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Research Article

Understanding the situation of Aquaculture farms in Latvia: A Multidimensional Scaling Analysis

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ABSTRACT

Aquaculture holds significant importance within the agricultural sector of numerous countries worldwide. This industry plays a crucial role in providing consumers with safe and high-quality food products that are carefully monitored in controlled environments, resulting in a smaller ecological impact. Seafood and fish are vital sources of nutrition and sustenance on a global scale. Multidimensional scaling detected meaningful underlying dimensions, allowing the researcher to explain observed similarities or dissimilarities between the investigated objects. In aquaculture business multidimensional scaling can find the distance between denotes the perceived similarity between them and would result in a scale from the worst to the best state.

Keywords: Aquaculture Farms, Multidimensional scaling, Business model

Introduction

Contextualizing a Multidimensional scaling method

Multidimensional scaling (MDS) is an alternative to factor analysis. It can detect meaningful underlying dimensions, allowing the researcher to explain hobserved similarities or dissimilarities between the investigated objects [1]. Multidimensional scaling is based on similarity or dissimilarity data. Subsequently, these institutions were forced to face closure, as they lacked in administering and engaging the right advances to achieve some better financial operations. In many business to business markets respondents tell us that there is little difference between products and suppliers. To find out if this is true we can use multi-dimensional scaling. Multidimensional scaling refers to a family of mathematical (not statistical) models that can be used to analyze distances between objects (e.g., aquaculture). Information contained in a set of data is represented by a set of points in space. These points are arranged in such a way that the geometrical distance between them will reflect empirical relationships in the data. The geometrical relationships can be situated in multidimensional space but can also encompass the one-dimensional mode. They may be interval (metric) or rank distances (nonmetric). The “psychological distance” between denotes the perceived similarity between them and would result in a scale from the worst to the best state [2].

In multidimensional scaling analyses, “proximities” refer to observed differences between objects. These are described as either similarities or dissimilarities. For similarities, larger numbers indicate that objects are nearer, whereas the opposite applies to dissimilarities. Multidimensional scaling originated in psychometrics but has become a general data analytical technique, now used in a wide variety of fields [1].
Shepard developed a major extension of classical metric multidimensional scaling in 1962. Early work demonstrated that it was possible to derive metric multidimensional scaling solutions assuming only ordinal relationships between the objects [2].

MDS is also used as a container term for all methods that provide a graphical representation of variables and/or objects in a scatter plot. This definition is very broad and contains a wide variety of methods such as correspondence analysis, principal component analysis, canonical correlation analysis, etc.
To introduce MDS in a research context, we use an example from value research where MDS has always played a cardinal role. Values are guiding principles in people's lives, basic goals a person strives for in many actions and situations.

Overview of Aquaculture Sector

Regarding the economic importance of the aquaculture sector, it employs more than 20 thousand direct workers in Europe [3]. The produced products are sold fresh for consumption in the local market. The aquaculture product traditionally produced in fish farms is most often uniform (carp) and must compete with products grown in neighboring countries at lower production costs. The primary focus is on selling the freshly produced goods in the local market. A crucial aspect is expanding the variety of fish species that are cultivated. The consumption of fish and fish products holds significant importance for human nutrition [4]. Approximately 30% of the necessary protein intake for individuals is derived from aquatic organisms and fish. Aquaculture has the flexibility to utilize any accessible areas that lack restrictive conditions and are not subject to any governmental limitations hindering such activities [5].

Aquaculture plays an important role in various countries, but it also faces significant challenges. For example, aquaculture has long been an important economic sector along the coast of Norway. However, overcapacity is considered to be one of the main reasons for the poor financial performance of Norwegian aquaculture [6]. Over the past three decades, the Icelandic aquaculture industry has had to contend with a decline in the total number of fish farmed. The industry responded with layoffs, factory closures and ship scrapping, which significantly reduced employment in industry, especially in the processing sector [7]. The Belgian aquaculture industry is under pressure to prove the sustainability of its fish farming methods [8]. Aquaculture management in Northern Ireland also includes voluntary stock management measures such as grooving for berry lobster [9]. In Sweden the importance of addressing forest owners' interests in development and management of fish and water resources is essential for successful policy programmes. Not only they own forests, they are a major group owning a pond area with fishing rights [10].

The cultivation of aquatic organisms, known as aquaculture, plays a crucial role in ensuring food security by offering a more dependable food source compared to relying solely on wild-capture fisheries. Several studies have found that the potential for expansion and advancement in aquaculture is substantial [11].. Looking ahead, the outlook for aquaculture appears promising. According to the World Bank, nearly two-thirds of seafood consumption is projected to come from farm-raised sources by 2030 [11].

Results and discussion

Visual inspection of the configuration looking either for orders of the stimuli along the axes or for meaningful groupings of them. But to elevate subjective groupings to the status of clusters, it is absolutely necessary to apply some clustering technique. The visual inspection does not lead to a successful interpretation, the researcher still has the possibility to rotate the dimensions. The rotation can be made by hand or by statistical methods.

It is known that rotation by hand usually leads to more interpretable axes. Subject space Whereas the stimulus space is composed of points, the subject space is composed of vectors. Each subject is represented by vector (see figure 1), % different aspects of the vectors should be considered: the length and the direction, the latter being the most important.

The lenght is usually related to the fit of the model. The larger the length the better is the fit for a given subjecte. The direction is related to the relative salience of the dimensions for a particular subject. The closer the vector is to a given dimension, the more salient it is.

Case Processing Summary		
Cases		132
Sources		1
Objects		132
Proximities	Total Proximities	8646[a]
	Missing Proximities	0
	Active Proximities[b]	8646
a. Sum of all strictly lower-		
b. Active proximities include all		

Figure 1: Case Processing Summary

To perform preference analysis it is necessary to have obtained preference ratings of the stimuli from the subjects, in addition to the judged dissimilarities. Then the analysis fits the preference ratings to the stimulus space. As preferences vary widely between individuals, the analysis is mainly interesting at the individual level. To perform property analysis it is necessary to have measured either objective physical characteristics of the stimuli or subjective judgments of the stimulus characteristics. As it is often reasonable to assume that homogeneous subjects use the same properties, property analysis is usually performed at group level, that is, on ratings averaged over all subjects.

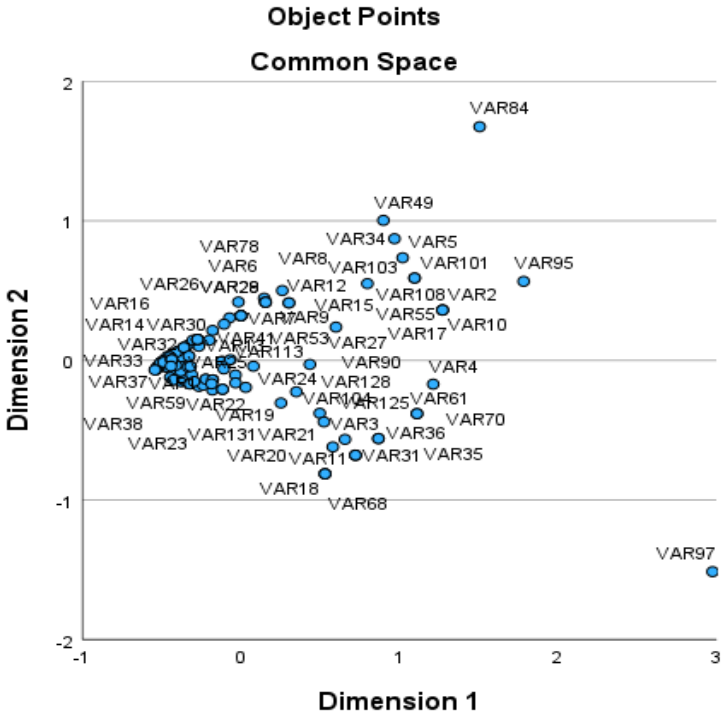

Figure 2: Proscal in aquaculture farms in Latvia

Multidimensional scaling analysis (MDS) scatter plot of cases and controls plotted for the first three MDS dimensions to correct for relatedness and population stratification. One way to quantify the agreement across solutions is to correlate the inter-item distances from one solution to another. We therefore collected vectors of distances from each point to every other in each space, and calculated their correlation. To the extent that the spaces have similar arrangements of points, the correlation will be strongly positive. Conducted this analysis for data set (aquaculture farms), comparing the coordinates derived from ALSCAL and PROXSCAL. Figure 2 shows the results: The correlations were strongly positive. This technique can also be applied to repeated attempts of a single scaling algorithm (recall that each attempt results in a different configuration), to index the stability of a solution.

Multidimensional scaling is a useful tool to help quantify the ubiquitous, but slippery, notion of similarity. Although we all know what it means for two things to share a sense of closeness, similarity is difficult to estimate empirically.

An argument could be made that any two items are similar because they share a potentially infinite number of arbitrary features. It seems likely that most people judge a pencil and a remote control to be dissimilar. But how dissimilar, exactly, might they be? Both items are solid objects that exist on earth, can be held in your hand, and can be used to scratch between your shoulder blades. Only when these objects are placed in the context of a larger set of items (e.g., other writing utensils, other electronic devices) can one begin to appreciate the ways in which they differ.

By subjecting similarity estimates to MDS, researchers acquire maps of the relationships among a set of stimuli. This map reduces the complexity inherent to a large table of proximities, and can be used to explore a space about which no prior hypotheses exist, or to confirm a priori notions about the organization of psychological space. MDS can be performed in various ways, using data obtained from overt ratings or indirect methods. Although there are important subtleties regarding the treatment of data, dimensional selection, and the interpretations of solutions, MDS analyses all share a key purpose: They reveal the relational structures among the rated items. The technique has broad applicability, and is of the utmost value to researchers in the cognitive sciences and beyond.

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