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Prediction of Non-Wood Forest Products Trade Using Artificial Neural Networks

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ABSTRACT

Wood and non-wood resources in the forests have occupied a very important place in human's life, since the advent of history. And today, developing technology along with increasing needs enhance the importance of the other functions of forests, in parallel with wood production. Both in the world and as well in Turkey, one of the featured functions of forests is the production of Non-Wood Forest Products (NWFP). Certain NWFPs are of high added value and are used in many such fields as food, pharmaceutics, and as well in cosmetics. It is emphatically essential to reveal the potential of these products by conducting studies. Vast contributions could be made to a country's economy by increasing and utilizing these potentials. With this study, it is intended to reveal the existing as well as the future return within a period of six years to the Turkish economy of NWFPs through a utilization of the foreign trade and production data of the gone years.

Keywords: Artificial neural networks, Foreign trade, Non-wood forest products, Prediction, Turkey.

INTRODUCTION

Non-Wood Forest Products (NWFPs) are in general defined as any herbal or animal product obtained from forests and clearings (DPT, 2001). However, the notion of NWFP includes many more possible benefits in parallel with the wood products obtained from forest resources (Turker et al., 2002). The concept of NFWP can be expanded to include such a wide range of biological materials, too, as fruits, nuts, spices, extracts of pharmaceutical effects, oils, gums, resins, and insects as well as other animals' products commonly denoted as "secondary products". The term "secondary product" is a false denomination according to specialists denoting the importance of utilizing these products along with their values (Tan *et al.,* 1996). NWFPs, in some regions of some countries, are offered more than wood products, are among the important income resources in terms of foreign trade, and make an important contribution to the diminishing of rural poverty and while the provision of local economic development. The fact that 80% of the needs of the world's population are met, particularly in the fields of health and food, through NWFPs indicates their socio-economic importance (Kilmann *et al.,* 2003).

NWFPs in a region develop according to the ecological conditions, social and economic standing, the technical development of the region, and the historical state of the utilized resource (Hansda, 2009). Turkey enjoys one of the richest floras of the world in terms of ecology and this is due to the fact that the county is located at the junction of the Euro-Siberian,

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Mediterranean, Iran-Turanian phythogeographical regions. There are 11,145 plant taxons in Turkey with 3,616 of these plants classified as indigenous. This means that the diversity within the territory of Turkey is six times the world average (Kutluk and Aytug, 2004). In addition, the ethno-botanical culture is rather developed in Turkey with plants having been used for healing purposes in Anatolia for centuries. All this in turn means that Turkey benefits from all the necessary infrastructure for the development of NWFPs. Given the undeniable importance of non-wood forest products, of which the contribution to the country's economy is much below its potential level, developing aways through expansion of infrastructure possibilities and opportunities, to increase their contribution to the economy is hereby being investigated.

From this viewpoint, scientific works regarding the possible contributions of NWFPs to rural development and nature preservation have started to attract attention and interest during recent years. The focus of the discussions is that the rural population would be more willing to prevent the damage to the forests if NWFPs employed to provide a secure as well as continuous income (Delang, 2006; Coban and Ozalp, 2011). Non-wood forest products have direct benefits regarding the generation of income and provision of employment. In some regions these products contribute more to the rural population than does the production of wood raw materials with their diverse benefits (Yilmaz *et al.,* 2009). A large part of NWFPs are generated in developing countries, an important part of which is consumed by the local population, and the remaining part commonly purchased by agents, and either marketed to the cities and towns or exported.

As it occurs across the world, so it does in Turkey where the main important portion of NWFPs are constituted by Non-Wood Herbal Forest Products (NWHFP), the number of important NWFPs in world foreign trade is predicted at 150 types and their annual foreign trade volume at USD 1.1 Billion (DPT, 2001). Today, along with nearly 100 NWFP plants known to exist in the forests in Turkey, it is highly probable that there are hundreds of plants of which there is either very little or nothing known at all. It is most probable that some of the plants that have remained undiscovered so far will be of significant use regarding human life in a near future. It is necessary to carry out studies regarding the diverse aspects of the issue and to publish the results to have ready the needed information. NWFPs will both be consumed more in the inner market and while the export volume will also increase, contributing to an important scale to the country's economy in the future (Demirci, 2011).

It is noted that the the country's income from the export of NWFPs has been much above that of the export of wood products during the recent past years (Konukcu, 2001). It is known that, along with a contribution of a serious income of USD 160 Million in 2009 and of USD 221 Million in 2010, NWFPs have provided employment possibilities to thousand of forest villagers (GDF, 2011). The benefits obtained from NWFPs should not only be evaluated from economic aspects, but need to be evaluated culturally, too, along with their usage as natural healthy food-nutrition with respect to the producers and consumers (Turner and Cocksedge, 2001). Therefore the world would not only take the forests as a source of wood but also as sites capable of providing a wide range of other beneficial products and services (Janse *et al.,* 2005).

Turkey, making great and more than half century old efforts to join the European Union is to harmonize with its forest product policies. Considering the fact that 26.6% of the total country area consists of forests, it becomes evidently necessary to determine the economic value of forest products as well as their competition status. Turkey produces more non-wood forest products than many European countries (Aydin and Yildirim, 2011). But NWFPs have not attracted much attention in the past since they are mostly consumed by the regional population and not sufficiently marketed (Delang, 2006; Coban and Ozalp, 2011).

Within the present research's scope, and in order to forecast the necessary future volumes of timber in Greece, a neural network has been developed and trained. Comparing the results of this project with linear and non-linear econometric forecasting models, it has been found that neural networks correspond, as confirmed by the econometric indicators MAPE average absolute percentage error and RMSE the square root of the percentage by the average sum of square differences (Tigas *et al.,* 2013). Based on the above, forecasts can provide significant information and define the future structure of the market for fuel wood, because they constitute a decision-making basis for the primary sector, in determining the selling price of fuel wood. Ioannou *et al*., (2009) has assessed the future prices of conifer fuel wood in Greece using Artificial Neural Network (ANN) method. Main objective of this research is the study of the wood market and the wood products for the 25 member states of the European Union. The major product categories, which have been examined, are round wood for coniferous and non coniferous trees, as primary production, saw wood for coniferous and non coniferous trees, wood panels, wood pulp and paper–paper board. All the above mentioned products are converted to round wood equivalent units with the usage of coefficients to be compared with each other (Koulelis, 2006). *Chu et al* (2013) has analyzed to identify important water quality parameters using a factor analysis method and Hopfield neural network method.

Turkey benefits from a great potential regarding NWFPs, gaining more importance day by day in the world economy. Here, NWFPs are used in many fields, taken from nutrition to pharmaceutics as well as cosmetics. This potential of the country can be revealed with various studies and can contribute to the economy by generating a higher production level in a commercial sense. With this study, it is intended to reveal the existing *vs.* the future contributions within a period of six years to the country economy through a utilization of the data recorded during of the previous years.

MATERIALS AND METHODS

Materials

NWFPs include a wide range of product groups. In this study, the following products are mentioned in the International Standard Industry Classification (ISIC) of the United Nations (UN) and referred to as Non-Tree Forest Products (NTFP) when grouped according to the ISIC Revision 4 classification, which is also accepted and applied by the Turkish Statistical Institute (TSI). The export and import values of these products for years 1989-2011 were obtained from the TSI database (TSI, 2011).

Products within the scope of non-tree forest products and their codes (ISIC Rev4);

130110: Lac, 130120: Gum Arabic, 130190: Natural gums, resins and gum resins and oil resins, 400130: Balata, gutta-percha; natural gums like guayule, chicle etc., 450110: Natural mushroom (processed/simply prepared), 60410: Mosses and lichens, 60491: Plant leaves, branches and other parts suitable for bouquets (fresh), 60499: Plant leaves and branches suitable for bouquets (in other forms), 70951: Agaricus type mushrooms (fresh/cooled), 70959: Other mushrooms (fresh/refrigerated).

Methods

The Artificial Neural Networks (ANN) method, which has been successfully employed in many fields in recent years and provides very realistic results regarding predictions, is applied in order to perform a future oriented projection. The independent variable, used in the prediction model of the study is time factor.

Time series are strings which are generated by ordering the monitoring values of an event as according to time. Time series analysis is a method aimed at modelling the stochastic process, provide the structure of the monitored series regarding the event, monitor at determined time intervals, and to make future oriented predictions by the aid of monitoring values regarding past periods. Predictions with time series analysis, widely used in the fields of business administration, economy and finance, is very important in terms of future oriented planning works on both a country's economy and business basis. There are many methods employed in time series analysis. The Box-Jenkins method is one of the most common and most widely applied ones in the analysis of a linear time series. The Box-Jenkins method can be applied successfully in linear and static processes or non-static series which are made static by diverse statistical methods. But many time series also include non linear relations along with linear relations. Different methods capable of modeling this non linear relation are needed. Artificial neural networks, which are capable of modeling both linear and non linear relations, depending on the characteristics of the activation function in their structure, have become some of the alternative methods employed in the analysis of non linear time series during recent years (Kaynar ve Tastan, 2009).

Different models of varying network structures and learning parameters were established through ANN, and then trainings performed. The models were tested with data not used in the training set regarding the test of the network performances and reserved for tests, with attempts made to achieve the most accurate results.

The prediction values resulting from the test process were compared with the real values and models providing the best results with respect to ratios of the Root Mean Square Error (RMSE), calculated through Equation (1), and the Mean Absolute Percentage Error (MAPE), calculated through Equation (2), selected as the prediction models.

$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(t_i - td_i\right)^2} \tag{1}$$

$$MAPE = \frac{1}{N}\left(\sum_{i=1}^{N}\left[\left|\frac{t_i - td_i}{t_i}\right|\right]\right)\times 100 \tag{2}$$

Where, the *MAPE* value stands for the sum of the absolute values of the percentage errors. The error values do not eliminate each other in *MAPE*, and all the error values generated at the prediction remain visible. The *MAPE* measure is therefore more frequntly used for error assessement (Meydan, 2007). The desired result for all the handled statistics is to establish the prediction model through *RMSE* and *MAPE* statistics with the lowest value. That the *MAPE* has a meaning itself since it defines the forecast errors in percentages is accepted to be its superiority against other methods (Akgul, 2003). Witt and Witt (1992) have classified prediction models with a *MAPE* value of below 10% as "highly correct" models, and models of between 10 and 20% as "correct prediction" ones.

RESULTS AND DISSCUSION

The export and import values (US-$) of non-tree forest products were obtained from the database of the TSI and modelled with the aid of the artificial neural network. To be able to predict the export and import values of non-tree forest products within the next six years, the export and import values within the period in question were grouped as training with test values while different value sets generated and used for the training of artificial neural networks.

The feed forward and back propagation multilayer ANN was preferred in the solution of problems and the training and testing of the networks, performed through Matlab package program (Demuth and Beale, 2000). Throughout the study, the hyperbolic tangent sigmoid function (tansig) was used as the activation (transfer) function, and while the linear transfer function (purelin), and the Levenberg Marquardt algorithm (trainlm) selected. The gradient descent with momentum back propagation algorithm (traingdm) was used as the training rule, and the Mean Square Error (MSE) was used as the performance function.

To ensure that each parameter contributed equally to the models, the data in the training and test sets were presented to the network by normalizing these within a (-1, 1) range since the hyperbolic tangent sigmoid function was used in the models, and then the values were converted into their original ones by subjecting them to a reverse normalization process to ensure that the results could be read. The normalization (scaling) was performed through the aid of Equation (3):

$$X_{norm} = 2 \times \frac{X - X_{\min}}{X_{\max} - X_{\min}} - 1 \qquad (3)$$

Where, X_{norm} indicates the normalized data, X indicates the real value of the variable, X_{min} representing the minimal value of the data group, and X_{max} indicatingthe maximum value of the data group.

The export and import figures of some 23 years between 1989 and 2011 regarding the NTFPs in Turkey can be seen in detail in Tables 1 and 2.

From Tables 1 and 2, it can clearly be seen that the import and export values of NTFPs tend to increase by years, in general, even if they do decrease from time to time. Whilst the export value shows a nearly four-fold increase during the years in question, the import shows a seven-fold increase. Turkey, while having a foreign trade surplus during

Table 1. Export values (US-$) of Non-Tree Forest Products according to year.

Code / Years	130110	130120	130190	400130	450110	60410	60491	60499	70951	70959	Total
1989	0	0	1.624.027	143	0	13.463	303.789	43.955	2.531.207	0	4.516.585
1990	0	0	1.726.553	30	0	67.645	295.861	48.388	2.133.886	0	4.272.363
1991	889	5.040	729.902	525	0	9.036	526.079	269.194	5.444.498	0	6.985.164
1992	10.473	0	935.537	2.116	0	29.962	766.732	221.131	5.327.374	0	7.293.325
1993	34.562	72	92.369	1.260	8.680	34.381	586.511	291.891	3.883.262	0	4.932.988
1994	0	0	591.048	0	145	104.588	22.136	218.844	4.035.800	0	4.972.561
1995	0	8.114	511.556	0	190	238.249	29.684	236.029	4.518.104	0	5.541.926
1996	330	1.048	325.266	0	3.043	254.834	27.858	259.868	6.481.929	0	7.354.176
1997	4.580	64	490.964	1.829	0	372.412	113.313	313.098	6.917.470	0	8.213.730
1998	0	1.934	435.794	13	67	464.114	156.393	338.722	5.420.277	0	6.817.314
1999	932	91	705.664	17.378	4.370	568.669	530.928	346.709	4.331.849	0	6.506.590
2000	0	0	944.485	44.260	13.958	360.727	261.808	678.640	3.816.502	0	6.120.380
2001	0	275	872.573	213	303	301.241	1.060.025	1.866.263	3.244.936	0	7.345.829
2002	0	7.784	1.123.868	218	2.792	548.641	2.614.807	2.386.119	712	6.896.592	13.581.533
2003	0	12.597	1.223.193	15.252	211	1.021.318	4.826.975	3.830.719	0	4.144.522	15.074.787
2004	0	34.770	1.932.327	3.464	0	1.340.969	5.573.674	1.495.810	12.896	3.914.636	14.308.546
2005	0	8.741	936.633	0	0	2.512.128	3.342.242	1.558.517	7.935	6.859.961	15.226.157
2006	0	5.361	92.593	11.901	0	2.169.372	2.881.852	1.401.873	249	11.321.558	17.884.759
2007	0	3.516	171.949	2.345	6.118	1.455.406	2.682.392	1.933.381	0	5.961.794	12.216.901
2008	0	3.028	239.975	7.463	2.209	1.715.452	1.977.481	2.066.608	429.762	8.145.808	14.587.786
2009	0	6.499	319.184	634	0	1.713.374	1.746.917	2.384.095	38.464	11.752.074	17.961.241
2010	0	586.351	140.553	6.439	0	1.416.571	1.632.000	2.811.542	32.433	7.489.071	14.114.960
2011[a]	0	61.957	216.745	13.162	0	538.993	65.950	808.882	0	5.359.869	7.065.558

[a] First 5 Months' Period, Non-Tree Forest Products (TSI).

Table 2. Import values (US-$) of Non-Tree Forest Products according to year.

Code /Years	130120	130190	400130	450110	60410	60491	60499	70951	70959	Total
1989	214.645	135.465	11.781	6.797	4.016	9.335	14.563	0	0	396.601
1990	322.890	243.946	15.796	0	8.574	41.265	72.842	0	0	705.313
1991	132.142	177.089	25.360	0	876	10.192	32.039	0	0	377.699
1992	186.237	263.364	55.135	0	0	0	117.255	16.617	0	638.608
1993	226.314	281.943	75.006	9.477	161	8.334	91.475	1.176	0	693.886
1994	147.978	256.553	0	0	4.734	0	67.518	543	0	477.326
1995	272.551	297.021	1.727	0	8.856	0	211.188	0	0	791.343
1996	252.097	404.416	1.964	5.615	174	0	156.207	41.664	0	862.137
1997	388.533	332.948	29	20.610	45.279	2.073	45.440	53.442	0	888.354
1998	371.497	156.247	15.246	708	1.273	0	107.401	5.158	0	657.530
1999	229.819	265.933	30.649	0	8.434	12.997	116.627	4.578	0	669.037
2000	275.320	203.383	29.306	0	39.255	1.362	79.509	1.839	0	629.974
2001	275.921	153.758	24.252	75.956	98.347	254	7.200	8.028	0	643.716
2002	495.100	164.146	4.190	130.252	0	85	405.551	0	29.614	1.228.938
2003	818.030	415.813	4.161	82.866	0	5.973	260.816	0	0	1.587.659
2004	1.181.218	602.233	2.746	96.668	24.949	144.392	244.617	0	0	2.296.823
2005	1.373.328	602.850	144	14.762	5.342	31.555	473.890	0	0	2.501.871
2006	1.268.883	981.925	7.768	88.774	0	34.784	289.913	0	8.886	2.680.933
2007	1.259.093	1.222.938	20.534	20.773	7.543	57.128	395.896	0	7.511	2.991.416
2008	1.082.083	1.642.808	6.370	0	0	8.684	486.784	0	28.925	3.255.654
2009	999.815	1.905.037	59.151	0	0	8.312	317.669	0	15.841	3.305.825
2010	1.069.269	1.677.302	112.919	5.595	3.512	32.210	471.325	0	5.550	3.377.682
2011[a]	707.490	734.270	43.210	10.356	0	4.913	83.582	0	0	1.583.821

[a] First 5 Months' Period, Non-Tree Forest Products (TSI).

all the years regarding NTFPs, recorded an increase of more than three-fold between 1989 and 2011. There are many reasons for the NTFPs attracting such interest and becoming widespread. While it is an important income source for the local population, it is also important for the sustainable management of the forests. The regional population in developing countries, living in close proximity to the forests collect non-wood forest products for food or for obtaining an income.

The production volumes realized in Turkey between the years 1988 and 2009 under the secondary forest products' title, obtained from the old publication sources of the TSI, are given in Table 3. With a look at the table, it can be seen that even if the production volume shows an up and down trend within a period of 22 years, the overall course was towards a great increase.

The values estimated according to the predicted figures for the export and import, the real values, the variation quantits, the

Table 3. Secondary forest products production volumes (1988-2009).

Years	Production Volume (Kg)
1988	1.695.000
1989	371.000
1990	4.524.000
1991	8.171.000
1992	11.696.000
1993	15.813.000
1994	13.207.000
1995	11.487.000
1996	15.955.000
1997	15.602.000
1998	12.770.000
1999	12.303.000
2000	19.466.896
2001	23.085.658
2002	20.641.953
2003	18.418.729
2004	26.111.525
2005	21.150.934
2006	15.026.558
2007	22.481.939
2008	15.370.364
2009	29.347.243

percentage error rates, and the *RMSE* as well as *MAPE* figures are given in Tables 4 and 5 respectively as training and test values.

The ANN models constisting of one input layer, two hidden ones and one output layer, providing the closest results to the real values regarding the export and import can be seen in Figure 1.

In the models, e_{t-1}, e_{t-2}, e_{t-3} indicate the previous years at export and while i_{t-1}, i_{t-2}, i_{t-3} at import, with e_t is taken as the output variable at export and i_t taken as the output variable at import. The process element (neuron) numbers in the hidden layers are 10 and 10 in the export model, while11 and 7 in the import model respectively, as in Figure 1.

The iteration dependent error variation graphics of the artificial neural networks selected for export and import are seen in Figure 2, and the number of the epochs, at which the training of the models were stopped, are figured out as 19 and 82 respectively.

The relationship between the values, calculated by utilizing the export and import prediction models, and the real values can be seen in Figure 3. The comparative graphicS of these values are depictedin Figure 4.

Considering the results obtained from the test set *vs.* the real results of the problem at the realization of export and import predictions, it is understood that the network achieved and presented results of a sufficient accuracy, based on the fact that the R^2 value resulted in 84 and 98% and the *MAPE* resulting in 4.66 and 2%.

The findings regarding the future six-year predictions of the export and import values obtained through modelling of the established time series model through ANN can be seen in Table 6. A detailed view regarding the realized export and import values within the past gone years *vs.* the expected values are given in Figures 5 and 6.

Table 4. Training and test data set of export values.

	Nr.	e_{t-3}	e_{t-3}	e_{t-3}	e_t Real	e_t Calculated	Deviation	% Error	MAPE	RMSE
Training data	1	4516585	4272363	6985164	7293325	7390525	-97201	-1.33	0.53	48829
	2	4272363	6985164	7293325	4932988	4997763	-64775	-1.31		
	3	6985164	7293325	4932988	4972561	5012761	-40200	-0.81		
	4	7293325	4932988	4972561	5541926	5545045	-3119	-0.06		
	5	4932988	4972561	5541926	7354176	7400764	-46588	-0.63		
	6	4972561	5541926	7354176	8213730	8177425	36305	0.44		
	7	5541926	7354176	8213730	6817314	6907869	-90555	-1.33		
	8	7354176	8213730	6817314	6506590	6501941	4649	0.07		
	9	8213730	6817314	6506590	6120380	6120401	-21	0.00		
	10	6817314	6506590	6120380	7345829	7412741	-66912	-0.91		
	11	6506590	6120380	7345829	13581533	13598751	-17218	-0.13		
	12	6120380	7345829	13581533	15074787	15102718	-27931	-0.19		
	13	7345829	13581533	15074787	14308546	14337596	-29050	-0.20		
	14	13581533	15074787	14308546	15226157	15224583	1574	0.01		
Test data	15	15074787	14308546	15226157	17884759	16000982	1883777	10.53	4.66	972929
	16	14308546	15226157	17884759	12216901	13222811	-1005910	-8.23		
	17	15226157	17884759	12216901	14587786	14899762	-311976	-2.14		
	18	17884759	12216901	14587786	17961241	18080615	-119374	-0.66		
	19	12216901	14587786	17961241	14114960	13868175	246785	1.75		

Table 5. Training and test data set of import values.

	Nr.	e_{t-3}	e_{t-3}	e_{t-3}	e_t Real	e_t Calculated	Deviation	% Error	MAPE	RMSE
Training data	1	396601	705313	377699	638608	637985	623	0.10	0.12	1221
	2	705313	377699	638608	693886	695348	-1462	-0.21		
	3	377699	638608	693886	477326	477801	-474	-0.10		
	4	638608	693886	477326	791343	791219	124	0.02		
	5	693886	477326	791343	862137	864870	-2733	-0.32		
	6	477326	791343	862137	888354	888756	-402	-0.05		
	7	791343	862137	888354	657530	659541	-2011	-0.31		
	8	862137	888354	657530	669037	669410	-373	-0.06		
	9	888354	657530	669037	629974	630099	-125	-0.02		
	10	657530	669037	629974	643716	645135	-1419	-0.22		
	11	669037	629974	643716	1228938	1230546	-1608	-0.13		
	12	629974	643716	1228938	1587659	1588699	-1040	-0.07		
	13	643716	1228938	1587659	2296823	2297409	-586	-0.03		
	14	1228938	1587659	2296823	2501871	2501363	508	0.02		
Test data	15	1587659	2296823	2501871	2680933	2764082	-83149	-3.10	2.00	71856
	16	2296823	2501871	2680933	2991416	3102337	-110921	-3.71		
	17	2501871	2680933	2991416	3255654	3255484	170	0.01		
	18	2680933	2991416	3255654	3305825	3338750	-32925	-1.00		
	19	2991416	3255654	3305825	3377682	3451948	-74266	-2.20		

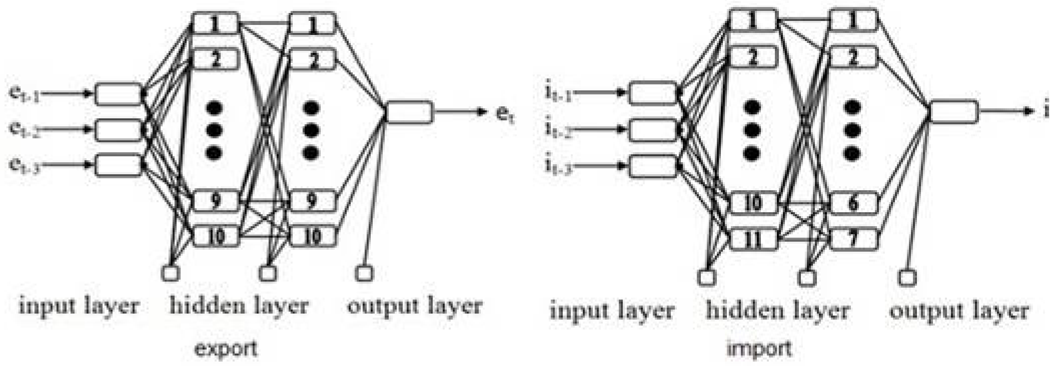

Figure 1. The ANN architecture selected for the prediction model regarding export and import.

With a lok at Figure 5, it can be clearly seen that, even if an increase should occur from time to time, the increase woulb be in export values. And within the six-year predictions, it is expected that the fluctuations will course between US-$ 15 and 20 Million at export. Looking at Table 6, it is predicted that the export value will increase to a level of US-$ 19.5 Million in 2014. Considering Figure 6, it is expected that import of NWFPs, which have shown a rapid increase since 2001, will sustain this increase projection somewhat during the coming years, too. According to Table 6, it is expected that the import value will reach its top ones, being increased to US-$ 3.7 Million in 2014 and 2015.

The multi-functional value of Turkey's forests would increases day by day and the importance of the forests, which had been deemed to serve only as a source of wood in the past, would gain weight as both service

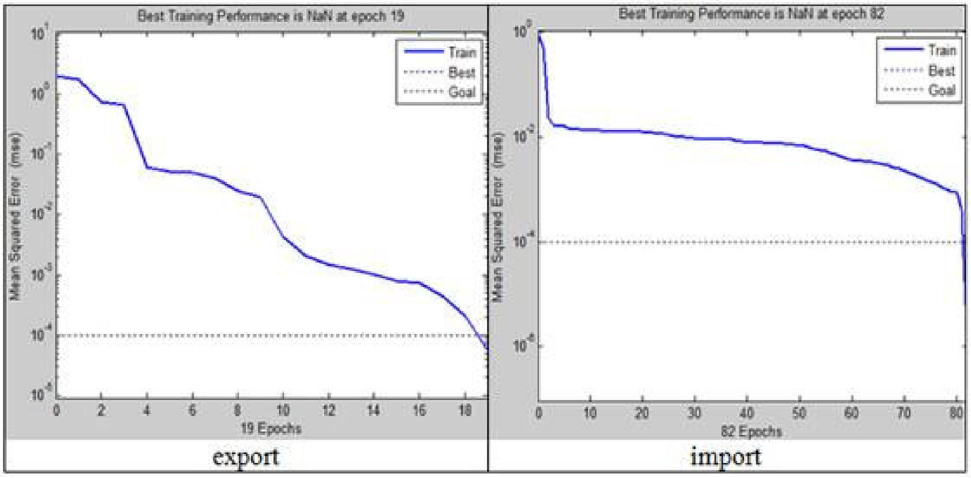

Figure 2. Iteration dependant error variation graphics of the ANN.

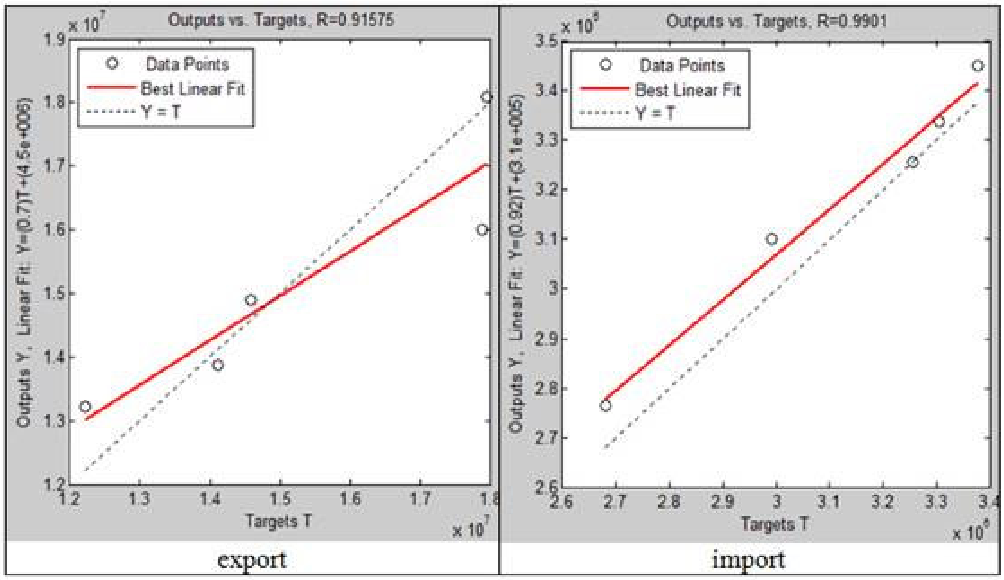

Figure 3. Relation between the real values and the ANN values.

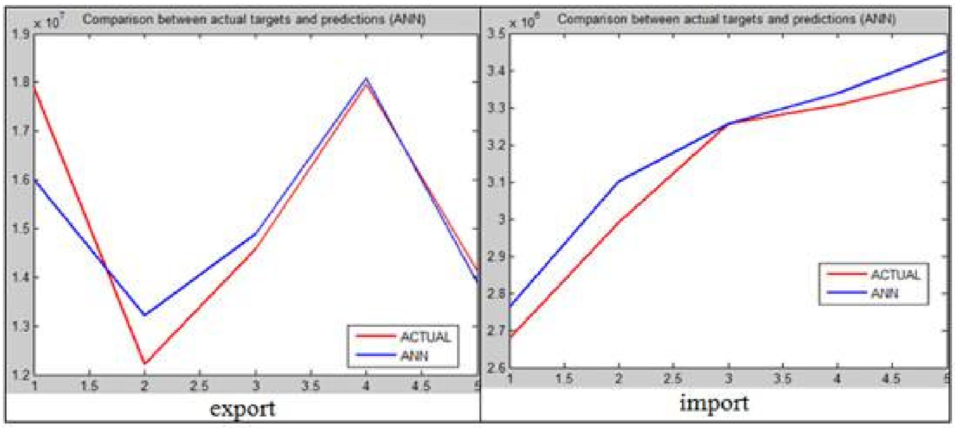

Figure 4. Comparison of the real values with the ANN values.

Table 6. Predicted results for the future six year period regarding export and import values.

Years	Export values ($)	Import values ($)
2011	18.446.176	3.583.727
2012	16.860.437	3.583.848
2013	15.233.496	3.563.724
2014	19.451.695	3.673.780
2015	14.803.338	3.676.177
2016	18.466.408	3.635.163

and benefit providers. Though the NWFP production potential stands at very high in Turkey, production volume is much below the estimated and expected potential. However, unfortunately, there are no sufficient laws and regulations regarding the inventory of NWFPs, integration into development plans, or production and marketing. These essentials need to be attended to and performed as needed preliminary steps.

CONCLUSIONS

According to the performed evaluations, it is seen that the demand for NWFPs will tend towards an increase both in terms of export as well as import, reaching an expected peak

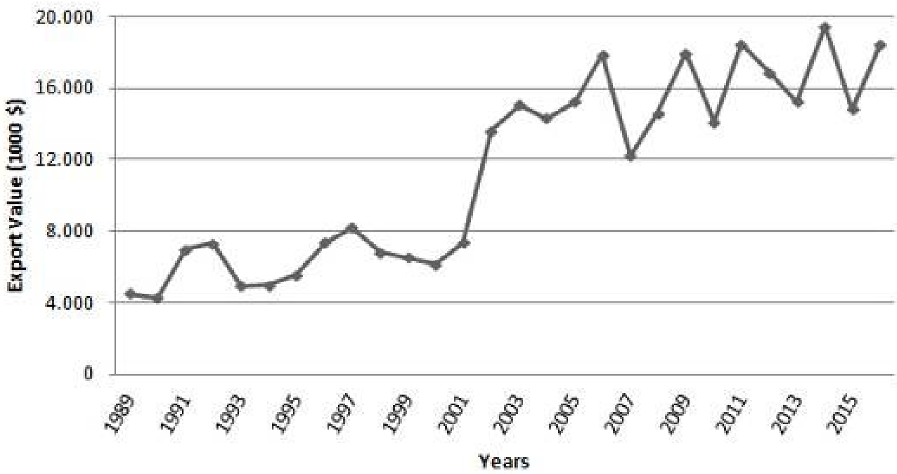

Figure 5. View of the export values regarding previous years and the prediction regarding the next six years.

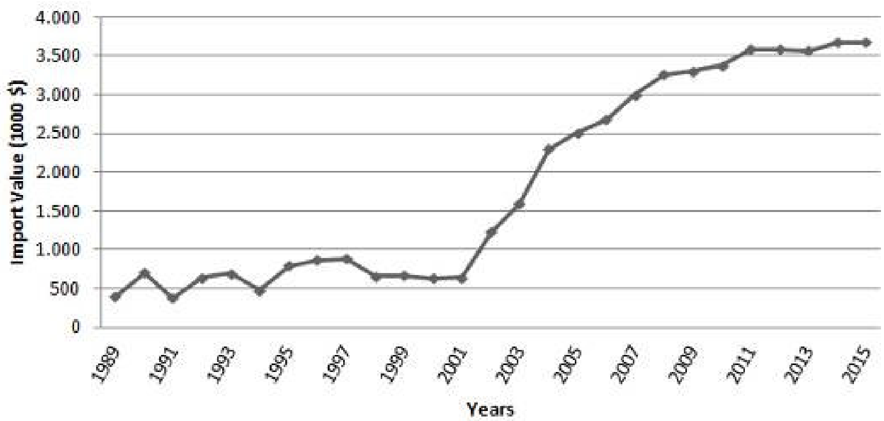

Figure 6. View of the import values regarding previous years and the prediction regarding the next six years.

in 2014. This great increase in export and import could only sustain its ratio within the general foreign trade from the past to present. Yet, it is possible to use this potential and to increase its ratio within foreign trade. It is essential that this potential be realized in a conscious manner by preparing necessary plans and programs. This will result in demand being concentrated and will increase the differentiation both in the national and international markets. In this sense, it is necessary that the required regulations are initiated as soon as possible and that Turkey obtains its deserved place in the NWFP market. Furthermore, it should be ensured that the producers are trained and a more efficient production is performed with concious specialists; in this manner, damage to the forests by benefiting from the resources without first implementing plans and programs and by being unaware to the extent that the sustainability of the forestry is threatened can be prevented.

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پیش‌بینی تجارت تولیدات غیر چوبی جنگل با استفاده از شبکهٔ عصب مصنوعی

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چکیده

منابع چوبی و غیر چوبی جنلگها جایگاه بسیار مهمی را در زندگی بشر از بدو تاریخ به خود اختصاص داده‌اند، و امروزه فناوری در حال گسترش همراه با احتیاجات رو به افزایش جوامع، بر اهمیت سایر نقش‌های جنگل (علاوه بر نقشی که در زمینهٔ فراهم آوردن چوب ایفا می‌نمایند) می‌افزاید و نیز در کشور ترکیه، یکی از نقش‌های برجستهٔ جنگلها تولید محصولات غیرچوبی (Non Wood Forest Products (NWFO)) از جنگل است. پاره‌ای از این محصولات دارای ارزش افزودهٔ فراوانی هستند و در زمینه‌هائی نظیر غذا، دارو و لوازم آرایشی کاربرد دارند. این نکته مؤکداً حائز اهمیت است که توانائی بالقوهٔ این تولیدات از طریق مطالعاتی که انجام خواهد گرفت به مظهر ظهور برسد. از طریق افزایش و به کارگیری این توانائیهای بالقوه می‌توان گشایش شایانی را در اقتصاد یک مملکت فراهم کرد. در خلال این مطالعه قصد این است که منابع اقتصادی فعلی و منابع اقتصادی مملکت در طول شش سال آینده را (با استفاده از آمار و اطلاعات تولید و تجارت خارجی مربوط به سالهای گذشته در سطح مملکت) برآورد نمود و ارائه داد.