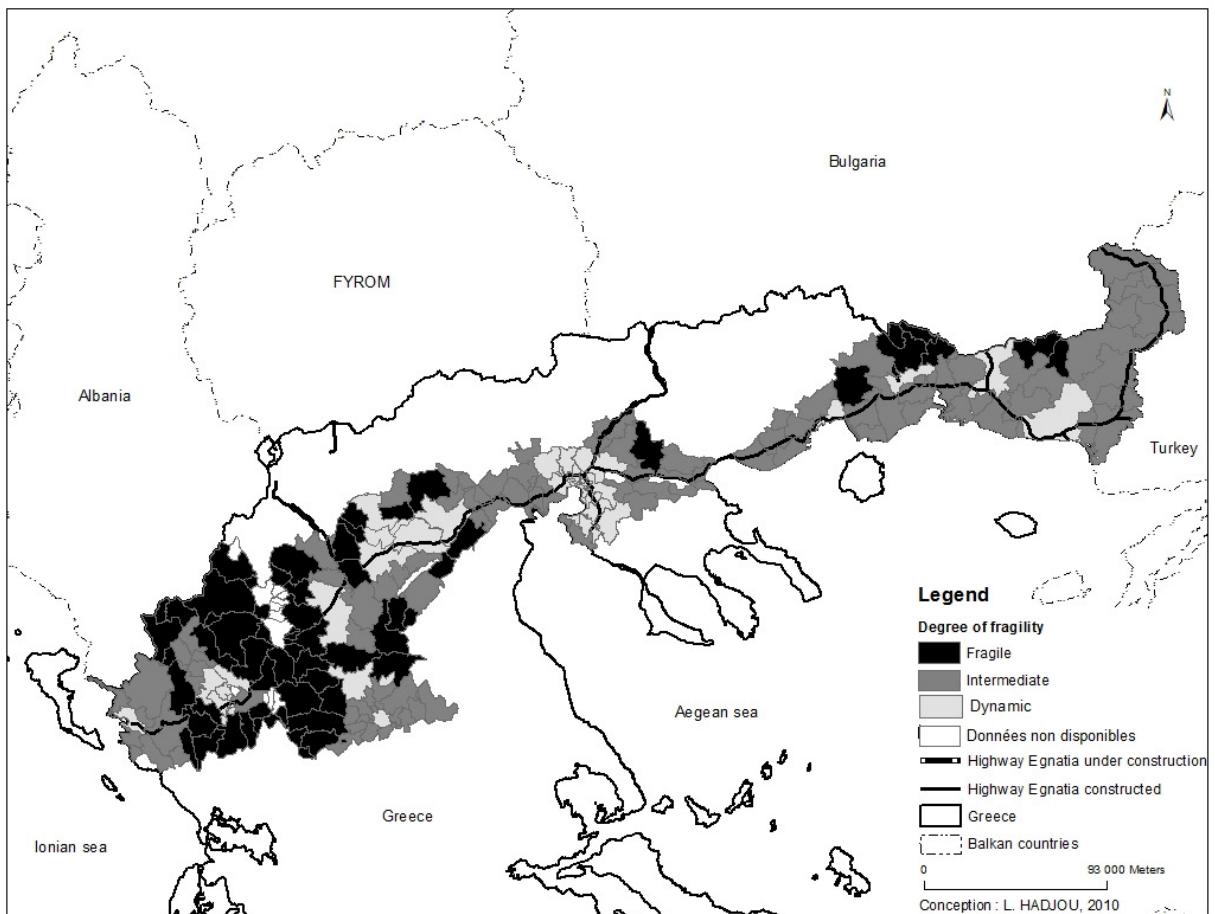
On the basis of these four new composite variables, we proposed to classify the 200 municipalities and communes, using the k-means cluster analysis method in order to detect different groups of municipalities and communes as regards their fragility's situation. The goal of this method is to obtain an appropriate partition of the 200 municipalities so that the local territorial units within a group have to be similar to one another but different from the territorial units included in other groups.

The implementation of this method allows us to detect three meaningful groups with final centroids clearly distinct.

- The first group incorporates 45 **dynamic urban or peri urban municipalities** (Fig 3) with an important demographic growth in between the two last censuses, around 35% on average. The majority of them are located at proximity of Thessaloniki, the most important urban center of Northern Greece. Moreover, all the administrative centers of the provinces cross by the new highway Via Egnatia are included in this dynamic group. These urban municipalities without objective handicaps, present high proximity indexes (internal and external) with a diversify production system and qualify labor force. As it was expected, they are also characterized by intense home-to-work commuting (table 1), especially in terms of incoming mobility, confirming their important attractiveness.
- The second group of municipalities is an **intermediate** one, presenting some aspects of fragile areas but not necessary in a very intense way. This group concerns nearly half of the examined municipalities and communes (95). With only 22% of the population living in urban areas<sup>2</sup>, these municipalities are mainly rural. If they maintain their population, they nevertheless present a relatively high ageing ratio: the percentage of elderly people stood at 22% compared with only 13% for the dynamic municipalities.  
A large part of these intermediate territorial units are located in the region of Thraki, at the borders with Bulgaria and Turkey (North-East of Greece). Their relative fragility is a direct consequence of the geographical situation and remoteness from decision centers. The other municipalities included in this 2<sup>nd</sup> group are located in semi-mountainous areas of Ipiros, Central and Western Macedonia. If they are partly confronted to objective handicaps, they generally gain from relative proximity to urban centers (convenient accessibility) so that, they are still at least partially integrated in the regional economy. Finally, if the territorial units of the 2<sup>nd</sup> group are not in the present devitalized, they are confronted to some unfavorable conditions that they have to transcend, if they want to stop the process and develop new perspectives.

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<sup>2</sup> As defined by the National Service of Statistics, a local territorial unit (LAU2: Dimotiko Diamerisma) is defined as urban if at least 2000 inhabitants live in its main commune.

**Fig3. Degree of fragility of northern Greek municipalities (Δήμοι)**

- The third group is composed of 60 municipalities and communes mainly located in the mountain of Ipiros. With only 11% of population living in urban areas as previously defined, these municipalities are mainly rural and present an **intense degree of fragility**. The population density is especially low (14 inhabitants by km<sup>2</sup>) and at least three time less than the second group.

The geomorphologic and demographic handicaps are strongly marked, comparatively to the previous group of territorial units. Most of these municipalities have a weighted altitude more than 700m. As we can observe, they are not anymore able to maintain their population and are confronted to a decrease in between the last two censuses about 10% by average. The ageing process is especially intense with a percent of ageing population greater than 30% while in some cases, it can reach 40%. Moreover, the median age is nearly 67 years old against 42 and 58 respectively for the 1<sup>st</sup> and 2<sup>nd</sup> groups.

**Table 1: Main characteristics of the municipalities cross by the new Via Egnatia**

	Groups of municipalities		
	Dynamic	Intermediate	Fragile
Number of municipalities	45	95	60
Population variation	34,5	-,4	-9,4
Average weighted altitude	220	183	777
Percent of population living in mountainous areas	3,7	7,3	91,2
Percent of mountainous surface	15,0	14,4	92,4
Population density	3339	50	14
Percent of urban population	79,5	22,5	11,1
Median age	36,3	44,2	50,1

Ageing ratio	13,5	22,5	30,2
Youngness ratio	17,1	13,9	11,6
Percent of High education level in population more than 20 years old	15,9	5,1	4,6
Contiguity index	,66	1,76	2,38
Road network density (km for 10 km <sup>2</sup> )	36,7	3,9	2,7
Outgoing mobility	87,2	27,4	24,8
Ingoing mobility	58,3	9,6	8,2
Index of home-to-work commuting	,68	,25	,18
Index of entropy	,910	,725	,692

It is undeniable that all these fragile municipalities suffer from a lack of internal and external proximity. It is not only a question of lack of contiguity with the provincial administrative center (order of contiguity greater than 2) but also a question of low density of road network which brakes the home-to-work commuting and finally reinforces their objective handicaps. Contrary to the 2<sup>nd</sup> group, we can admit that the third group of municipalities is in an advanced stage of fragility with a deficient diversification of economic activities and services. This situation combined with the distance, explains that migration to urban centers is still continuing. For these municipalities, one of the new challenges is effectively how they could benefit of and valorize the recent highway *Via Egnatia* in order to reverse the actual tendency.

## 5. Conclusion

The territorial approach developed in this article, based on the three dimensions of Fragility, specifically the lack of coordination of actors, the low level of valorization of resource and the objective disabilities, proves its effectiveness in discriminating between the dynamic and fragile areas. This more clear approach allows us to go beyond the traditional approaches of fragile areas, since in addition to the factors of distance and objective disabilities, other indicators reflecting the organization of local territories are taken into account.

The implementation of this approach to the Greek municipalities crossed by the *Via Egnatia* highlight three groups with a degree of fragility more or less intense. It is important to underline the fact that some municipalities, even if they are characterized by high rates of disability in terms of objective handicaps and distance, are not classified automatically in the most fragile group.

Urban areas having a high degree of coordination of actors, a more diversification of resources and low disabilities are thus, classified as the least fragile of the region. The peri-urban areas, municipalities suffering from low degree of proximity to urban centers are classified as intermediate degree of fragility. The last group of municipalities that are heavily concentrated in Epirus combines, at the same time, objective disabilities, low internal and external proximity and a low degree of diversification.

Our methodological approach built on an original set of indicators and methods of factor analysis and classification permit to capture interesting dimensions of fragile rural areas that are generally neglected, specifically the permissive conditions of coordination between actors and the capacity to valorize local resources. This methodology of classification of spaces according to their more or less degree of fragility is of course very open and could be improved.

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