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Research Article

# Formal Comparison of Spatial Socioeconomic Units Based on their Typological Properties

Athanasia **DARRA**[1*]

[1]*National Technical University of Athens, Greece*

## Keywords

*Spatial Socioeconomic Units,*
*Typology,*
*Properties,*
*Similarity,*
*Formal Comparison*

## Abstract

Spatial units often serve as a reference to socioeconomic phenomena constituting what is known as spatial socioeconomic units (SSEUs). SSEUs find a wide application in geography. To understand and compare different typologies of SSEUs, it is necessary to examine the most important part of their definition which is their properties, mainly spatial but also non-spatial. SSEUs defined in this framework can be qualitatively compared based on their properties using the efficient method of Formal Concept Analysis (FCA). Basic elements of FCA are (a) the Formal context which associates objects and attributes via a relation, (b) the Formal concept or category, which is a collection of objects which share common attributes, (c) the hierarchical relation from a more general to more specialized concepts, and (d) the concept lattice which shows all formal concepts of a formal context. This paper presents an FCA-based comparison of SSEUs typological properties using two indicative examples.

***Highlights:***

- *'Socioeconomic units*
- *Geographic typologies*
- *Spatial properties*
- *Semantic similarity*



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## 1. INTRODUCTION

An essential category of spatial phenomena which are of importance to geography, are those expressing the socioeconomic dimensions of space. Entities and units defined according to their socioeconomic characteristics are thus called socioeconomic units (SEUs). When the spatial properties and behavior of SEUs becomes particularly important, these units are known as spatial SEUs or SSEUs (Frank et al., 2001).

SSEUs can be administrative units, post codes, census tracts, electoral wards, service areas, design regions, cadastral parcels, etc. It is obvious that not only there is a variety of SSEU types but they can also be differently defined or understood by different countries, scientific or professional disciplines, organizations, cultures, etc. Without a thorough understanding of such semantic similarities or differences, it is impossible to effectively or correctly compare and analyze socioeconomic data or perform data integration. Therefore, it is of utmost importance (i) to have instruments for the ontological definition and comparison of SSEUs, (ii) to be able to semantically compare concepts or objects using similarity measures, and (iii), to have visual means of portraying such properties. Ontological issues of SSEUs have been already addressed by Frank (2001), Raper (2001), Smith (2001), and recently by Darra & Kavouras (2019).

This paper focuses on the different properties that help define SSEUs and presents ways of semantically comparing them. There are various conceptual tools and structures available, but here, a Formal Concept Analysis (FCA) approach (Ganter & Wille, 1999), is employed as a formal method for comparing concepts based on their common properties. It also uses the concept lattice, an informative line structure produced by FCA which helps to visually interpret SSEU concepts and relations.

In the rest of the paper, Section 2 presents the background knowledge about spatial socioeconomic units, their characteristics, properties and relations, as well as previous work on the definition of SSEUs. Section 3 introduces specific conceptual structures and FCA for the comparison and analysis of such units. Section 4 presents two exemplary cases of SSEU comparison using FCA and concept lattices. Concluding remarks are the subject of Section 5.

## 2. BACKGROUND

### 2.1 Spatial Socioeconomic Units (SSEUs)

The term "Spatial SEUs" first appeared in a Specialist Meeting: *"Formalizing and Representing Change of Spatial Socio-Economic Units in GIS",* which took place in Nafplion-Greece in 1996, organized in the context of ESF-European Science Foundation GISDATA Program. The objective of this meeting did not only address the definitional and ontological aspects of SSEUs, but also made significant progress about Change – a notion interweaved with the difficult concept of Time, which till then had not received sufficient attention. The edited volume, "*Life and Motion of Socio-Economic Units"* which followed (Frank et al., 2001), included a first theoretical approach to the typological differences of SSEUs, mainly in reference to their spatiotemporal behavior.

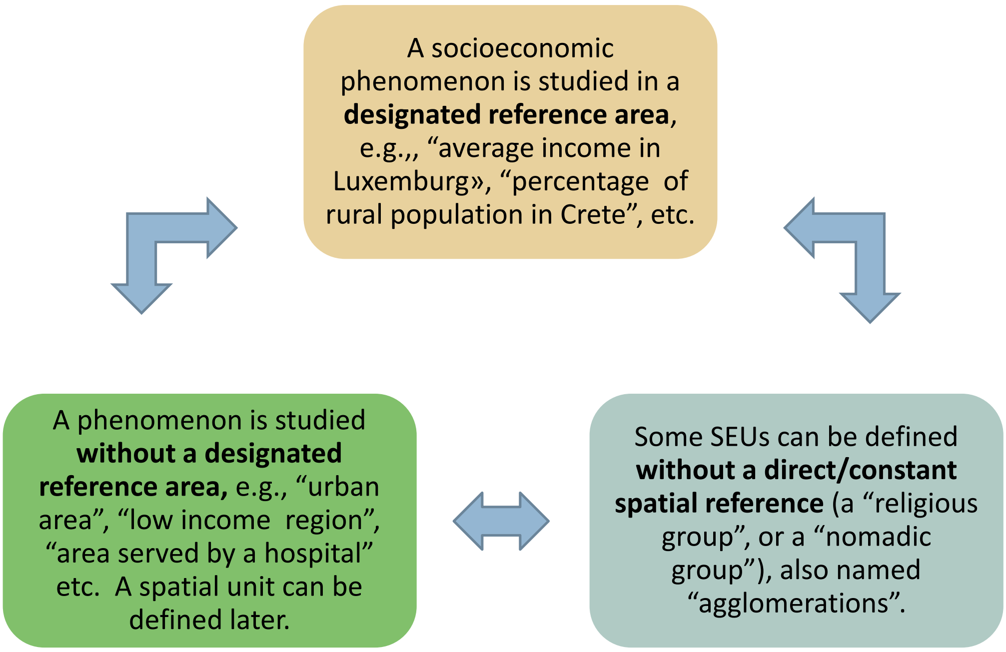
As defined at the time, spatial socioeconomic units are typically nonphysical entities, but often the result of social construction (Raper, 2001), "…. *socially created large geographic objects, used to subdivide space for administrative and economic purposes. Social processes, mostly political, subdivide geographic space in delimited areas, some as large as a continent, some as small as a parcel of land owned by a person"* (Frank et al., 2001).

The large number of socioeconomic processes has led to a variety of SEUs (Stubkjær, 2001). Context plays a major role in SEU categorization. Jurisdiction, economy, social security, health, education, infrastructures, political system, religion, culture, migration, social values, are some important processes used to understand and define SEUs. Depending on the question in context each time, they are examined accordingly. For example, when administrative units such as countries or municipalities, are compared on the basis of their general characteristics, census data provide important views of the socioeconomic phenomena. Other surveys can address more focused issues, e.g., European or World social values (Haerpfer et al., 2021), based on several socioeconomic aspects of life, family, work, religion, politics and society.

In the case of Spatial SEUs however, where the spatial aspect becomes predominant, socioeconomic phenomena are looked upon differently because of their geographic characteristics, geospatial properties, scale and resolution, boundary delineation, topological relations, etc. Common such SSEUs are administrative units (INSPIRE, 2014), statistical units (census tracts/areas/districts) (EUROSTAT, 2020), electoral wards (Monmonier, 2001; Photis, 2012), design regions, service areas, post codes (Raper et al., 1992; Berger et al., 2015), parishes, agglomerations (Smith, 1999), and cadastral units (Dale & McLaughlin, 1999). SEUs, even seemingly similar, frequently follow different typologies/taxonomies. In general, taxonomic diversity may be due to socio-cultural views, disciplinary training, perspective/interest, methodology/technology used, or simply cognitive diversity (Kavouras & Kokla, 2007).

Important differentiating characteristic of SSEUs include the way units are defined, the reference area they use and their boundary definition. Furthermore, these characteristics are examined with respect to (a) their degree of sharpness/vagueness, and (b) their endurance in time. Figure 1 presents three SEU types with different spatial reference. The first case uses a firm spatial reference such as a country, a city, or an island. Socioeconomic information refers to this firm spatial units. In the second case, it is the thematic socioeconomic information that is given priority and the spatial reference is the outcome of this process (e.g., determine the area served by a hospital). The third case is more fluid where the unit has no constant spatial reference, may be not compact, and changes in space and time.

**Figure 1.** Three types of SEUs based on their spatial reference.



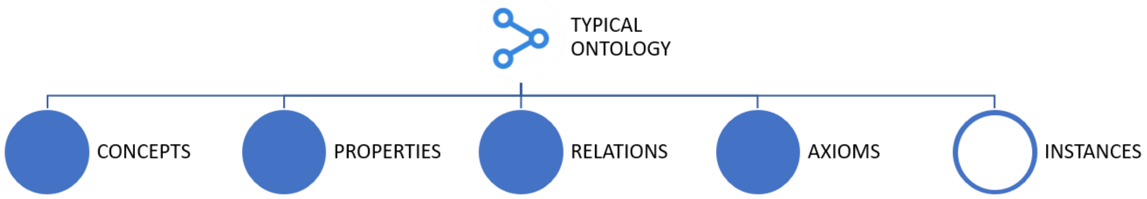

*Source: National Technical University of Athens*

Ontological issues associated directly or indirectly with the geography of SSEUs have been dealt with in Smith (1997, 1999, 2001), Smith & Vargi (2000), Kavouras & Kokla (2007, 2011), López-Pellicer et al. (2008), and Darra & Kavouras (2019). Ontological approaches are pivotal in the understanding of SSEUs which is the first step before different units are to be properly compared and integrated. SSEU concepts, such as *city, town, settlement, municipality, province, prefecture, county, district, zone, locality, region, neighborhood*, *cadastral property*, etc., do not mean the same everywhere. A municipality or a cadastral property for example, are defined differently across Europe. It is thus necessary to employ appropriate methodologies for a systematic and effective SSEU comparison. This capability will facilitate the following:

- similarity determination and homogeneous clustering
- dealing with possible heterogeneities
- reorganization of space and units according to their characteristics
- knowledge discovery
- generalization of units at different levels of detail
- meaningful data integration

A typical ontology has five constituting components (see Figure 2): concepts, properties, relations, axioms (constraints) and instances. Strictly speaking, instances are not an essential part of an ontology but are often used.

**Figure 2.** Constituting components of a typical ontology.




*Source: National Technical University of Athens*

In short, the fundamental ontological component of a SSEU is the concept (also known as class, category, type, kind, etc.); '*city'* is a concept; *'service area'* is also a concept. *'Paris'* is an instance (individual) of the concept *'city'*. Concepts are described by properties and relations. Normally, properties refer to one concept while relations associate different concepts. *'Has-as-Name'* is a property of the concept '*city'*. '*Is-part-of'* is a mereology relation between concepts *'province'* and *'country'*. '*Is-subclass-of'* is subsumption (taxonomic) relation between concepts *'municipality'* and *'administrative unit'*. Finally, the ontology may include axioms with constraints on the values of concepts or instances.

Since ontologies describe the knowledge essentials of a domain, an application, or a task, there is no closed set of concepts, properties/relations or instances to rely upon. This is the reason why seemingly clear concepts (e.g., town, stream, lake, forest) may differ a lot from one data set to another. In the spatial domain, some spatial properties/relations prove to be important to SSEUs (Darra & Kavouras, 2019). These are: location, form (shape, coherence), size (area), structure (single/fragmented), relief–mountaineity, and adjacency. Other semi- or non-spatial properties/relations are also definitionally important to SSEUs. These may include: legal status, stability of location, superSEU, subSEU, neighborhood (topology), sea contact, boundary type, life–temporal history, motion, internal self-sufficiency, distance from major city poles, standard of living, etc.

Boundaries play a special role in the definition of SSEUs. Smith & Varzi (2000) distinguish two boundary types, *bona fide* and *fiat*. Bona-fide boundaries are mostly defined by nature, independently of any human cognitive process (e.g., an island). Fiat boundaries are not self-evident but the result of a convention or political process (e.g., the boundary between Belgium and Holland). It must be said however, that since political/governmental spatial decisions produce new space, fiat delineations may in due course produce bona-fide situations.

### 2.2 Similarity and Comparison of SSEUs

Based on the above definition of spatial socioeconomic units, their similarity and comparison are based on their properties, spatial but also non-spatial (socioeconomic). Similarity is a fundamental notion; its determination is not absolute but relative based on a specific context (Tomai & Kavouras, 2005). In the case of SSEUs, and in such a given context, their similarity is based on the comparison of their identity, their spatial properties, their non-spatial properties or a combination of all these.

Comparison is mostly applied in the following two cases: (a) comparison of SSEU categories and (b) comparison of SSEU instances.

In the first case, one for example can compare administrative SSEUs as they are defined in different EU countries in order to determine similarities and differences between administration systems. Is a municipality in Greece the same as a municipality in Germany? Another example could be the comparison of entities in cadastral systems with different legislation on ownership rights. When real-estate estate platforms attempt to integrate EU member databases, such problems arise and must be resolved in an interoperable manner. One major difficulty in comparing concepts/categories is the fact that they are often defined differently, they do not have the same properties in different taxonomies, and they sometimes differ in scale and detail. The process of determining what alignment is needed in such integration is a real challenge.

In the second case, the comparison is about instances of the same concept/category by comparing the values of their common properties. In this way, one can compare different municipalities of the country, different regions, different islands, etc. An example would be to compare how similar two specific cities are with respect to their size, distance from big centres, and whether they are maritime or mainland cities. The results of such analyses are essential in policy making and spatial planning.

To perform a successful comparison of SSEUs, it is necessary to use appropriate conceptual structures and tools. An important means for comprehending the outcome of the comparison is to employ informative semantic networks. Assessing and visualizing semantic similarity is a real challenge for geographic information science and modern cartography.

## 3. CONCEPTUAL STRUCTURES - FCA

There are various conceptual tools, structures and visual means to systematically examine and compare entities at the concept level but also at the instance level. These include similarity measures (Tversky, 1977; Rodriguez & Egenhofer, 2003; Schwering, 2008), Bertin's Image Theory of visualization (Bertin, 1981), Benediktine Spaces (Benedikt, 1991), spatialization and cartograms (Kuhn & Blumenthal 1996; Skupin & Buttenfield 1997; Darra et al., 2004), MDS-Multidimensional Scaling (Kruskal & Wish, 1978), and SOM-Self Organizing Maps (Kohonen, 1995).

SSEU comparison methods using various similarity measures usually result in a quantitative figure which does not reveal qualitative differences. In this paper, we employ a different approach to SSEU comparison and visualization based on instances and their properties/relations. This is the *FCA-Formal Concept Analysis method* (Ganter & Wille, 1999), an approach for the formal representation of knowledge which draws from the mathematical theory of lattices and ordered sets. FCA can be applied in the analysis of the formal context of concepts/objects and properties/attributes to reveal conceptual relations and overlaps. Its central notion is the powerful mathematical structure of the *Concept Lattice*.

FCA can be used not only in the analysis of concepts (classes, categories) but also in the analysis of instances. The result is a unified concept lattice which contains all existing concepts (or instances) and properties that were introduced, plus some new as the result of the analysis. In FCA, some primitive concepts – the outcome of a process known as semantic factoring - play an important role. The resulting concept lattice is a visual and very informative representation of knowledge.

The basic FCA notions are the following:

- *Formal Context (G, M, I):* a set of objects G, a set of attributes M and a binary incidence relation I.
- *Incidence relation I:* the connection between objects and attributes.
- *Formal Concept, Conceptual Class or Category*: collection of entities or objects exhibiting one or more common characteristics or attributes.
- *Superconcept/subconcept relation:* the order proceeding top-down from more generalized concepts with larger extent and smaller intent to more specialized concepts with smaller extent and larger intent.
- *Concept Lattice {B(G, M, I); ≤}:* the ordered set of all formal concepts of a formal context.

The use of FCA and concept lattices proves to be a systematic, straightforward, but also a very informative approach for the semantic qualitative comparison of concepts and instances as shown in the exemplary cases presented in the next section.

## 4. TWO EXEMPLARY CASES

Two examples are presented thereinafter, demonstrating the comparison of SSEU instances based on their spatial and non-spatial properties/relations. The comparison uses the Formal Concept Analysis approach while the result is shown in the Concept Lattices produced. For the implementation of the two cases, the ConExp (Concept Explorer) (Yevtushenko, 2000), an editor for FCA systems was employed (ConExp (c) 2000-2006, Serhiy Yevtushenko and contributors, http://conexp.sourceforge.net/).

## 4.1 Case example 1

In this example, seven Greek island SSEUs (Antiparos, Serifos, Folegandros, Rhodes, Mytilene, Corfu, Syros) are analyzed based on their common properties, a combination of spatial or non-spatial properties - such their size (small, medium, large), their level of infrastructures (good, medium, poor), and their distance from big centers (far, medium, close):

| | | |
|---|---|---|
| SIZE-S | : | SMALL SIZE |
| SIZE-M | : | MEDIUM SIZE |
| SIZE-L | : | LARGE SIZE |
| INFRA-G | : | GOOD INFRASTRUCTURES |
| INFRA-M | : | MEDIUM INFRASTRUCTURES |
| INFRA-P | : | POOR INFRASTRUCTURES |
| DIST-FAR | : | FAR FROM BIG CENTRES |
| DIST-M | : | MEDIUM DISTANCE FROM BIG CENTRES |
| DIST-CL | : | CLOSE TO BIG CENTRES |

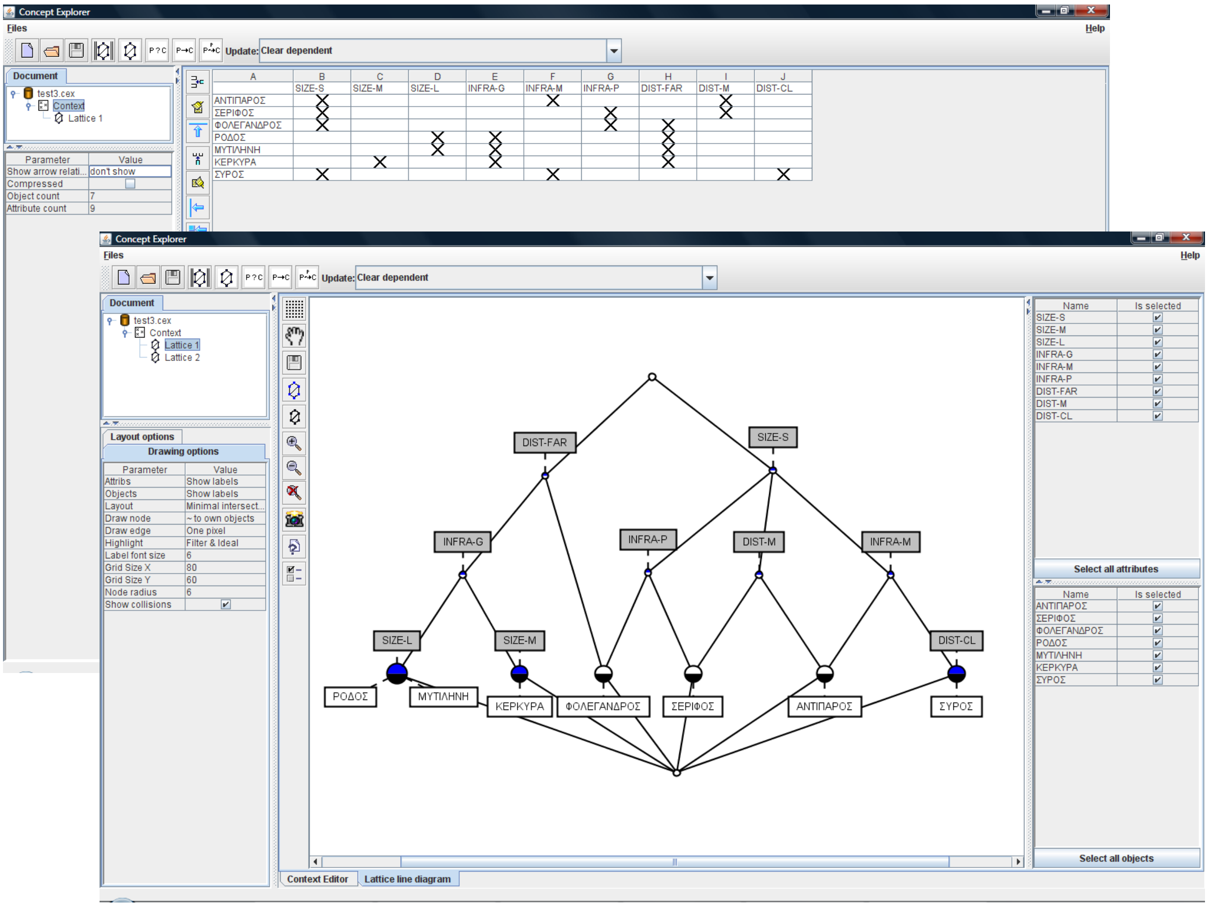
Based on this selection, the next step in the FCA approach is to design the Formal Context 1 as presented in Table 1. Table values are binary, that is, ‘Yes’ is 1, and ‘No’ is 0. Figure 3 presents the same Context in the FCA editor, and the Concept Lattice produced.

**Table 1.** Formal Context 1: Seven island objects and their properties.

| | SIZE-S | SIZE-M | SIZE-L | INFRA-G | INFRA-M | INFRA-P | DIST-FAR | DIST-M | DIST-CL |
|---|---|---|---|---|---|---|---|---|---|
| ANTIPAROS | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| SERIFOS | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| FOLEGANDROS | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| RHODES | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| MYTILENE | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| CORFU | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| SYROS | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |

*Source: National Technical University of Athens*

**Figure 3.** Creating (a) the CONTEXT of objects and properties and (b) the CONCEPT LATTICE.

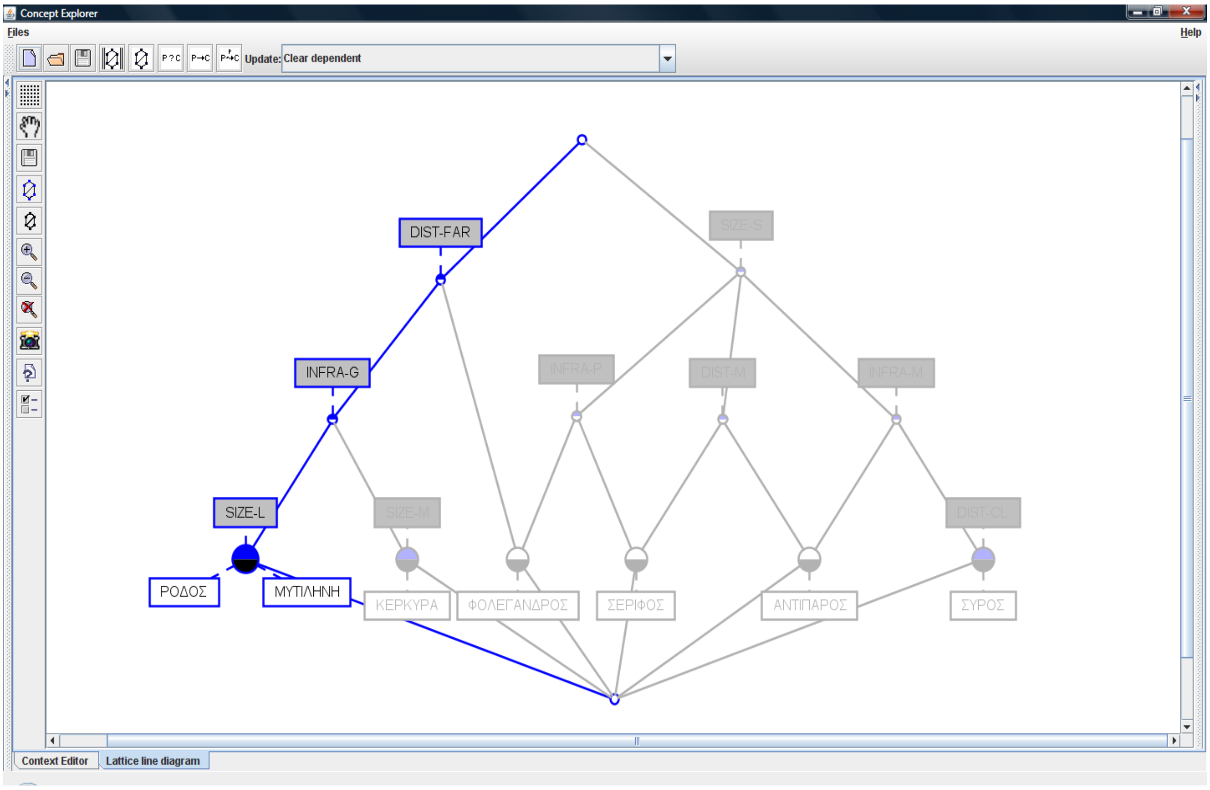



*Source: National Technical University of Athens*

Navigating across this lattice, interesting object-property associations can be derived as shown in Figure 4. The blue path in the lattice shows that a group of two islands (RHODES and MYTILENE) are similar for they have a large size, good infrastructures and are both far from the big centers.

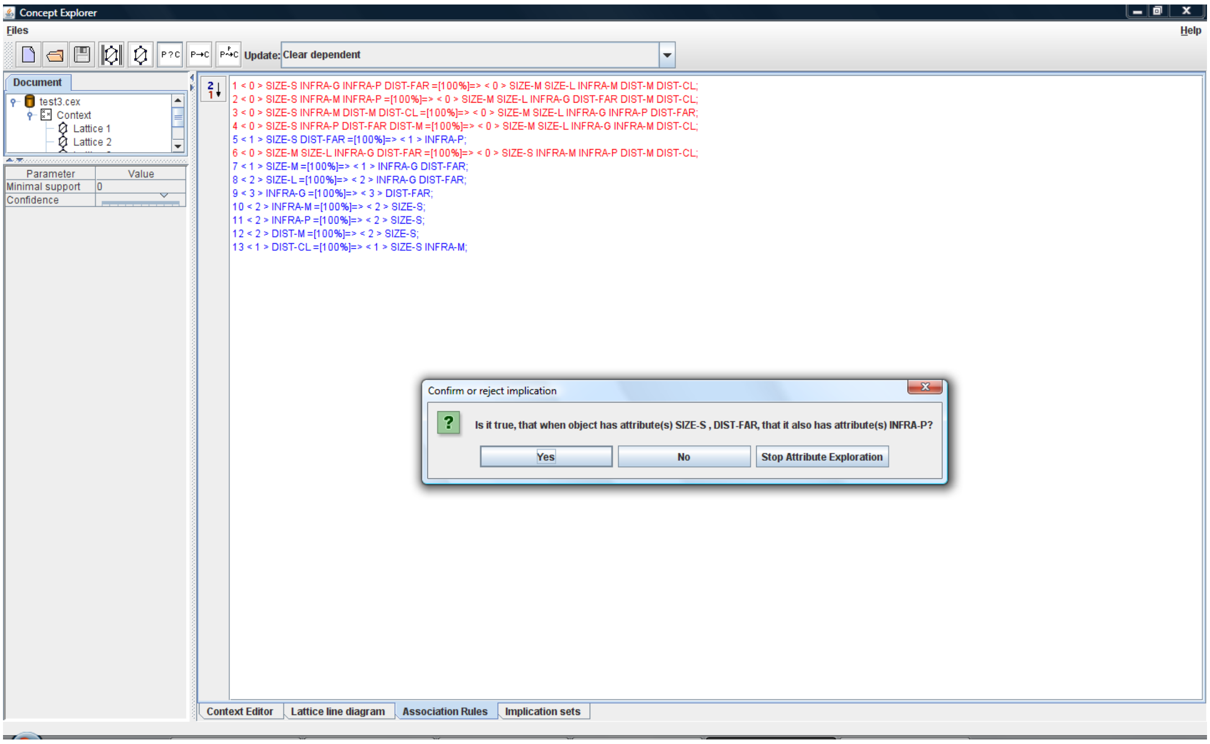
The approach also helps validate the analysis and pinpoint possible inconsistencies or results that do not make sense. This possibility to analyze, accept or reject the concept-property relations helps improve the conceptual context. Figure 5 for example, presents results of the analysis and a question prompt: '*Is it true, that when object has attribute(s) SIZE-S, DIST-FAR, that it also has attribute(s) INFRA-P?*'. In the dataset of the present example this is true indeed, therefore the answer here would be 'Yes'.

**Figure 4.** Blue path in the lattice shows that the members of the group [RHODES, MYTILENE)] have a large size (SIZE-L), good infrastructures (INFRA-G) and are far from big centers (DIST-FAR).




*Source: National Technical University of Athens*

**Figure 5.** Analysis, acceptance or rejection of object-property relations for improving the conceptual context.




*Source: National Technical University of Athens*

## 4.2 Case example 2

In this example, 11 SSEUs (Karpathos, Thasos, Naxos, Nisyros, Paros, Samothraki, Corfu, Amorgos, Corinth, Patra, Tripolis) are analyzed based on their common spatial properties, such their Shape (long, round), Size (small, large), geographically Remote, if they are Islands, and if they are Maritime SSEUs, as follows:

| | | |
|---|---|---|
| SHAPE-LONG | : | "elongated" shape (large ratio PERIMETER/AREA) |
| SHAPE-ROUND | : | "roundish" shape – compact (small ratio PERIMETER/AREA) |
| LARGE | : | large area |
| SMALL | : | small area |
| REMOTE | : | far from big centers |
| ISLAND | : | island SSEU |
| MARITIME | : | maritime SSEU (neighboring to sea) |

Purposely, the properties are different from case example 1, to indicate the differences between various SSEU data collections.

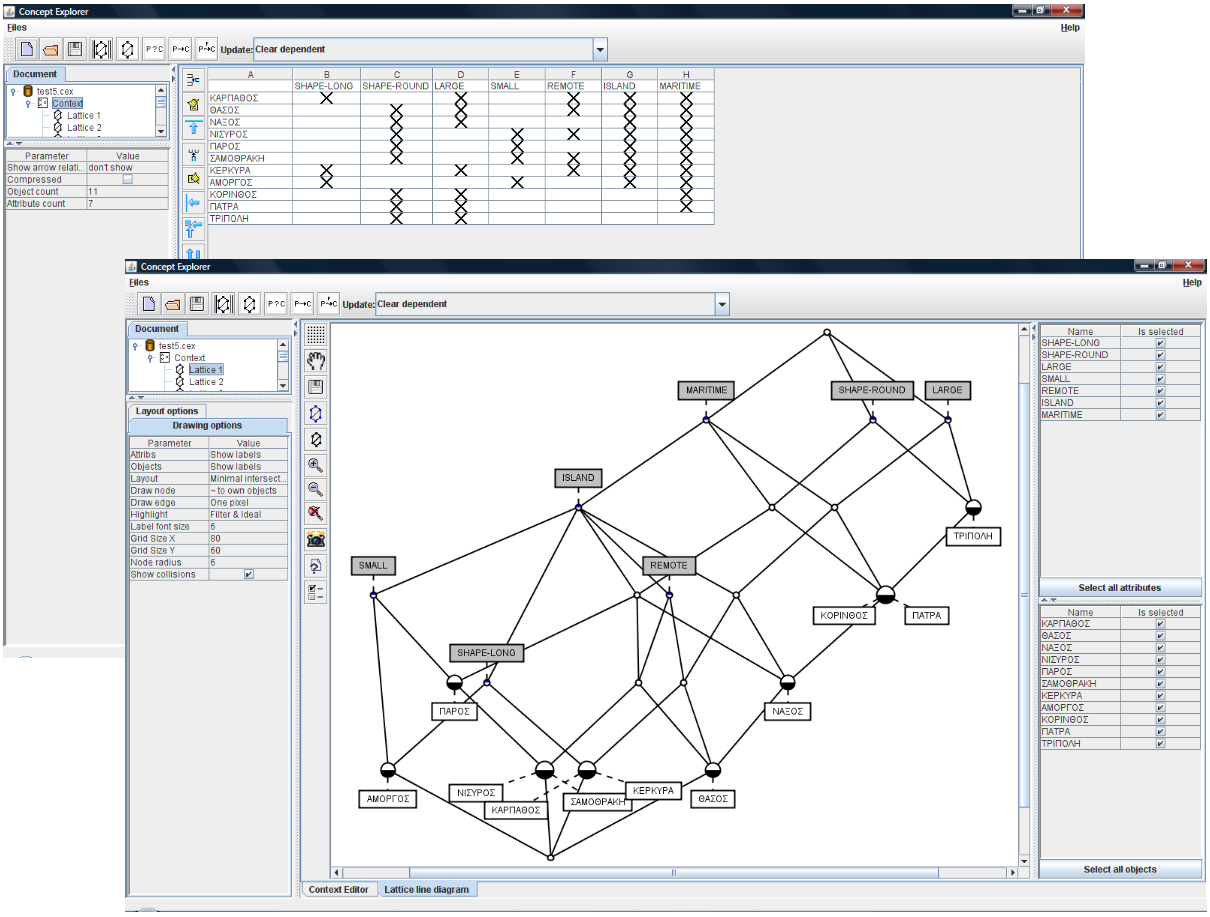
Based on this selection, the next step in the FCA approach is to design the Formal Context 2 as presented in Table 2. Table values are binary, that is, 'Yes' is 1, and 'No' is 0. Figure 3 presents the same Context in the FCA editor, and the Concept Lattice produced.

**Table 2.** Formal Context 2: Eleven SSEUs and their properties.

| | SHAPE-LONG | SHAPE-ROUND | LARGE | SMALL | REMOTE | ISLAND | MARITIME |
|---|---|---|---|---|---|---|---|
| KARPATHOS | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| THASOS | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| NAXOS | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| NISYROS | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| PAROS | 0 | 1 | 0 | 1 | 0 | 1 | 1 |
| SAMOTHRAKI | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| CORFU | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| AMORGOS | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| CORINTH | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| PATRA | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| TRIPOLIS | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

*Source: National Technical University of Athens*

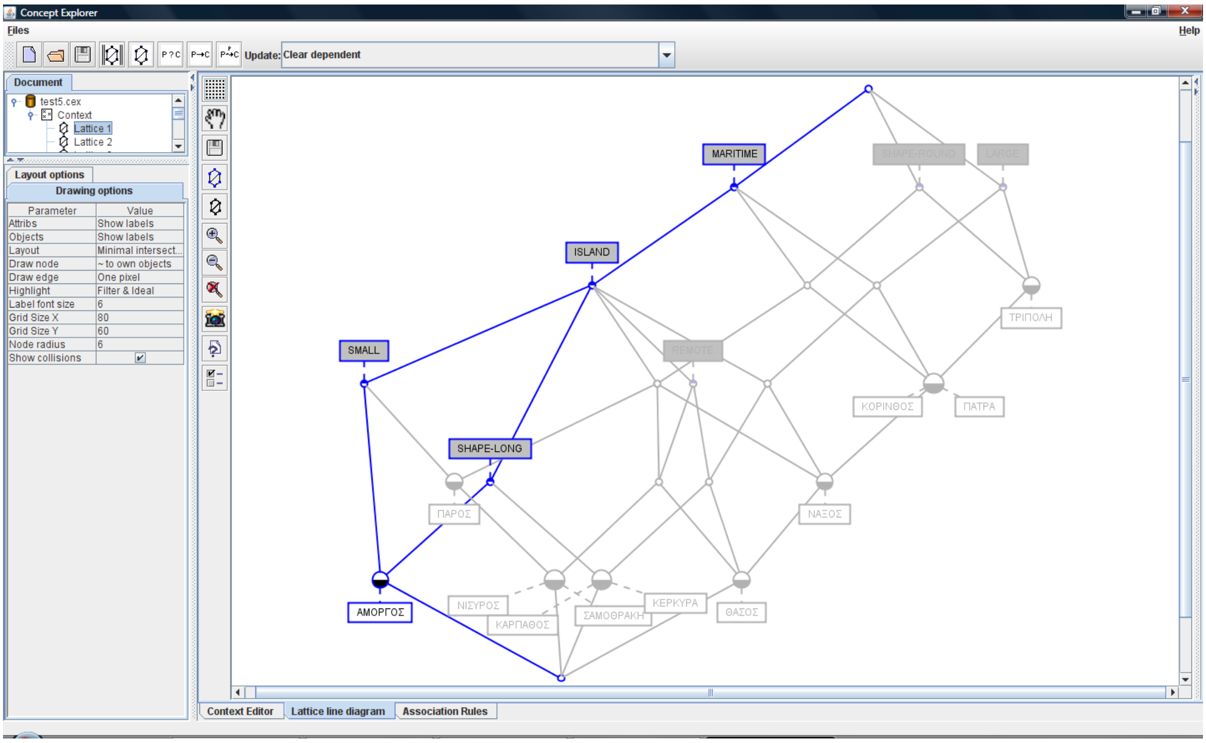
**Figure 6.** Creating (a) the CONTEXT of objects and properties and (b) the CONCEPT LATTICE.




*Source: National Technical University of Athens*

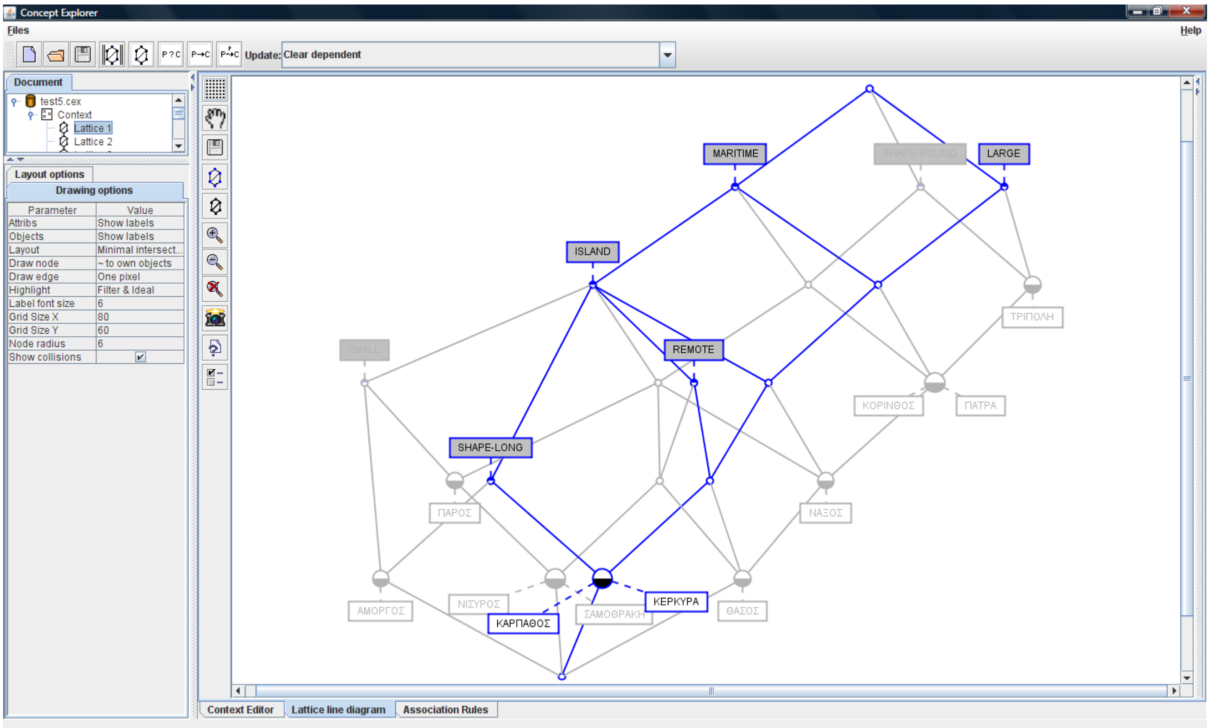
Navigating again across this lattice, interesting object-property associations can be derived. As shown in the blue path in Figure 7, AMORGOS has a small size (SMALL), it is a next to the sea (MARITIME). Specifically, it is an island (ISLAND) and has an elongated shape (SHAPE-LONG). The blue path in the lattice of Figure 8 shows that the SSEU members of the group [KARPATHOS, CORFU] have a large size (LARGE), they are at the sea (MARITIME), being actually islands (ISLAND). They are also far from big centers (REMOTE) and have an elongated shape (SHAPE-LONG).

**Figure 7.** Blue path in the lattice shows that SSEU AMORGOS has a small size (SMALL), s a next to the sea (MARITIME). Indeed, it is an island (ISLAND) and has an elongated shape (SHAPE-LONG).




*Source: National Technical University of Athens*

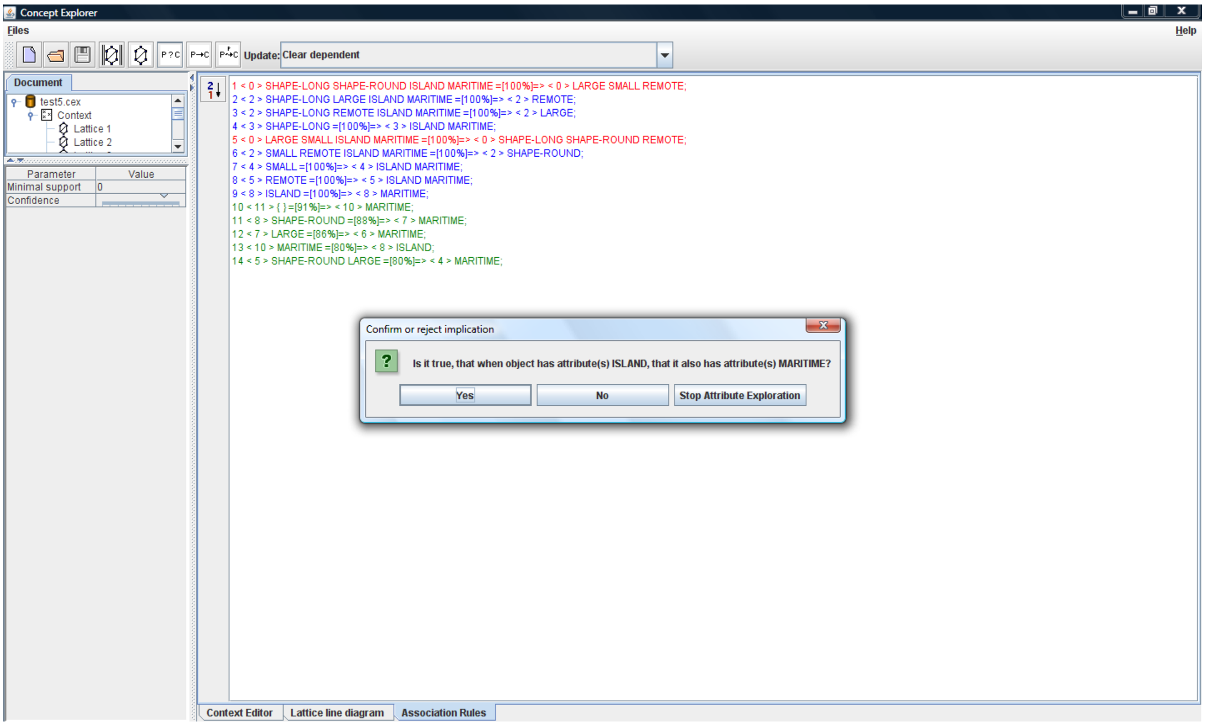
**Figure 8.** Blue path in the lattice shows that the SSEU members of the group [KARPATHOS, CORFU] have a large size (LARGE), are at the sea (MARITIME). Also, they are islands (ISLAND), are far from big centers (REMOTE), and have an elongated shape (SHAPE-LONG).




*Source: National Technical University of Athens*

Following this systematic approach of applying FCA and exploring the resulting Concept Lattices, the object-property relations are either verified or need to be corrected. In Figure 9, the obvious conclusion of the analysis leads to the question*: "Is it true, that when object has attribute(s) ISLAND, that it also has attribute(s) MARITIME?",* which of course is true.

**Figure 9.** Analysis, acceptance or rejection of object-property relations for improving the conceptual context.




*Source: National Technical University of Athens*

**Table 3**. Results of the object-property analysis.

| |
|---|
| 1 < 0 > SHAPE-LONG SHAPE-ROUND ISLAND MARITIME =[100%]=> < 0 > LARGE SMALL REMOTE; |
| 2 < 2 > SHAPE-LONG LARGE ISLAND MARITIME =[100%]=> < 2 > REMOTE; |
| 3 < 2 > SHAPE-LONG REMOTE ISLAND MARITIME =[100%]=> < 2 > LARGE; |
| 4 < 3 > SHAPE-LONG =[100%]=> < 3 > ISLAND MARITIME; |
| 5 < 0 > LARGE SMALL ISLAND MARITIME =[100%]=> < 0 > SHAPE-LONG SHAPE-ROUND REMOTE; |
| 6 < 2 > SMALL REMOTE ISLAND MARITIME =[100%]=> < 2 > SHAPE-ROUND; |
| 7 < 4 > SMALL =[100%]=> < 4 > ISLAND MARITIME; |
| 8 < 5 > REMOTE =[100%]=> < 5 > ISLAND MARITIME; |
| **9 < 8 > ISLAND =[100%]=> < 8 > MARITIME;** |
| 10 < 11 > { } =[91%]=> < 10 > MARITIME; |
| 11 < 8 > SHAPE-ROUND =[88%]=> < 7 > MARITIME; |
| 12 < 7 > LARGE =[86%]=> < 6 > MARITIME; |
| **13 < 10 > MARITIME =[80%]=> < 8 > ISLAND;** |
| 14 < 5 > SHAPE-ROUND LARGE =[80%]=> < 4 > MARITIME; |

*Source: National Technical University of Athens*

To assist this process, the analysis provides quantitate information as shown in Table 3. The two obvious cases (#9 and #13) shown in bold above, read as follows:

- Case # 9: All (i.e., 100%) of island SSEUs are also maritime SSEUs.
- Case # 13: 80% of the (10) maritime SSEUs (i.e., 8) are islands.

## 4. CONCLUDING REMARKS

The great variety of socioeconomic phenomena creates a multitude of socioeconomic areal units with varying characteristics. It is widely accepted (international organizations, European Programs, conferences, standards, directives, research agendas) that issues concerning SEUs require a systematic methodology for their definition and comparison.

For many reasons, these SEUs, even seemingly similar may in fact be quite different and are treated as such. In order to communicate, perform spatial analysis, integrate databases, or design and apply spatial planning policies, it is essential to formalize such knowledge and facilitate its reuse. In an era of constantly increasing geoservices, which have a great economic and societal impact, developing such knowledge tools is critical. Conceptual structures and visualization instruments, as those presented above, prove to be effective and novel in the formalization of spatial socioeconomic knowledge. Methods like FCA can greatly assist a qualitative comparison of SSEU categories or instances, on the basis of their typological properties, spatial or non-spatial.

In this endeavor, there are many open research challenges, such as the following:

- The typology/taxonomy of SSEUs differs in spatial, thematic and cognitive detail when scale changes. Specialization or generalization methodologies, despite their progress, are still limited and cannot deal with the complex socioeconomic reality.
- Vague, ill-defined and indeterminate spatial boundaries have a great impact on the typologies of SEUs and other geographic entities (Couclelis, 1996).
- SSEU definition and comparison must take into consideration the existence of vague semantic boundaries between categories, and sufficient modelling is needed to deal with this.
- Not all properties and relations are essential for the identity of SSEUs especially as context varies. Determining the importance of properties and relations in the identity of the units is an open ontological issue.
- In their lifetime SSEUs go through several changes, maintaining however their identity. Changes may be in their non-spatial properties, spatial properties or both. As long as changes do not alter the SSEU identity, they are not considered ontologically essential. Most countries for instance have gone through several territorial/border changes. Spatiotemporal modelling capabilities are necessary for dealing with such life and motion issues.
- New spatialization techniques (Darra et al., 2004) can be explored to make it easier to understand socioeconomic phenomena and their changes, without the need for large-scale data analysis.
- In the past, the definition and analysis of socioeconomic units was a task for the experts. Nowadays however, with the emergence of neogeography and neocartography (Wilson & Graham, 2013) everyone can produce such data or publish their “analysis” or “map”, and such information is produced at a mega scale. Devising methods to exploit such wealth of data produced by the society at large, but also confirm their validity will become very crucial in the years to come. Indeed, many years after Mormonier’s classic *“How to lie with Maps”* (Mormonier, 1996), the validity or fakeness of socioeconomic data and representations has become an issue again.

Making progress in the some of the above directions will greatly advance interoperability, the level of knowledge about SSEUs, and the quality of spatial reorganization in geography.

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