Súhrn

V súčasnom poľnohospodárstve krajín Európskej únie je možné pozorovať dva trendy. Prvým trendom je intenzifikácia, koncentrácia a špecializácia v niektorých oblastiach. Druhým pozorovaným trendom v ostatných regiónoch je znižovanie, alebo likvidácia výroby. Poľnohospodárstvo v krajinách Európskej únie je charakteristické rôznymi typmi fariem. V roku 1997 tu bolo takmer 7 miliónov poľnohospodárskych usadlostí s priemernou veľkosťou okolo 18 hektárov. Počet fariem rastom ich špecializácie a intenzívneho poľnohospodárstva má klesajúci trend. Za obdobie rokov 1975 až 1995 počet fariem klesol o viac ako 1,4 milióna usadlostí, čo je takmer 20 %. V porovnaní s rokom 1994 došlo na Slovensku v roku 2001 k zníženiu počtu fyzických osôb o 30,19 % a zároveň k zvýšeniu priemernej veľkosti subjektov o 66,48 %. Pri sledovaní právnických osôb došlo k zvýšeniu počtu subjektov oproti roku 1993 o 33 % a zároveň sa znížila priemerná výmera o 32 %.

Kľúčové slová: farmy, Európska únia, štruktúra, rastlinná výroba, špecializácia

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MOŽNOSTI NĚKTERÝCH KVANTITATIVNÍCH METOD PŘI HLEDÁNÍ TRŽNÍCH STRUKTUR

POSSIBILITIES OF SOME QUANTITATIVE ANALYSES IN EXPLORING THE MARKET STRUCTURES

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In order to arrive at objective conclusions from a market survey, many quantitative methods can be used to advantage. If the market structures are searched for, traditional methods of cluster analysis are usually used. Among these traditional methods is crisp partitioning, i.e. statistical groups are classified into non-overlapping clusters. Fuzzy clustering provides a bit different approach. For classification purposes six variables were utilised, representing certain the so-called transplanted solid organs. The result from fuzzy clustering analysis "fanny" was illustrated in a clusplot. In the biplot and clusplot the data are presented through first two principal components. These graphical outputs were achieved using programming in S-Plus language.

Key words: fuzzy clustering, silhouette plot, clusplot, principal components, market

Traditional methods of cluster analysis are based on classical Cantor's set theory. It means we suppose that binary variables {0; 1} are a function of membership. These methods are suitable for crisp values. A different view on classification problems consists in a possibility of using fuzzy set theory set up by professor L. Zadeh (1977). This theory makes it possible to classify objects the attributes of which are not precisely defined. This approach is more convenient than the first one because in ordinary life there is a lot of vagueness and uncertainty.

Methods of cluster analysis are used primarily for classification tasks. In the marketing area, for example, methods of cluster analysis are specifically utilized for segmentation of the target market. Widely used classical cluster analysis methods are offered by Everit, Dunn (1998). The first man who proposed different approach to classification through fuzzy decomposition was Ruspini (1976). On his concept other algorithms were based but they were not suitable for a large data set (Xinbo, Weixin, 2000). With regard to these difficulties it was changed to the methods which optimize some objective functions. One of these methods is a method applied in this work. It is called "fanny" and was proposed by Kaufman, Rousseeuw (1990). The „ fanny" method is rather robust for the assumption of spherical clusters. In contrast to classical crisp cluster analysis, this method spreads each object over various clusters. For each object i and each cluster v there will be a membership μ_{iv} that indicates how strongly specific object *i* belongs to cluster *v*. These memberships have to satisfy the following conditions:

$$\mu_{iv} \geq 0 \text{ for all } i = 1, 2\ldots, n \text{ and all } v = 1, 2\ldots, k \qquad (1)$$

$$\sum_{v=1}^{k} \mu_{iv} = 1 \text{ for all } i = 1, 2\ldots, n \qquad (2)$$

The aim of this method is to determine the memberships μ_{iv} for every object in the data set with respect to distance matrix. The memberships of particular objects are defined through minimisation of the objective function.

$$\sum_{v=1}^{k} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} \mu_{iv}^2 \mu_{jv}^2 d(O_i, O_j)}{2\sum_{j=1}^{n} \mu_{jv}^2} \qquad (3)$$

In this expression, the dissimilarities $d(O_i, O_j)$ are known and the memberships μ_{iv} are unknown. The minimisation is carried out numerically by means of an iterative algorithm, taking into account the side constraints on membership by means of Lagrange multipliers Kaufman, Rousseeuw (1990). The information about character of clustering provides the Dunn's coefficient to us:

$$F_k = \sum_{i=1}^{n}\sum_{v=1}^{k} \frac{\mu_{iv}^2}{n} \text{ where } F_k \in \left\langle \frac{1}{k}; 1 \right\rangle \qquad (4)$$

Material and methods

In this work a quantity of transplantations was studied, which were carried out in eighteen European countries in dependence on a type of transplanted solid organs in 106 inhabitants. Only some European countries were included into a study because there was lack of valid data sets. These data could be the basis for establishing the market potential for perspective selling drugs with immunosuppressive effects. Classification of particular European countries was performed by the use of a fuzzy clustering method called „fanny". Six variables were used to classify these countries. The variables are in the following order: kidney (from dead bodies and a living donor), liver, heart and lung, heart, lung (both and separately), and pancreas. The non-weighted euclidean metric was used as a distance measure:

$$d(O_i, O_j) = \sqrt{\sum_{k=1}^{n} \left(x_{ik} - x_{jk} \right)^2} \qquad (5)$$

The decomposition which maximised an average silhouette width was chosen as the best classification result. For graphical display we utilised the principal component analysis to construct a biplot and a bivariate plot called „Clusplot", with a possibility of interpreting and visualising the results. The ellipses in the clusplot are based on the average and the covariance matrix of each cluster, and their size allows them to contain all points of their cluster.

Results and discussion

After carrying out the fuzzy cluster analysis, output data were obtained. For these results see Table 1. Value of the objective function reached a minimum in the case of dissection into four clusters, but the average value of silhouette width was only 0.375269. This low value indicates a rather weak structure of these four clusters. In case of decomposition into three clusters, conversely, this value was 0.4549564. For this reason the decomposition into three clusters has been chosen as optimal one.

Table 1 Results from fuzzy cluster analysis

Decomposition into K clusters (1)	K = 2	K = 3	K = 4	K = 5
Iteration (2)	25	155	52	126
Objective function value (3)	60.218	38.965	27.031	30.584
Dunn's coefficient (4)	0.573	0.515	0.441	0.393
Normalised Dunn's coefficient (5)	0.147	0.272	0.255	0.242
Average silhouette width for particular clusters (6)	0.383	0.256	0.590	0.5167
	0.416	0.521	0.048	0.196
	–	0.856	0.491	0.173
	–	–	0.849	0.408
	–	–	–	0.847
Average silhouette width for particular decomposition (7)	0.405	**0.455**	0.375	0.362

Tabulka 1 Výsledky fuzzy shlukové analýzy
(1) rozklad do K shluků, (2) iterace, (3) hodnota funkcionálu kvality rozkladu, (4) Dunnův koeficient, (5) průměrná délka obrysu pro každý shluk, (6) průměrná délka obrysu pro příslušný rozklad

Table 2 Coefficients of membership, crisp membership and silhouette value for individual European countries decomposed into three clusters

Country (1)	Membership coefficient (2)	Membership coefficient (3)	Membership coefficient (4)	Crisp membership (5)	Silhouette value (6)
Benelux (7)	**0.747**	0.178	0.075	1	0.4211
Czech Republic (8)	**0.557**	0.308	0.136	1	0.2665
Denmark (9)	0.190	**0.696**	0.115	2	0.5611
Finland (10)	0.166	**0.656**	0.178	2	0.6176
France (11)	0.175	**0.705**	0.121	2	0.6054
The Netherlands (11)	0.209	**0.666**	0.125	2	0.5217
Italy (12)	0.188	**0.490**	0.322	2	0.3364
Hungary (13)	0.235	**0.511**	0.254	2	0.4428
Germany (14)	0.173	**0.678**	0.149	2	0.6314
Norway (15)	**0.493**	0.366	0.149	1	0.1062
Poland (16)	0.040	0.064	**0.896**	3	0.8558
Portugal (17)	**0.517**	0.350	0.132	1	0.1252
Austria (18)	**0.709**	0.197	0.094	1	0.4303
Greece (19)	0.041	0.065	**0.895**	3	0.8562
Spain (20)	**0.652**	0.228	0.119	1	0.4354
Sweden (21)	**0.504**	0.393	0.103	1	0.0044
Switzerland (22)	0.266	**0.638**	0.096	2	0.3723
Great Britain (23)	0.176	**0.702**	0.122	2	0.5994

Tabulka 2 Stupně příslušnosti, ostré příslušnosti a obrysová hodnota jednotlivých evropských zemí rozložených do tří shluků
(1) země, (2) stupeň příslušnosti k prvnímu shluku, (3) stupeň příslušnosti k druhému shluku, (4) stupeň příslušnosti k třetímu shluku, (5) ostrá klasifikace, (6) obrysová hodnota, (7) Benelux, (8) Česká republika, (9) Dánsko, (10) Fínsko, (10) Francúzsko, (11) Holandsko, (12) Taliansko, (13) Maďarsko, (14) Nemecko, (15) Nórsko, (16) Poľsko, (17) Portugalsko, (18) Rakúsko, (19) Grécko, (20) Španielsko, (21) Švédsko, (22) Švajčiarsko, (23) Veľká Británia

With respect to the value of normalised Dunn's coefficient it can be concluded that the clustering process had very strong fuzzy character. The particular membership coefficients obtained through the fuzzy clustering method "fanny" are shown in Table 2. It can be stated that countries like Benelux, Denmark, France, Netherlands, Germany, Poland, Austria, Greece, and Great Britain are very well classified. These countries are connected with a relatively high value of membership coefficient for one of three clusters. On the contrary, the countries such as Italy, Norway, and Sweden are not classified in such a clear way.

Crisp memberships of individual countries are also presented Table 2. As we can see from this table, the first cluster is represented by the following countries: Spain, Austria, Czech Republic, Portugal, Norway, Sweden, and Benelux countries. The third one contains only Greece and Poland. The other countries are classified into the second cluster. With respect to the value s(i) for Sweden it is evident that this country

Figure 1 Silhouette plot for individual European countries decomposed into three clusters
Graf 1 Obrysový graf jednotlivých evropských zemí rozložených do tří shluků
(1) průměrná obrysová hodnota, (2) obrysová šířka

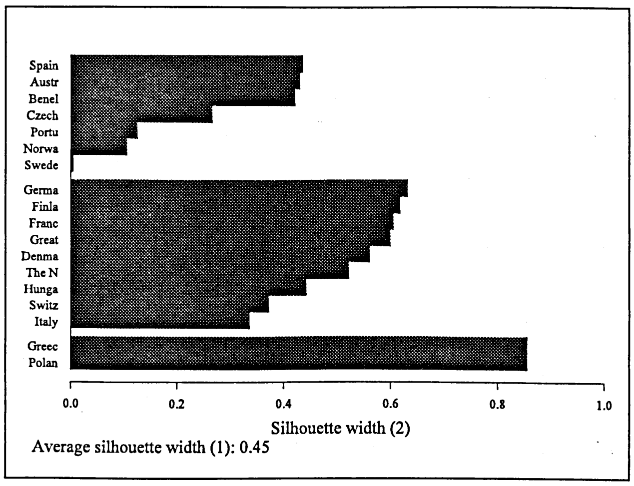


Figure 2 Plot of the variances of derived variables – scree graph
Graf 2 Scree graf
(1) rozdiely, (2) hlavní komponenty (zde zachyceny kumulativně)

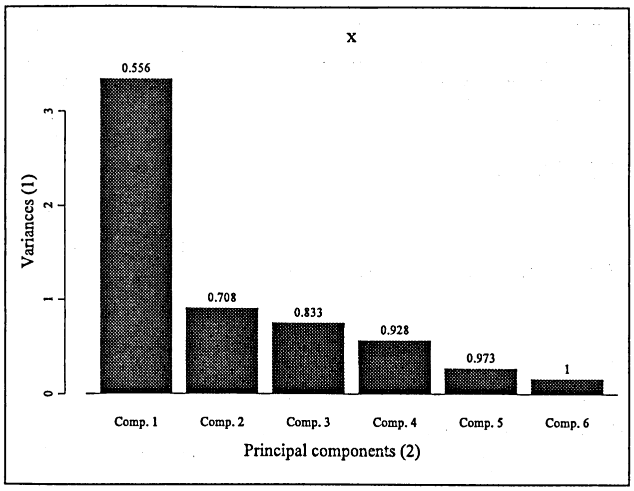
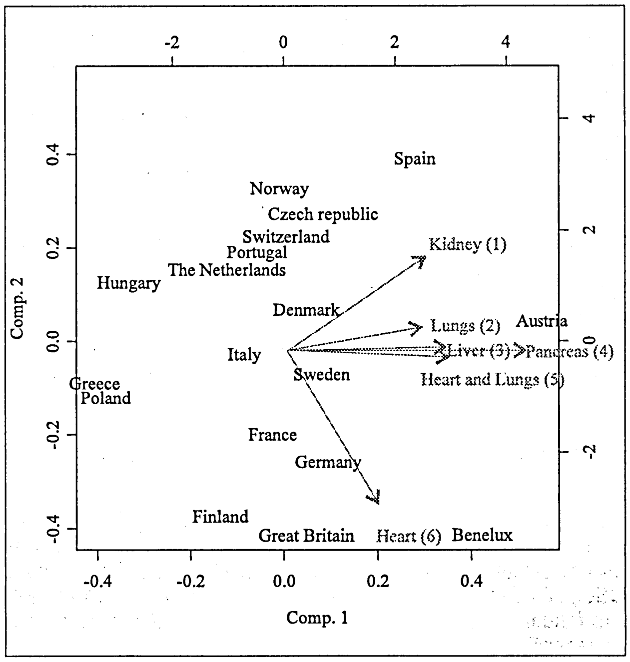


Figure 3 Biplot of multivariate data with arrows which graphically indicate a proportion of the original variance explained by the first two principal components and their relative loading

Graf 3 Znázornění vícerozměrných dat pomocí prvních dvou hlavních komponent spolu s šipkami znázorňujícími velikost původního rozptylu vysvětleného pomocí prvních dvou hlavních komponent a jejich relativní zátěže
(1) oblička, (2) plíce, (3) pečeň, (4) pankreas, (5) srdce a plíce, (6) srdce



lies between clusters 1 and 2. The countries like Greece and Poland, conversaly, create very compact clusters. Their silhouette values are 0.8562 and 0.8558, respectively (Table 2.). For graphical representation of the decomposition and silhouette value see Figure 1.

Figure 2 illustrates a scree graph. It is obvious that the first two principal components relatively well describe the variance contained in the data set. This scree graph clearly shows that the first two principal components explain 70.8 % of the total variability included in the data set.

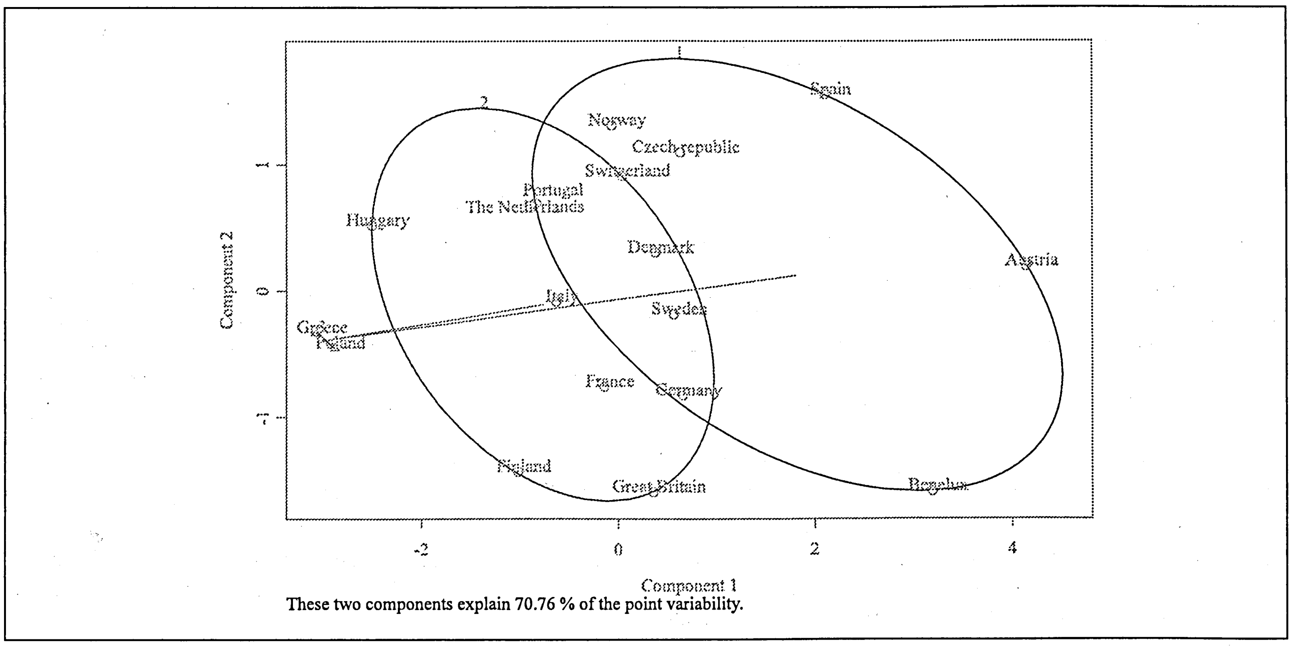
Figure 3 shows the biplot Its interpretation is straightforward. The x-axis represents the scores for the first principal component, y-axis for the second principal component. The arrows in the biplot graphically indicate a proportion of the original variance and their direction indicates the relative loading on the first and second principal components. We can see that each of the original variables has relatively high positive loading with the first principal component. In this sense the first principal component could be called the general transplantation practice.

As shown in Fig. 3, the countries on the lower side of the biplot, contrary to those located on its upper side, have negative loading with the second principal component. It can be said that the second principal component primarily distinguishes among the countries with relatively high loading in absolute values for the original variables like heart and kidney.

The final graphical result from a fuzzy cluster analysis called fanny is shown in Figure 4. There is the clusplot displaying a partition of the data set using algorithm fanny and the first two principal components. All observations are represented by the names of the countries in the plot. As mentioned above, the first two principal components explain 70. 8% of the total variability contained in the data. Thus, graphical representation of the data sets provides relatively convenient projection of the six-dimensional objects into two-dimensional space with an indication of the cluster membership. The distance between three clusters is represented as a line connecting the centres of clusters. It is clear from the colours of the spanning ellipses that cluster 2 has higher density than cluster 1. Cluster 3 covering only Poland and Greece has the same density as cluster 1.

Figure 4 The graphical interpretation of the results from fuzzy clustering algorithm "fanny" – clusplot

Graf 4 Grafická interpretace výsledků z fuzzy shlukového algoritmu „fanny" – clusplot



Conclusion

The fuzzy clustering algorithm called fanny, contrary to classical methods, enables to obtain particular degrees of membership including classical crisp partitioning. The „fanny" provides the additional information about classified objects to this effect. It can be concluded that the European countries investigated could be classified in a meaningful way into three clusters in terms of marketing. A similar structure can be expected to be revealed for transplanted solid organs in Spain, Austria, Benelux, Czech Republic, Portugal, Norway, and Sweden. Consequently, we can conclude that country like Sweden, with respect to its value s(i), is on the border of cluster, i.e. between clusters 1 and 2. The Czech Republic is fully comparable with West European countries such as Austria or Belgium.

Souhrn

Pro objektivní zhodnocení marketingového výzkumu, lze s výhodou využít mnoho kvantitativních metod. Jestliže se hledají tržní struktury obvykle se používají tradiční metody shlukové analýzy. Tyto tradiční metody shlukové analýzy jsou tzv. ostře klasifikující, to znamená, že jednotlivé statistické jednotky jsou roztříděny do navzájem disjunktních shluků. Poněkud odlišný přístup umožňuje fuzzy shlukování. Pro klasifikaci bylo použito šest proměnných, které representovali určité tzv. pevné transplantované orgány. Výsledek fuzzy shlukové analýzy „fanny" byl znázorněn v clusplotu. V clusplotu jsou data znázorněna pomocí prvních dvou hlavních komponent. Tyto grafické výstupy byly získány pomocí programování v jazyce S-Plus.

Klíčová slova: fuzzy shlukování, clusplot, hlavní komponenty, trh

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POSTAVENIE PRODUKTOV VYBRANÝCH SLOVENSKÝCH MLIEKARNÍ V KONKURENČNOM PROSTREDÍ

THE COMPETITIVE ENVIRONMENT STATUS OF THE PRODUCTS FROM SELECTED MILK PROCESSING ENTITIES IN

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A decision-making process of top managers from the viewpoint of business strategy is affected by competitive environment. The aim of the work is to evaluate the status of selected milk products in competitive environment, based on the given information, data and results. The theoretical and practical aspects of competitiveness are analysed, and a comparison of competitive advantages with the European Union, CEFTA countries and the Czech Republic over 1999–2001 is presented using an RCA indicator According to the results achieved, some measures are recommended to improve the business acivity of chosen entities.

Key words: competitiveness, competition, competitive environment, milk products, strategy, competitive advantages

Jedným z prejavov procesu globalizácie a internacionalizácie podnikateľského prostredia z európskeho a územného ponímania sa stáva skutočnosť, že podnikateľské subjekty vstupujú do obdobia trvalej konkurencie. Úspešní sú iba tí, ktorí sa dobre pripravujú a využívajú príležitosť na dosiahnutie konkurenčnej výhody.