

STSM Report

STSM reference: FP1203 “European Non-Wood Forest Products Network”

Title: *Study of international truffles trade*

Working group: *WG1: Mushrooms and truffles and the Task force 4: Economics, marketing and policies for NWFPs*

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Abstract

The objective of the STSM was to test the applicability of social network analysis on the international trade of NWFP. The literature review has shown that classical trade analysis contains many concepts which relate to social network analysis. Practical analysis was performed on trade of truffles, which shows that the market is strongly growing, but that it is still unstable. Comprehensive plan for future collaboration with EFI HQ and Department of Land, Environment, Agriculture and Forestry, University of Padova has been made, where the emphasis is on publication activity.

Purpose of the STSM

The purpose of the STSM was to study international trade of NWFP. The interdisciplinary environment of EFI HQ has enabled me to gain deeper knowledge on the economy of NWFPs and on the data cleaning process of the bilateral trade information derived from the UN COMTRADE data base. The STSM can be characterized as a mutual learning process on NWFPs, international trade and social network analysis between the members of CFRI, EFI HQ and Department of Land, Environment, Agriculture and Forestry, University of Padova. The focus of analysis was on the trade of truffles.

Description of the work carried out during the STSM;

The main goal of the STSM was to explore the applicability of social network analysis in the study of international trade of NWFPs. The first step was the data cleaning process, where special emphasis was put on handling double entries, missing values and on outliers. Data on global trade was obtained from the UN COMTRADE data base for all types of mushroom products, foliage, nuts and honey. The second step was theoretical matching up of the economic characteristics of international trade with their corresponding network concepts. The third step was network analysis of international trade of truffles.

Description of the main results obtained;

Following a literature review and extensive data mining analysis, an excel-based procedure for data cleaning was developed. The main elements of data mining procedure were the analysis of differences between importing and exporting values and quantities, the differences in the reporting of quantities and values, the impact of missing data on the structure of trade flows, and the assessment of different methods to substitute missing quantities with values and vice versa. The procedure was performed on truffle trade data, and will drastically decrease the future data cleaning process for other NWFP product groups.

A literature review on international trade of NWFPs has showed that in the majority of cases cross-sectional and dynamic econometric models of global trade use parameters that correspond to several network concepts, most notable to Freeman`s and Bonanchich`s approach to centrality, to the continuous core-periphery analysis and to the top-down approaches to identification of cohesive sub-groups. Literature review on network models of world systems and of general global trade showed that characterizing general global trade of NWFPs can most suitably be performed on equivalence based routines.

Practical network analysis has been performed on truffle trade data, for the period 1988-1996.

Whole network analysis shows that the truffle trade has strongly expanded within the observed period. Average bilateral trade has increased from US\$ 126 000 in 1988 to US\$ 325 000 in 1990, and then has fluctuated between US\$ 205 000 and US\$ 262 000 in the 1991-1996 period. The number of countries that were involved in international trade has steadily increased from 14 to 41. However, the overall density (share of actual trade flows as percentage of all possible trade flows) for all the years is below 1% and average degree (average number of trade partners for all the countries involved in international trade within the observed period) has steadily grown from 0.10 to 0.75. These figures

show that overall only a small portion of countries had participated in trade, but that the level of their connectedness is steadily increasing. The network became also more complex, as the diameter (maximal length of trade flow from one country to another, counted in number of connected trade flows) has increased from 3 to 6; which shows that in 1996 the longest supply chain for truffles consisted out of four intermediary countries. The overall conclusion of the whole network analysis is that the network is strongly developing itself basically from no relations at all. The high fluctuation in the reciprocity (share of reciprocated trade flows between two countries) indicates that relations are not stable, and that countries are still “looking” for their optimal trade relations. Strong expansion in the number and volume of trade flows, fluctuations in the reciprocity and the frequent changes of trade partners all characterize international trade of truffles as underdeveloped market.

Components routine has been performed, which looks for maximally connected sub-groups on specified level (value) of trade relations (i.e. searches for groups of countries where all the countries in the group are interconnected to all other countries in the group with increasing thresholds of trade flow). The components routine for all of the observed years shows that there are “steep peak” components, which consist only in two countries. A summary interpretation of the components routine would be that France and Italy have strong bilateral relations throughout the period, and that in the first years Germany was in this group, and that in last years of the period USA and Spain were in that group. But overall it can be stated that the groupings fluctuate. This indicates that the network is not stable, and that there are no real cohesive sub-groups (components) that can be identified.

Factions routine has also been performed, which searched for maximally interconnected sub-groups that have minimum ties between the sub-groups (i.e. tries to group countries into sub-groups that have no trade relations between each other) . General trend is the decrease in the badness of fit (percentage or number of errors or deviations from the ideal type, in which all the countries in all the sub-groups have connections to all other countries within the same sub-group, and have no connections to any country from any other sub-groups) with the increase in the number of factions, which shows that in most cases there is no “optimal” sub-group structure of the network. Another trend is that in each grouping a single faction has high density, while others have low density. These two elements point to “core-periphery” structure of the networks,

Categorical core-periphery analysis has been performed, which searches for maximally interconnected core and minimally interconnected periphery. This analysis identified France, Italy, Spain, Japan and China as the core countries, where density-by-group matrix shows that core countries mostly export to the periphery, but that it imports relatively little. Unlike in previous analyzes of sub-groups, here there is a stable group –

the core. This means that the “central” countries have stable structural position in the network.

Regular equivalence routine has been performed, which groups the countries according to their profile similarity, i.e. to what extent do they form similar trade relations to other similar countries. On 8 % of profile similarity the routine separates Germany, China and Japan, which are the largest importers. One of the well-known mechanisms of social systems is the institutional isomorphism, where “less successful” units mimic the “more successful” ones. This is valid from individuals, to organizations, industries and countries. In developed systems these processes are apparent, and regular equivalence fits perfectly to the concept. The general trend here is that on the higher values of profile similarity analysis shows grouping only of two countries, and that these differ across years. This indicates instability in the network, and that it has not yet developed to a state where countries react to its structural position and to the positions of other countries.

Centrality is a group of node-level concepts. Here only two are addressed; degree and beta-centrality. Degree for valued ties is disseminated into outdegree (export) and indegree (import), where the value of degree represents total export and import by country. A little more complicated measure is the beta centrality, which assigns different weights to having ties with more “central” and more “peripheral” actors. The results shows dominance of Italy and France in having ties to central alters (other countries to which they have trade flows), followed by Germany and South Africa. Beta centrality relations changed a lot in the 1988-1996 period. Summary results of the centrality analysis are:

- Total level of degree (i.e. total export) network grows each year, the growth fluctuates but shows a decreasing trend
- In general there is a demarcation on importing and exporting countries. Exception is France.
- France was in the beginning of the time frame more oriented towards trade with more “central” actors, and Italy toward more “peripheral” actors. With the passage of time they have developed similar pattern of ties. Spain is more oriented towards central alters. Italy also had a very strong increase of export in 1991.
- Chinese exports have quadrupled in 1992, and it has similar pattern of ties to central and peripheral countries. Similar situation happened in Hong Kong in 1995.

Special attention has been devoted to defining of the stochastic actor-oriented network models (SIENA) for the trade in NWFPs. According to the literature review the crucial next steps in understanding of international trade relations is the understanding of its indirect effects, and the understanding of longitudinal structural effect on the change in the trade patterns. Several types of SIENA models have been identified that can address these challenges, and they are: longitudinal network model of trade for the understanding of indirect structural effects, co-evolution model for understanding of interplay between

taxation, trade policies and trade patterns, and the multiple network evolution model for the understanding of added-value chains of NWFPs.

Future collaboration with host institution

The STSM that has been undertaken represents an initial cooperation on the topic of international trade of NWFPs. A comprehensive plan of future collaboration has been prepared, which encompasses further data cleaning procedures, defining of SIENA models, extensive cross-product comparison of NWFPs, and a series of scientific publications.

Foreseen publications/articles resulting or to result from the STSM

Several publications are foreseen to stem from the STSM. The first would focus on the UN COMTRADE data cleaning procedure, and the second would focus on the general applicability of social network analysis to the study of international trade of NWFPs. The third publication would focus on product-specific issues, such as added-value chain in mushroom group of products. The article on the UN COMTRADE data cleaning procedure is the immediate priority, and it is envisaged that it is submitted for publication until July 2014, while the articles on social network analysis and product-specific issues would be submitted latest by first quarter of 2015.

Appendix 1. Letter of confirmation by the European Forest Institute of the successful execution of STSM.