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INTERNATIONAL JOURNAL OF *ELECTRONICS*, MECHANICAL and MECHATRONICS *ENGINEERING* (IJEMME)

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From the President

It is our great pleasure to publish fifth issue of international journal, "International Journal of Electronics, Mechanical and Mechatronics Engineering" (IJEMME) of Istanbul Aydin University. Our sustainable strategy is to demonstrate new trends in science and technology subject to high quality standards by ensuring a stringent peer review process.

The scope of the International Journal of Electronics, Mechanical and Mechatronics Engineering (IJEMME) covers the novel scientific papers about Electronics, Image Processing, Information Theory, Electrical Systems, Power Electronics, Control Theory, Embedded Systems, Robotics, Motion Control, Stochastic Modeling, System Design, Multidisciplinary Engineering, Computer Engineering, Optical Engineering, Design Optimization, Material Science, Metamaterials, Heat and Mass Transfer, Kinematics, Dynamics, Thermo-Dynamics, Energy and Applications, Renewable Energy, Environmental Impacts, Structural Analysis, Fluid Dynamics and related topics of the above subjects.

Manuscripts reporting original theoretical and/or experimental work and tutorial expositions of permanent reference value are highly welcome.

I sincerely wish to thank the editor in chief, members of the editorial board, and authors of the seventh issue who have generously contributed their time and knowledge to the work and the mission of the journal.

Dr. Mustafa AYDIN
President

From Editor

In this issue of "International Journal of Electronics, Mechanical and Mechatronics Engineering (IJEMME)", we have especially selected the scientific areas which will cover future prospective Engineering titles such as Robotics, Mechanics, Electronics, Telecommunications, Control systems, System Engineering, Biomedical, and renewable Energy Sources.

We have selected only a few of the manuscripts to be published after a peer review process of many submitted studies. Accepted papers are as follows:

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OPTIMALITY ISSUES IN A SERIES SYSTEM FROM MANUFACTURER'S PERSPECTIVE CONSIDERING BURN-IN AND WARRANTY PERIODS

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Abstract- *Reliability engineers generally have to deal with systems that consist of some components in series and others in parallel. Reliability of a series system can be calculated by multiplying the reliability of individual elements in that system. Failure rate of many deteriorating systems shows a bathtub shape curve. The aim of this paper is to find the average total cost of a series system, from a manufacturer's point of view, during the first two phases of its life; considering optimality issues for burn-in and warranty periods. Numerical illustration is provided to show the applicability of the model.*

Keywords: *Series System, deteriorating system, renewing warranty, burn-in, optimization*

1. INTRODUCTION

Nowadays, increase in consumers' knowledge and expectations has forced manufacturers to produce high quality products at reasonable prices. This necessitates manufacturers to either employ various techniques such as a burn-in test in order to manufacture highly reliable products; or satisfy their customers by offering different types of warranties. Two types of extended warranty policies from manufacturer's point of view and their relevant cost and profit models have been proposed by Su and Shen (2012). Burn-in is a process in which the product is run under conditions like the real field conditions for a specified period of time in the manufacturer's place so as to detect problems and filter out defective items. After successfully passing burn-in period a product is considered to be of a quality that can be marketed. In order to maximize reliability, Kim and Kuo (2009) established an exchange between component reliabilities during system burn-in period and developed an optimal burn-in time for repairable non-series system.

When selling a product, warranty is offered by the producer to the customer for two simple but important reasons: be in the safe side and increase customer's satisfaction. Generally warranties are in two classes, namely renewing and non-renewing warranties. Renewing warranty means that if a sold product faces a failure during its warranty period of length W, it will be replaced by a new product with a new warranty period of length W. Jung *et al*. (2010) considered the maintenance policy of a system under the renewing warranty during its wear out period. In another study, Vahdani *et al*. (2011) developed a replacement repair model in order to investigate a renewing free replacement warranty for a class of multi-state deteriorating repairable products. In a non-renewing warranty policy, however, the failed item at age t is replaced with a new item with a warranty period of length W-t. Recently, Jung *et al*. (2012) studied the optimal maintenance policy for non-renewing warranty by formulating the average cost rate per unit time from the consumer's viewpoint.

Generally for deteriorating products, the rate of failure is a high value during two periods of their life; first when they are completely new. During this period the failure rate decreases with a sharp slope. This period is known as burn-in or infant mortality period. The second period, where the rate of failure is a high value but has increasing rate, is known as post warranty or wear out period. Between these two periods, the failure rate is approximately constant and known as useful life period which overlaps the warranty period. Failure rate curves of such systems based on their failure rate functions usually depict a bathtub shape curves (see Figure 1).

The purpose of this work is to find the average of the total cost during the first two periods (burn-in and useful life) of product life by considering optimum values of burn-in and warranty periods from the manufacturer's point of view. Considering both burn-in and maintenance policy at the same

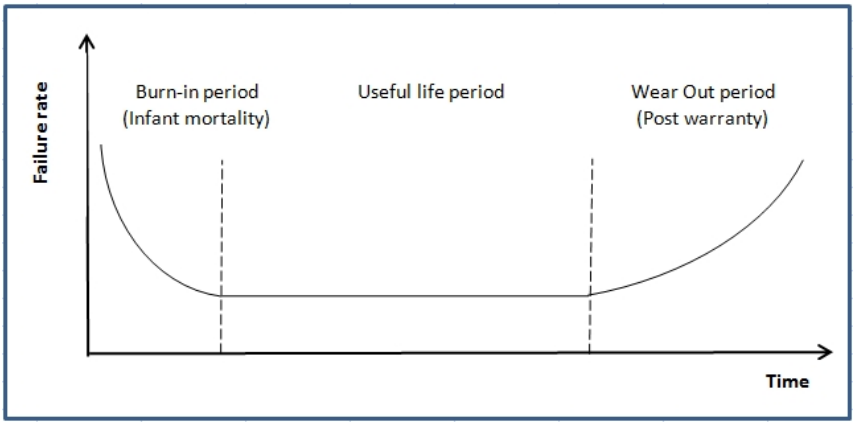

Figure 1: Bathtub failure rate curve

time to study optimum burn-in with random minimal repair cost has been presented by Kwon et al. (2010). Moghimihadji and Rangan (2012) in their recent work, investigated some optimality issues based on the total average cost of a parallel system over its entire useful life from the perspective of both consumers and manufacturers.

2. NOTATIONS USED

$f_j(t)$: Failure rate density of jth component
$h_j(t)$: Bathtub shape failure rate curve of jth component
b: Burn-in period length
W: Warranty period length
m: Number of components in the series system
N(b): Number of failed systems until for the first time one system can survive burn-in period of length b
c_{0j}: Purchasing and installation cost of jth component in the series system
c_{1j}: Operating cost of jth component during burn-in period
C_2: Cost of installation of the whole system
x_i: Lifetime of ith failed system during burn-in before completing burn-in period b
C_3: Cost of replacing failed system in customer's place
$N_b(W)$: Number of failed burnt-in systems during warranty period until for the first time one burnt-in system can survive warranty period of length W

3. THE MODEL

In the proposed model, we consider a series system with a bathtub failure rate curve. This system consists of *m* independently distributed elements with bathtub shape failure rate curve $h_j(t)$ and failure rate density $f_j(t)$. The manufacturer puts the system under a specified burn-in process of length *b*. If during this period the system fails, the manufacturer replaces the failed system with a new one.

Expected cost during burn-in period (0, b]

Related costs during this period are the *purchasing* and *installation* cost of each component of the series system, the *operating* cost of each component per unit time during burn-in period in manufacturer's place, and finally the *installation* cost of the whole system to do the burn-in test.

$$C_b = N(b) * \sum_{j=1}^{m} c_{0j} + \sum_{j=1}^{m} c_{1j} * \left(b + \sum_{i=1}^{N(b)-1} x_i\right) + C_2 * [N(b) - 1] \quad (1)$$

Let

$$C_0 = \sum_{j=1}^{m} c_{0j} \quad (2)$$

and $C_1 = \sum_{j=1}^{m} c_{1j}$. (3)

Now

$$P_r[N(b) = k] = G(b)^{k-1}\bar{G}(b) \quad (4)$$

where $G(b)$ and $\bar{G}(b)$ are the distribution and survivor functions of the series system and it can be seen that $N(b)$ has a geometric distribution function. Thus,

$$E[N(b)] = \frac{1}{\bar{G}(b)} \quad (5)$$

Using Wald's identity

$$E\left(\sum_{i=1}^{N(b)-1} x_i\right) = E[N(b)].E(x_1) - E[x_{N(b)}] = \frac{\int_0^b \bar{G}(t)dt}{\bar{G}(b)} - b \quad (6)$$

Hence, the expected cost during burn-in period is given by

$$E(C_b) = \frac{C_0}{\bar{G}(b)} + C_1 \frac{\int_0^b \bar{G}(t)dt}{\bar{G}(b)} + C_2 \frac{G(b)}{\bar{G}(b)} \quad (7)$$

Expected cost during warranty period (b, b+W]

Based on definition, systems that successfully pass the burn-in period are burnt-in systems and of the quality to reach the market. At this phase, the burnt-in system is sold in the market along with a warranty period of length *W*. The cost elements in

this period are the cost of having a burnt-in system (C_b) and the cost of changing a failed system with a new one in customer's place (C_3). Thus,

$$C_W = (C_b + C_3)[N_b(W) - 1] \quad (8)$$

Again using Wald's identity

$$E[N_b(W) - 1] = \frac{G_b(W)}{\bar{G}_b(W)} \quad (9)$$

where $G_b(W)$and $\bar{G}_b(W)$ are distribution and survivor functions of a burnt-in system, respectively. These functions are given by

$$G_b(W) = \int_0^W g_b(t)dt = \int_0^W \frac{g(b+t)}{\bar{G}(b)}dt = \frac{\int_b^{b+W} g(t)dt}{\bar{G}(b)} \quad (10)$$

and

$$\bar{G}_b(W) = \frac{\bar{G}(b+W)}{\bar{G}(b)} = \frac{\int_{b+W}^{\infty} g(t)dt}{\bar{G}(b)}. \quad (11)$$

Thus, the expected cost during warranty period is given by

$$E(C_W) = (C_b + C_3)\frac{G_b(W)}{\bar{G}_b(W)} \quad (12)$$

At the end of warranty period the total age of the system is $b+W$ (it is obvious that $b<W$) and the average total cost of the system up to this point is the summation of equations (7) and (12) over the total age of the system.

$$ATC = \frac{E(C_b)+E(C_W)}{b+W} \quad (13)$$

4. NUMERICAL EXAMPLE

In order to illustrate the application of this model for real cases, we consider a simple series system, which contains only two components. It should be emphasized that only two components are considered in this system for the sole purpose of keeping the calculations simple. Now, suppose that each component has a bathtub failure rate curve

given by

$$h(t) = KC\lambda t^{C-1} + b(1-K)\beta t^{b-1}e^{\beta t^b}. \quad (14)$$

This function was introduced for the first time by Dhillon (1979). By changing the values of shape parameters b and C in this five-parameter failure rate function; one can generate different shapes of failure rate curve for different types of component. In this illustration, we fix these five parameters as follows:

$\beta = 1, \lambda = 2, K = 0.5, b = 1.5,$ and $C = 0.3$ for the first component, and for the second component we chang only b and C as follows: $b = 1.4,$ and $C = 0.4$. Since the mean value of lifetime of this system is about 0.3587, we define the range of burn-in period from 0.025 to 0.375 by step size 0.025. In addition, we define the range of warranty period from 0.05 to 1.1 by step size 0.05. Table 1 shows the amount of average total cost for different pair values of burn-in and warranty periods.

Burn-in / Warranty	0.025	0.050	0.075	0.100	0.125	0.150	0.175	0.200	0.225	0.250	0.275	0.300	0.325	0.350	0.375
0.05	2509.1	2107.0	1890.6	1770.4	1708.5	1686.5	1695.0	1728.7	1785.3	1863.8	1964.8	2089.6	2240.5	2421.0	2635.3
0.10	1699.3	1588.2	1529.5	1506.7	1510.9	1537.4	1583.8	1649.3	1734.0	1838.9	1965.9	2117.5	2297.4	2509.8	2760.7
0.15	1376.2	1352.9	1353.8	1374.6	1412.9	1467.8	1539.3	1628.2	1735.9	1864.4	2016.7	2196.2	2407.6	2656.6	2950.4
0.20	1219.3	1235.4	1267.0	1313.3	1374.1	1449.9	1541.9	1651.7	1781.6	1934.6	2114.3	2325.4	2573.9	2867.0	3214.0
0.25	1142.1	1181.2	1233.2	1298.2	1377.3	1471.7	1583.4	1714.6	1868.7	2049.2	2261.2	2510.5	2804.7	3153.3	3568.1
0.30	**1112.4**	1168.5	1236.8	1318.5	1415.1	1528.6	1661.5	1817.1	1999.3	2213.1	2464.8	2762.0	3114.6	3534.9	4038.8
0.35	1116.5	1187.5	1271.6	1370.2	1485.7	1620.6	1778.4	1963.1	2180.0	2435.6	2737.8	3097.1	3526.3	4042.1	4665.8
0.40	1148.5	1234.8	1335.7	1453.5	1591.0	1751.6	1939.9	2161.2	2422.3	2731.8	3100.5	3542.2	4074.6	4720.5	5509.9
0.45	1207.2	1310.5	1431.0	1571.7	1736.2	1929.1	2156.3	2424.9	2744.0	3125.2	3583.4	4137.5	4812.5	5640.7	6665.3
0.50	1294.0	1417.8	1562.3	1731.6	1930.4	2165.1	2443.3	2774.8	3172.1	3651.3	4233.2	4945.0	5822.5	6913.7	8282.7
0.55	1413.3	1562.6	1737.8	1944.1	2188.1	2478.3	2825.2	3242.6	3748.1	4364.6	5122.5	6061.8	7236.4	8719.2	10610.4
0.60	1572.7	1755.0	1970.4	2225.9	2530.8	2896.8	3338.9	3876.9	4536.3	5351.2	6367.3	7645.8	9271.0	11359.0	14072.9
0.65	1783.8	2010.1	2279.7	2602.5	2991.7	3464.1	4041.9	4754.0	5639.4	6750.4	8158.3	9961.6	12297.4	15360.3	19429.7
0.70	2064.4	2350.9	2695.5	3112.9	3622.3	4248.6	5025.5	5997.8	7226.6	8795.9	10822.6	13471.7	16979.5	21689.4	28108.9
0.75	2441.6	2812.6	3264.3	3818.6	4504.6	5361.1	6440.8	7816.1	9587.5	11896.3	14944.2	19023.7	24565.4	32214.5	42955.8
0.80	2957.5	3450.9	4060.1	4819.2	5773.9	6987.2	8545.8	10572.1	13239.8	16800.1	21622.0	28256.5	37542.0	50779.6	70030.8
0.85	3679.2	4355.8	5205.0	6281.7	7661.9	9451.7	11802.3	14931.1	19157.0	24954.8	33045.0	44541.9	61206.3	85883.1	123282.4
0.90	4717.4	5678.4	6907.7	8498.3	10582.3	13349.8	17078.1	22179.8	29279.0	39338.7	53876.0	75334.9	107749.4	157952.7	237850.4
0.95	6261.4	7683.0	9541.5	12004.1	15313.8	19831.8	26102.8	34965.4	47737.4	66536.2	94846.6	138554.7	207884.3	321139.5	512182.8
1.00	8649.6	10853.2	13808.6	17833.7	23407.3	31265.1	42560.1	59140.7	84041.4	122373.9	182992.4	281702.8	447656.8	736559.3	1259036.2
1.05	12518.7	16125.0	21107.7	28116.2	38166.5	52883.4	74928.3	108773.7	162147.2	248806.7	394056.8	646110.6	1100422.6	1954040.6	3632698.2
1.10	19136.9	25423.4	34417.9	47558.4	67194.5	97266.5	144566.3	221157.3	349170.8	570662.9	968666.8	1714089.5	3175053.8	6184813.9	12734742.1

Table 1: Average total cost for different pair values of burn-in and warranty periods.

As it can be seen from Table 1, the minimum average total cost holds when the burn-in time is 0.025 and warranty period is 0.3. Indeed, it can be seen that when warranty period is very small, by increasing the burn-in time, first the average total cost decreases and then it starts to increase. When the amount of warranty period reaches 0.2 or more, the average total cost becomes a strictly increasing function of burn-in period. Same thing happens when we fix burn-in period at a very small value and then increase warranty period. As in the previous case, first the average total cost decreases and after that it increases. From b = 0.2745, the average total cost is an increasing function of warranty period. Figure 2 depicts the mesh diagram of average total cost for this example.

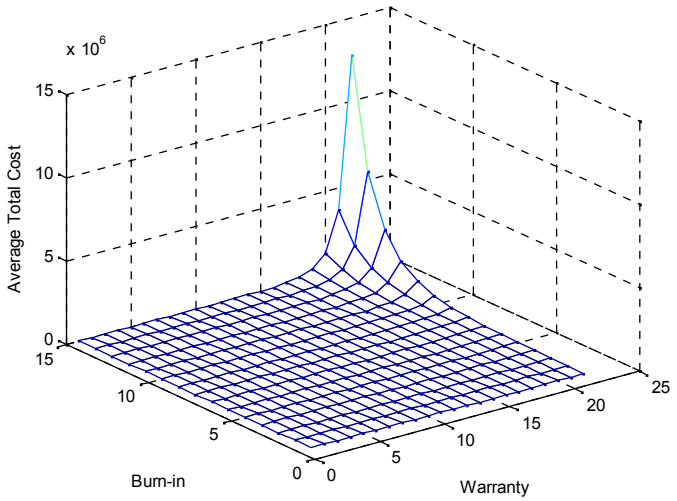

Figure 2: Mesh diagram of average total cost.

5. CONCLUSION

Nowadays, in light of fierce competition along with prudent and diligent customers, is it difficult to survive in the market without possessing the ability of producing high quality products that lure new customers while preserving the old ones. Hence, using techniques such as burn-in tests and offering suitable warranties along with selling the product are very important. In this research, we discussed some optimality issues like optimum burn-in and warranty periods in a series system from producer's point of view. Next step after this work can be to consider the maintenance cost during post warranty period, where the system maintenance and its relevant costs are borne by the consumer.

REFERENCES

[1] B. Dhillon, "A hazard rate model", *IEEE Transactions on Reliability*, Vol. 28, pp.150, 1979.

[2] K. M. Jung, M. Park, and D. H. Park, "Optimal maintenance strategy for non-renewing replacement–repair warranty", *Applied Stochastic Models in Business and Industry*, Volume 28, pp.607–614, 2012.

[3] K. M. Jung, M. Park, and D. H. Park, "System maintenance cost dependent on life cycle under renewing warranty policy", *Reliability Engineering & System Safety*, Volume 95, pp.816-821, 2010.

[4] K. O. Kim, and W. Kuo , "Optimal burn-in for maximizing reliability of repairable non-series systems", *European Journal of Operational Research*, Volume 193, pp.40-151, 2009.

[5] Y. M. Kwon, R. Wilson, and M. H. Na, "Optimal burn-in with random minimal repair cost", *Journal of the Korean Statistical Society*, Volume 39, pp.245-249, 2010.

[6] E. Moghimihadji, and A. Rangan, "Optimal burn-in, warranty , and maintenance decisions in system design", *International Journal of Modelling in Operations Management*, Vol. 2, pp.266-278, 2012.

[7] C. Su, and J. Shen , "Analysis ofextended warranty policies with different repair options", *Engineering Failure Analysis*, Volume 25, pp.49-62, 2012.

[8] H. Vahdani, S. Chukova, and H. Mahlooji, "On optimal replacement-repair policy for multi-state deteriorating products under renewing free replacement warranty", *Computers & Mathematics with Applications*, Volume 61, pp.840-850, 2011.

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WAVELET ANALYSES OF SOME ATMOSPHERIC PARAMETERS AT BLACK SEA REGION

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Abstract- *1D wavelet and continuous wavelet analyses of some atmospheric parameters (annual mean, maximum and minimum air temperature, relative humidity and annual total precipitation) in Şile (Northeastern Black Sea Region of Istanbul) between 1939 and 2012 are presented in this paper. The main aim of this study is to extract temporal structure changes of a climatic oscillation of some selected atmospheric parameters. The influence of climatic oscillations based on NO and El-Nino are analyzed for monthly and annual values. Wavelet analyses allowed quantifying both the pattern of variability in the time series and non-stationary associations in general. Mean air temperature values increases associated with decreasing of high frequency (small scale) fluctuations and increasing of low frequency (large scale) fluctuations in the second term. Increasing ratio of maximum air temperatures are more than mean air temperatures. Meso and small scale fluctuations play an important role on increasing of maximum air temperatures in study area. Large scale fluctuations cause increasing trend of minimum air temperature in the second term. Relative humidity increases beginning from 1976 (industrialization) and associates with amplitudes of high frequency fluctuations (small scale evens). Large scale evens have a great importance on this variation at the study area. Annual total rainfall rate values also increase in the second period. Increasing trend of amplitude of high frequency fluctuations are accompany with rainfall increasing. In this period, large scale evens observed every 5 to 20 year periodic modes have a great influence on rainfall increasing. Maximum rainfall rate observations in 1926, 1969-70, 1982-83, 1997-98 and 2009 may be reported strong associations between rainfall and El Nino periodic bands. Warm event matched with increasing values of relative humidity and annual total rainfall rate values.*

Keywords: *Climatic oscillations, wavelet, El Nino*

1. INTRODUCTION

STUDY AREA

Şile, 41°10' N latitude and 29° 36' E longitude is one of the province of Istanbul of the Northeastern part of Marmara Sea and of the Black Sea Region (Figure 1).

Fig. 1. Study area

DATA

Annual mean, maximum and minimum air temperature, relative humidity and annual total precipitation in Şile between 1939 and 2012 are archive data of the Turkish State Meteorological Service.

METHOD

Wavelet Packet Program covers Morlet, Mexican Hat and Meyer wavelets. These wavelets have generally applied on analyses of atmospheric variables in different scales.

Walker used Daubechies, Coifman, Haar, Gabore Sine, Gabore Cosine and Gabore Complex wavelets by using FAVA software. Wavelet means, small waves. At the initial stage, this method was used analyses of seismic signals by Morlet and Grossmann. Wavelet methodologies, has been used in different fields like; turbulence, ocean waves, seismic data, batimetry, environment, biology, electro cardio data, temperature, global warming.

Liu (1994) analyzed ocean waves by using wavelet spectrum.

Fourier spectrum does not detect some details of high frequency variations. Wavelet methods have more advantages than Fourier spectrum. They have been applied non stationary time series. They detect the details at frequency and time domain simultaneously. Wavelet method has more advantage for diagnostic fluctuations, as SST and climatic systems. Mathematical equations for of wavelet packets of a f(t) function are given as below, (Aslan et al., 2006; Çağlar at al., 2009) :

$$\int_{-\infty}^{\infty} | f(t) |^2 \, dt < \infty \qquad (1)$$

$\psi(t)$ is a continuous wavelet function:

$$\int_{-\infty}^{\infty} | \psi(t) |^2 \, dt = 1 \qquad (2)$$

$$\int_{-\infty}^{\infty} | \psi(t) | \, dt = 0 \qquad (3)$$

This paper presents some results of rainfall rate, air temperature and relative humidity variations based on 1D Wavelet Packets and Continuous Wavelet Transforms.

ANALYSES

Analyses of Annual Mean Air Temperature (1939-2010)

Mean air temperature values increases at the last term of the study period (Fig 2). Amplitudes of small scale factors decrease, but large scale fluctuations increase in the last period.

In the middle parts, the influence of small and meso scale factors decreases, (Fig 3). Large scale influences increases at the last term.

In the middle part, with the influence of small and meso scale factors, mean air temperatures decrease. Beginning from 1989, they show an increasing trend again (Fig 3).

Frequency histogram of air temperature values show a positive skewwness (Fig 4).

Annual Maximum Air Temperature Analysis (1939-2010)

Increasing trend of maximum air temperature is higher than mean air temperature, (Fig 5).

Meso scale fluctuations result in decreasing air temperature in the middle part of study term (Fig 6).

There is a negative skewwness of the histogram for maximum air temperatures, (Fig 7).

Analyses of Annual Minimum Air Temperature (1939-2010)

Lower level variations show smaller variations at the second part of the period, but higher level (low frequency) variations decrease.

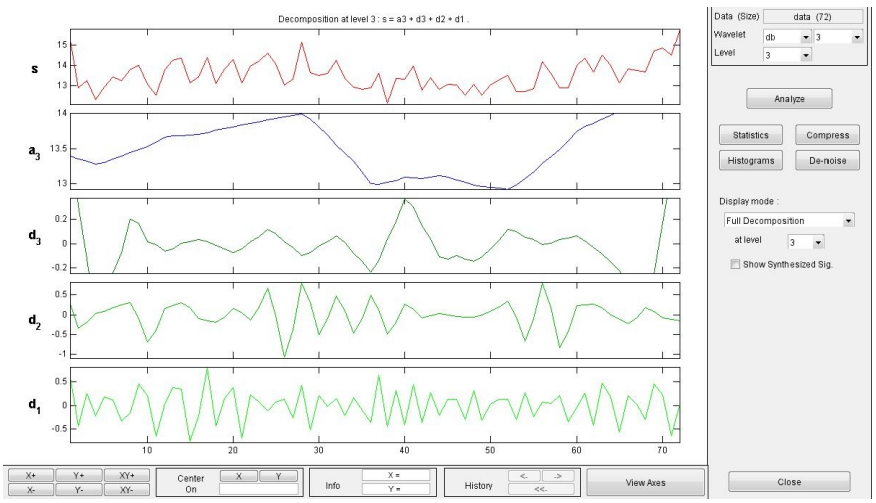

Fig. 2. Mean air temperature 1D Wavelet, Şile (1939-2010)

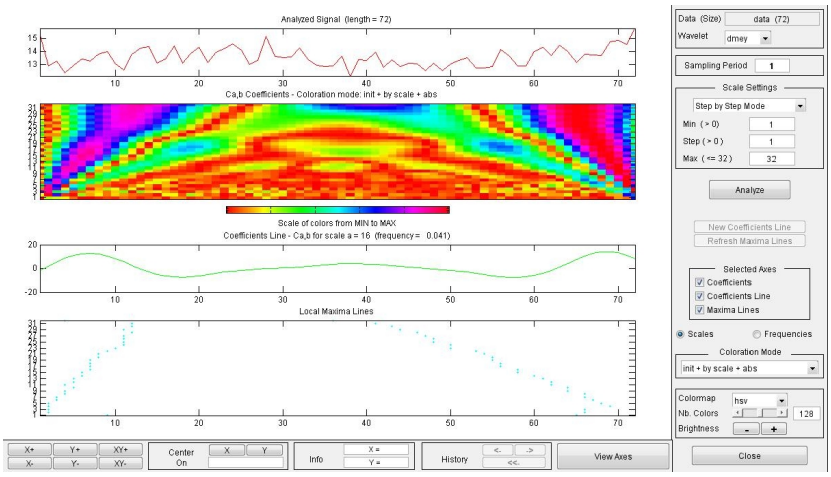

Fig 3. Mean air temperature, 1D Continuous Wavelet, Şile

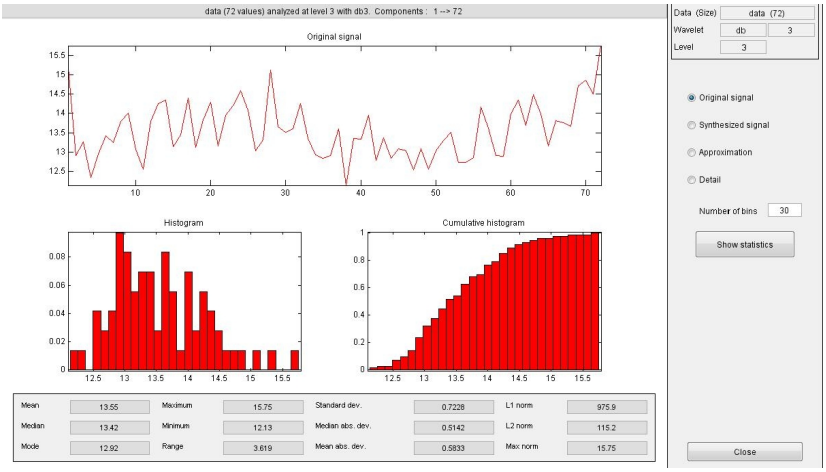

Fig 4. Mean air temperature (Statistical analysis, Şile)

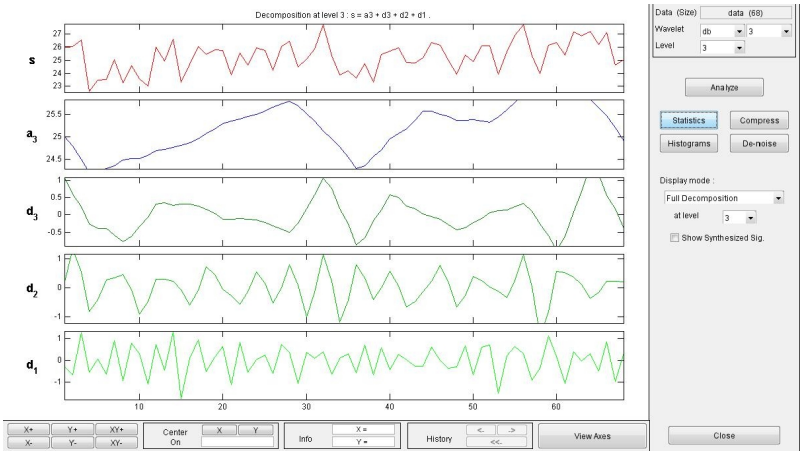

Fig 5. Maximum air tempereture1D Wavelet, Şile (1939-2010)

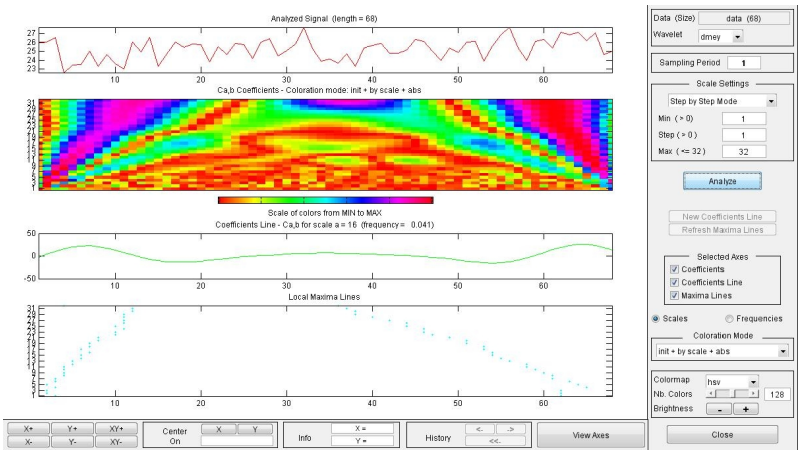

Fig 6. Maximum temperature, 1D Continuous Wavelet Analysis (Şile)

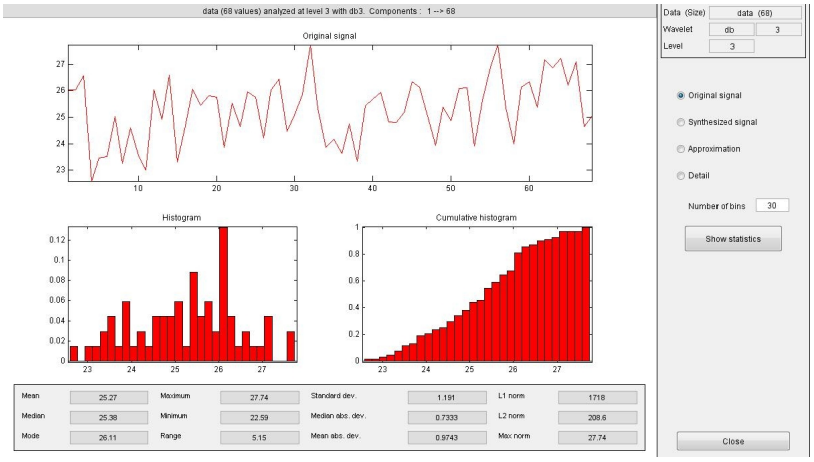

Fig 7. Maximum air temperature (Statistical analysis, Şile)

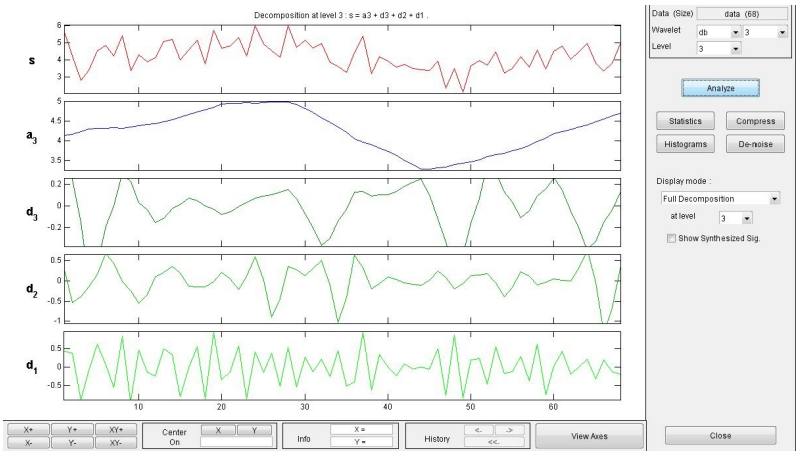

Fig 8. Minimum air temperature 1D Wavelet Analysis, Şile , (1939-2010)

Because of the role of large scale fluctuations, lover minimum air temperature values have been observed, (Fig 9).

Frequency analyses show a slightly negative skewwness. Frequency of lower level fluctuations is lower than higher ones, (Fig 10).

Annual Mean Relative Humidity Analyses (1939-2010)

Relative humidity increases beginning from the second part of the study period. This increasing trend is clearly observed at the amplitude (a3) diagram. All amplitudes at higher and lower frequencies decrease in the second term, (Fig 11).

Lower relative humidity values have a periodicity between 8 to 17 years. Almost in all period, roles of meso and small scale factors have been observed, (Fig12).

Bi-modal frequency distributions have been observed for relative frequency analyses, (Fig.13).

Annual Total Rainfall Rate Analysis, (1939-2010)

An increasing trend of air temperature temporal variations in Şile results in increasing humidity and rainfall rate at the second part of the period. This increasing trend has been associated with an increasing of small scale events, (Fig. 14).

Increasing trend of extreme precipitation is associated with El Nino years 1969-70, 1982-83, 1997-98 and 2009.

Large scale events with 5 to 20 years periodicity are important on rainfall rate variations, (Fig 15).

Statistical analyses present a positive skewwness for annual total rainfall rate values, (Fig 16).

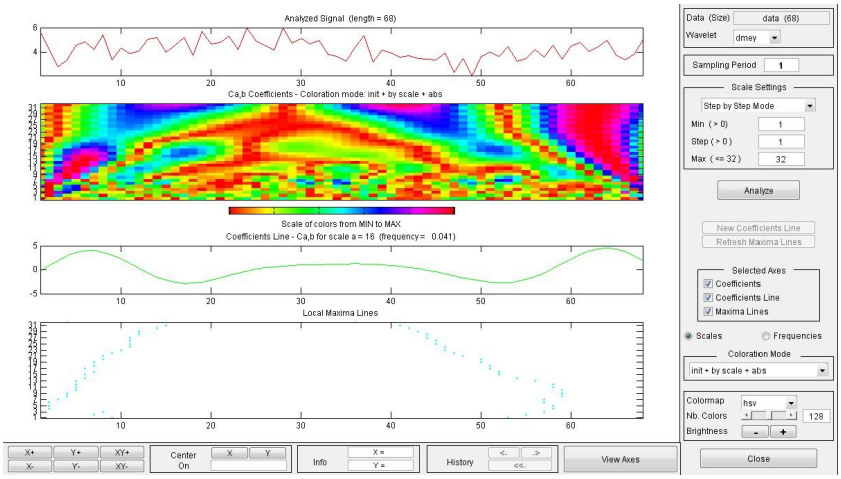

Fig 9. Minimum air temperature, 1D Continuous Wavelet Analysis (Şile)

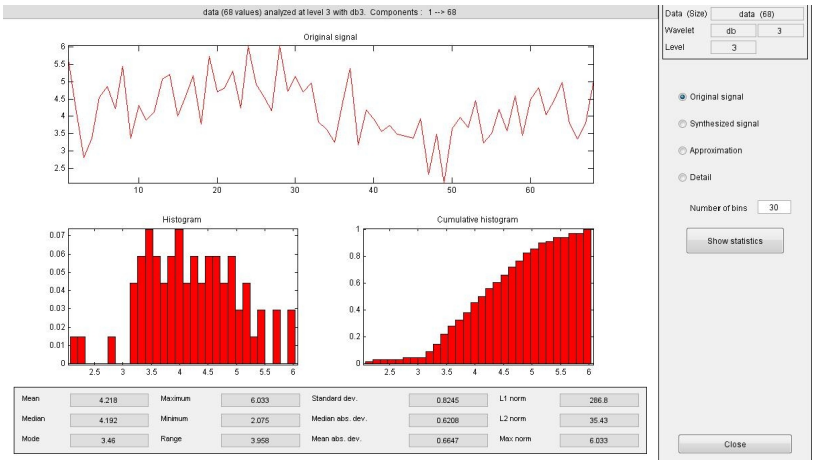

Fig 10. Minimum Air Temperature (Statistical analysis, Şile)

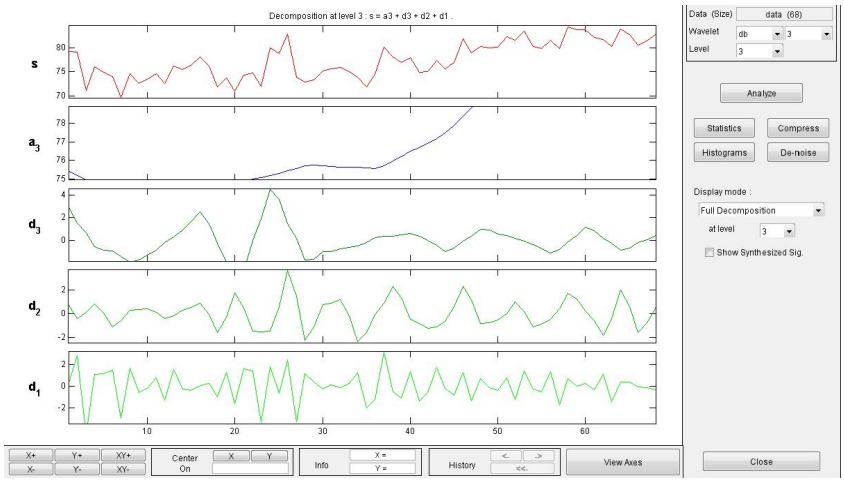

Fig 11. Relative humidity, 1D Wavelet, Şile , (1939-2010)

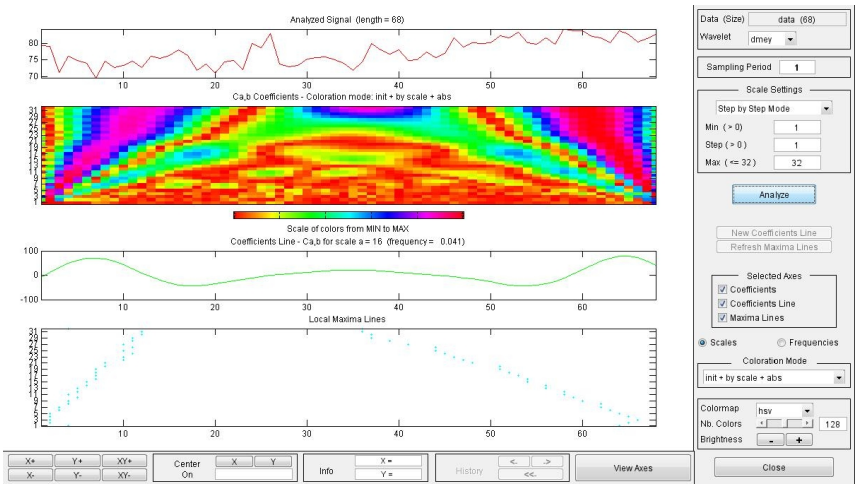

Fig 12. Relative humidity, 1D Continuous Wavelet (Şile)

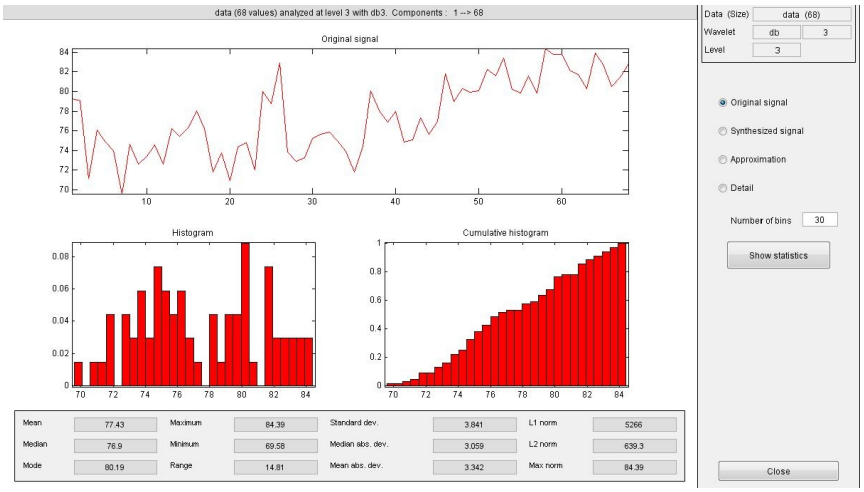

Fig 13. Relative humidity (Statistical analysis, Şile)

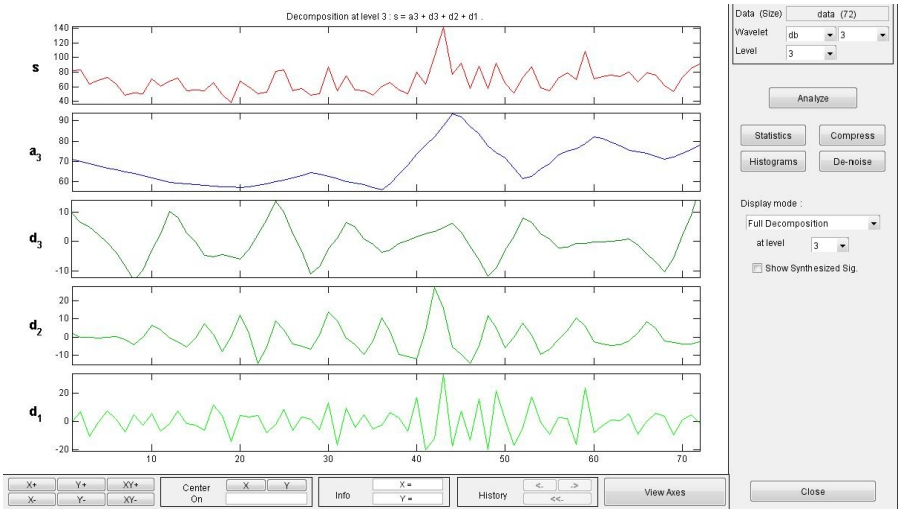

Fig. 14. Annual Rainfall Rate1D Wavelet Analysis, Şile (1939-2010)

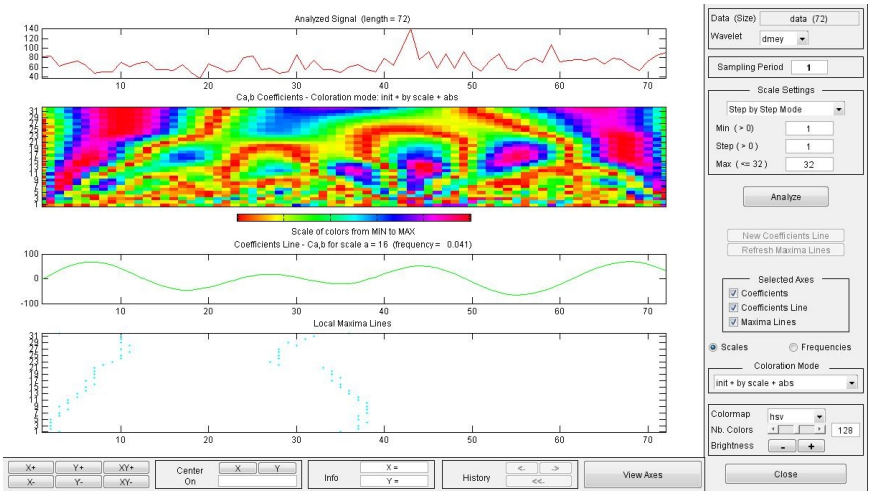

Fig. 15. Annual Rainfall Rate**,** 1D Continuous Wavelet Analyses (Şile)

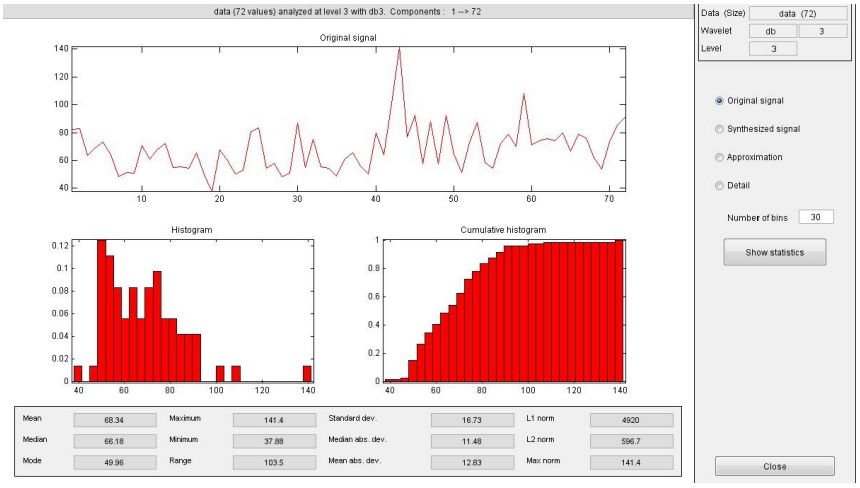

Fig. 16. Annual Rainfall Rate(Statistical analysis, Şile)

RESULTS AND CONCLUSION

Specific results of this study are listed as below:

- Mean air temperature values have been increased since 1989. This increasing rend is associated with large scale events in general,

- Since 1973, maximum air temperature values have been increased. This increasing trend is associated with large amplitudes of long term and meso scale events. In recent year combined role of small and meso scale events have been observed,

- Mean air temperature decreases in the last 20 years, because of large scale factors,

- Relative humidity increases during all study period. It is associated with meso scale events,

- Annual total rainfall rate is under the effects of small and large scale events

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REFERENCES

[1] Okçu, D., Aslan, Z., Maktav, D., Söğüt, A.S., Oğuzhan, B., Çağlar, N. Z., Tek, A., Yeniçeri, N., Giden, F., Kalafat, A., Koyuncu, H., Şengül, A., Ertürk A.G., Solum, Ş., 2012, ‘’Sel ve Taşkın Tahmini, Şehirleşmenin Sel Olayına Etkisinin Zaman Serileri ile Analizi’’ BÜ, BAP Proje No: 5572, İstanbul.

[2] Aslan, Z., D. Okçu and A. S. Soğut, (2006) : “Wavelet Based Analysis of Rainfall Rate and Erosivitiy, *International Conference on Climate Change and the Middle East Past, Present and Future,* 20-23 November 2006, Editors: Y. Ünal, C. Kahya, D. Demirhan Bari, İTÜ, Istanbul, (p. 107-113).

[3] Çağlar N. Z., Tokgözlü A., Aslan Z., (2009): Application of Wavelet in Analysis of Solar Radiation and Solar Energy Potential, IWW2009.

[4] Liu, P. C., (1994): ‘’Wavelet Spectrum Analysis and Ocean Wind Waves, Wavelets in Geophysics’’ Efi Foutoula - Georgiou and Praveen Kumar (edr.), Academic Press, San Diego, (pp: 151-166).

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COMPARISON OF REAL AND COMPLEX-VALUED VERSIONS OF WAVELET TRANSFORM, CURVELET TRANSFORM AND RIDGELET TRANSFORM FOR MEDICAL IMAGE DENOISING

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Abstract- *In this study; medical images were denoising with multiresolution analyses using real-valued wavelet transform (RVWT), complex-valued wavelet transform (CVWT), ridgelet transform (RT), real-valued first-generation curvelet transform (RVFG CT), real-valued second-generation curvelet transform (RVSG CT), complex-valued second-generation curvelet transform (CVSG CT) and results are compared. First and second-generation curvelet transformations are used for real-valued curvelet transform as two techniques. For the evaluation of the proposed system, we used 32 lung CT images. These images include 10 images with benign nodules and 22 images with malign nodules. Different types of noise like the Random noise, Gaussian noise and Salt & Pepper noise were added to these images and they are removed separately. The performances of used transforms are compared using Peak Signal to Noise Ratio (PSNR) parameter. Obtained results showed that complex-valued wavelet transform are suited for removal of random noise and Gaussian noise. In case of Gaussian noise in images, PSNRs of first generation curvelet transform and complex-valued wavelet transform are around 33 dB. The ridgelet transform provides high PSNR value (30.4dB) for denoising of salt & pepper noise in images.*

Key Words: *Wavelet transform, curvelet transform, ridgelet transform, denoising*

1. INTRODUCTION

Image processing is an engineering discipline that has been studied extensively and also contains obtaining new images by analyzing the various images. The importance of image processing, especially after digital image recording's being widespread, has been increasing day by day. Image processing techniques are used a wide variety of fields like face / fingerprint identification security systems, electromagnetic radar systems, medical systems, geology and astronomy research, mapping and control systems. Fourier analysis which is used for obtaining the information about frequency of image is the basic argument of image processing. Since it is unknown that which or when signals are active, some problems can be occur while implementing the process conversely to unstable frequency valued signals. On the other hand, there is no problem with the signals have time-invarient frequency value.

Since Fourier analysis is inefficient in time-frequency plane, wavelet analysis which is the basic of multi-resolution analysis is detected. Continous wavelet analysis is firstly implemented in field of geophysics in 1982 by Morlet [1]. Although Grossman and Morlet [2] studied on this subject in 1984, basic wavelet transform developed by Chui [3] in 1992 and Meyer [4] in 1993. Discrete form of this analysis is improved by Mallat[5] in 1989 and Daubechies [6] in 1992. Wavelet package analysis is the complex form of discrete wavelet analysis and formed by Coifman and Wickerhauser [7] in 1992. It is proved that wavelets have complex solutions by Lawton [8] in 1993 and Lina [9] in 1997. First applications of wavelet analysis about noise removal is implemented for uni-dimensional signals by Lang et. al. [10]. In 1996, wavelet

analysis began to be implemented on medical images with the study of Mojsilovic et. al. [11]. Studies of Chang et. al. [12] in 2000 was about noise removal for wavelet transform on two-dimensional images. Some other scientists studied on denoising with wavelet transform as Portilla et. al. [13], Chen and Bui [14], Abdulmunim [15] and Benjaminsen [16] who used complex valued wavelet transform to remove noises in 2007.

Wavelet transform is suitable to use for identifying the images but this transform can only be used for horizontal, vertical or diagonal (45^0). Because of this restrictive situation, changes on the other angle block is ignored, thus Ridgelet transform is developed by Candes and Donoho [17] to get over this problem. The difference between Ridgelet and wavelet analyses is that angular windows are identified in Ridgelet analysis and so images can be expressed with much and effective coefficients. Ridgelet transform is firstly used for removing noise by Do and Vetterli [18].

Curvelet analysis is based on wavelet analysis but uses curves not lines like wavelet for windowing. Curvelet analysis came out in 1999 by Candes and Donoho [19] and it is built up on Ridgelet analysis. Donoho et. al. developed this analysis's digital [20] and discrete [21] versions in time. Starck[22] established that Curvelet analysis is more suitable to find images' edge regions. Starck et. al. used Curvelet transform to remove noises in 2002. Also Gyaourova et. al. [23] studied on this subject in the same year. In 2007, Sivakumar [24] removed noises from CT images. A similar study is gone over in 2010 by Rayudu et. al. [25].

Although real types of transforms are used for denoising noises many times individually, there are really a few studies use some of them with or compare them with the each other. In addition, usually just one type noise is implemented to image and then it is removed in these studies. Number of the studies about performance evaluations for more than one noise is really a few. Studies about complex-valued wavelet and complex curvelet transform keep developing.

In this study, a denoising application is implemented on CT lung images with three type of noise using real-valued and complex-valued wavelet transforms, ridgelet transform, first and second-generation curvelet transforms and denoising algorithms. PSNR value is calculated between acquired images and original images.

2. METHOD

2.1. Wavelet Transform

Wavelet is a useful tool for representing nonlinearity [26]. A function $f(x)$ can be symbolized by the superposition of daughters $\psi_{a,b}(x)$ of a mother wavelet $\psi(x)$. Where $\psi_{a,b}(x)$ can be denoted as

$$\psi(a,b)(x) = \frac{1}{\sqrt{a}}\psi\left(\frac{x-b}{a}\right) \tag{1}$$

$a \in R_+$ and $b \in R$ are, separately, called dilation and translation parameters. The continuous wavelet transform of $f(x)$ is described as

$$\psi(a,b) = \int_{R^2} f(x)\overline{\psi}_{a,b}(x).d(x) \tag{2}$$

and the function $f(x)$ can be reconstructed by the reverse wavelet transform

$$f(x) = \int\int_{-\infty}^{\infty} w(a,b).\psi_{a,b}(x).\frac{da.db}{a^2} \tag{3}$$

The continuous wavelet transform and its inverse transform are not suitable to implement directly on digital computers. When the reverse wavelet transform is discretized, $f(x)$ has the following approach wavelet-based representation form:

$$\hat{f}(x) \approx \sum_{k=1}^{K} w_k.\psi\left(\frac{x-b_k}{a_k}\right) \tag{4}$$

where the w_k, b_k and a_k are weight coefficients, translations and dilations for each daughter wavelet [26]. It is perceived that the wavelet transform is an significant tool for analysis and processing of signals and images. In spite of its efficient computational algorithm, the wavelet transform suffers from three essential disadvantages: shift sensitivity, poor directionality and absence of phase information [27-32].

Most DWT applications use sectional filtering with real coefficient filters associated wih real wavelets resulting in real-valued approximations and details. Such DWT implementations cannot ensure the local phase information. All natural signal are fundamentally real-valued, hence to avoid the local phase information, complex-valued filtering is necessary [33, 34]. Latest research in the improvement of complex wavelet tarnsforms (CWTs) can be broadly classified in two groups; RCWT (Redundant CWTs) and NRCWT (Non-redundant CWTs). The RCWT contains two almost similar CWTs. They are denoted as DT-DWT (Dual-Tree DWT based CWT, see Figure 1) with two almost similar models namely Kingsbury's and Selesnick's [35]. In this paper, we used Kingsbury's CWT [34, 36] for image denoising.

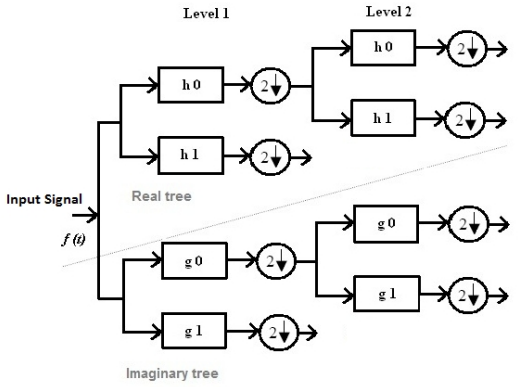

Figure 1: Complex Wavelet Transform with two level

2.2. Ridgelet Transform

The achievement of the wavelets essentially depends on the good performance brought by the one-dimensional (1-D) piecewise smooth functions. Unfortunately, this success is not acceptable in the two-dimensional (2-D) case. Fundamentally, wavelets are good at catching zero-dimensional or point singularities. However, 2-D signals (i.e., images) generally include 1-D singularities (i.e.,edges and corners). The edges separate the smooth regions by creating discontinuity across the edge while the edges themselves are also regular along the edge. By sentience, 2-D wavelet transforms are created by the tensor products of 1-D wavelets and they will so isolate the discontinuity across the edge by missing the smoothness along the edge.

In order to get over the weakness of wavelet transform in two or more dimensions, Candès and Donoho [17] improved a new system of representations called "ridgelets" which can effectively cover the line singularities in two dimensions. Nowadays, Ridgelets have been applied in image processing [37,38]. For each $a > 0$, each $b \in R$ and each $\theta \in [0, 2\pi]$, the bivariate ridgelet $\psi_{a,b,\theta}: R^2 \rightarrow R$ is described as

$$\psi_{a,b,\theta}(x) = a^{-1/2}.\psi((x_1.\cos\theta + x_2.\sin\theta - b)/a) \tag{5}$$

A ridgelet is stable along the lines $x_1 \cos\theta + x_2 \sin\theta = constant$. Transverse to these ridges it is a wavelet and given an integrable bivariate image $f(x_1, x_2)$, we can describe its ridgelet coefficients as

$$R(a,b,\theta) = \int \psi_{a,b,\theta}.f(x_1,x_2)dx_1dx_2 \tag{6}$$

The ridgelet transform can be indicated in terms of the Radon transform. The Radon transform of an image $f(x_1, x_2)$ is described as

$$RA(\theta,t) = \int f(x_1,x_2).\delta(x_1.\cos\theta + x_2.\sin\theta - t)dx_1dx_2 \tag{7}$$

where δ is the Dirac distribution.

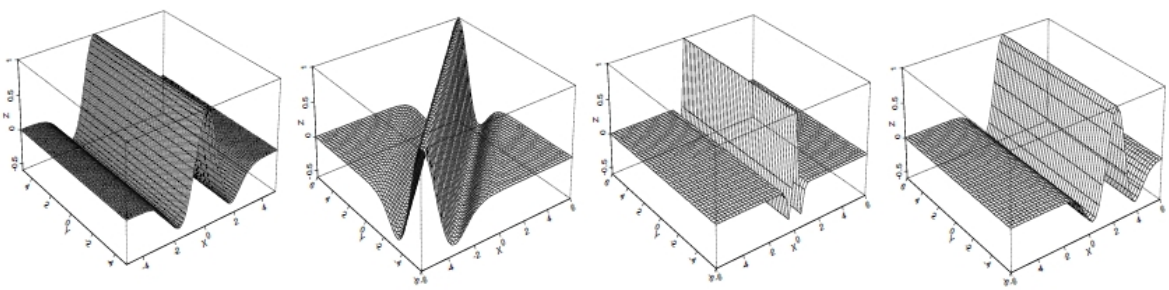

Figure 2: Ridgelet samples

Thus the ridgelet transform is precisely the implementation of a 1D wavelet transform to the slices of the Radon transform where the angular variable θ is stable and t is varying. Ridgelets are different from wavelets in a sense that ridgelets exhibit so high directional susceptibility and are highly anisotropic. A fast ridgelet transform can be applied in the Fourier domain. The 2D FFT is computed firstly. Then it is interpolated along a few straight lines equal to the selected number of projections. Each line passes through the centre of the 2D frequency space, with an inclination equal to the projection angle, and a number of interpolation points equal to the number of rays per projection. After the 1D reverse FFT along each interpolated ray, we perform a 1D wavelet transform. Pay attention to that the ridgelet coefficients so obtained are not represented in the Fourier frequency domain. The Fourier transform used is only a tool to succeed a fast application of the ridgelet transformation. Actually, it is equivalent to applying 1D wavelet transform to the Radon slices of the original pattern image.

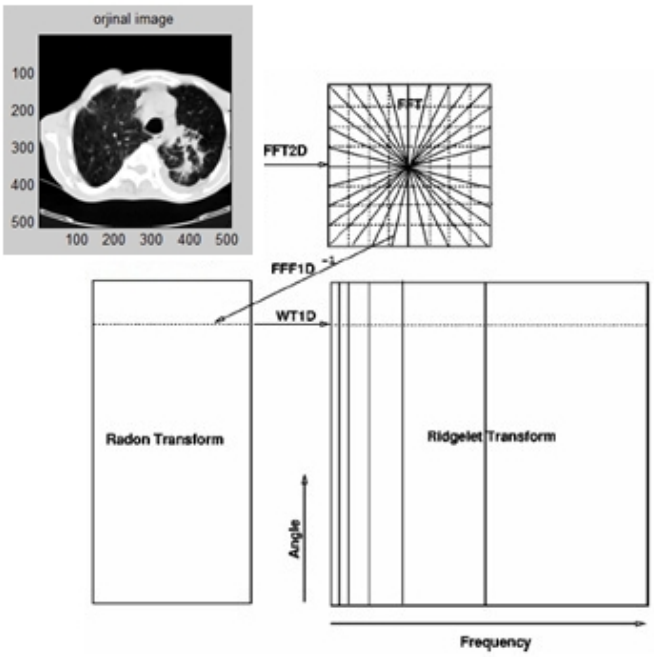

Figure 3: Scheme of ridgelet transform

2.3. Curvelet Transform

The idea of curvelets is to represent a curve as a superposition of functions of a variety of lengths and widths corresponding the scaling law *width* ≈ *length*^{2} [19]. This can be done by decomposing the image into subbands firstly, i.e., separating the object into series of disjoint scales. Each scale is then evaluated by means of a local ridgelet transform. Curvelets are based on multiscale ridgelets combined with a spatial bandpass filtering process to isolate different scales. This spatial bandpass filter nearly kills all multiscale ridgelets which are not in filter's frequency range. In other words, a curvelet is a kind of multiscale ridgelet which lives in a prescribed frequency band. The bandpass is set so the curvelet length and width at fine scales are interrelated by a scaling law *width* ≈ *length*^{2} and so the anisotropy increases with decreasing scale like a power law. There is a very special correlation between the index of the dyadic subbands and the depth of the multiscale pyramid; the edge length of the localizing windows is doubled at per other dyadic subband, thus maintaining the fundamental property of the curvelet transform which says that elements of length about 2^{-j} serve for the analysis and synthesis of the j th subband $[2^j, 2^{j+1}]$. Curvelets have a scaling corresponding 2 *width* ≈ *length*^{2} while multiscale ridgelets have random dyadic length and random dyadic widths. Loosely speaking, the curvelet dictionary is a subset of the multiscale ridgelet dictionary, however which allows reconstruction.

The discrete curvelet transform of a continuos function $f(x_1,x_2)$ makes use of a dyadic sequence of scales, and a bank of filters ($P_0 f, \Delta_1 f, \Delta_2 f$) with the feature that the passband filter Δs is concentrated near the frequencies $[2^{2s}, 2^{2s+2}]$, e.g.,

$$P_0 f = \Phi_0 x\ f\ ,\quad \Delta_s f = \Psi_{2s}\ x\ f \tag{8}$$

In wavelet theory, a decomposition into dyadic subbands $[2^s, 2^{s+1}]$ is used. Contrarily, the subbands used in the discrete curvelet transform of continuum functions have the non-standard form $[2^{2s}, 2^{2s+2}]$. This is non-standard characteristic of the discrete curvelet transform well worth considering. The curvelet decomposition is the sequence of the following steps with the notations of section above,

Subband Decomposition. f is decomposed into subbands

$$f \rightarrow (P_0 f, \Delta_1 f, \Delta_2 f, \Delta_s f) \tag{9}$$

Smooth Partitioning. Each subband is smoothly windowed into an appropriate scale's "squares" (sidelength 2^{-s})

$$\Delta_s f \rightarrow (w_Q \cdot \Delta_s f)_{Q \in Q_s} \tag{10}$$

Renormalization. Each resulting square is renormalized to unit scale

$$g_Q = T_Q^{-1} \cdot (w_Q \cdot \Delta_s f)_{Q \in Q_s} \tag{11}$$

Ridgelet Analysis. The discrete ridgelet transform is used for analysing each square.
In the definition, the ridgelet transform is applied after the two dyadic subbands [2^{2s}, 2^{2s+1}] and [2^{2s+1}, 2^{2s+2}] are merged.

We proposed a non-aliasing Curvelet transform to overcome the aliasing in Curvelet transform, namely complex Curvelet transform. The key innovation can be universalized as follows: 2D and 1D complex wavelet transform.

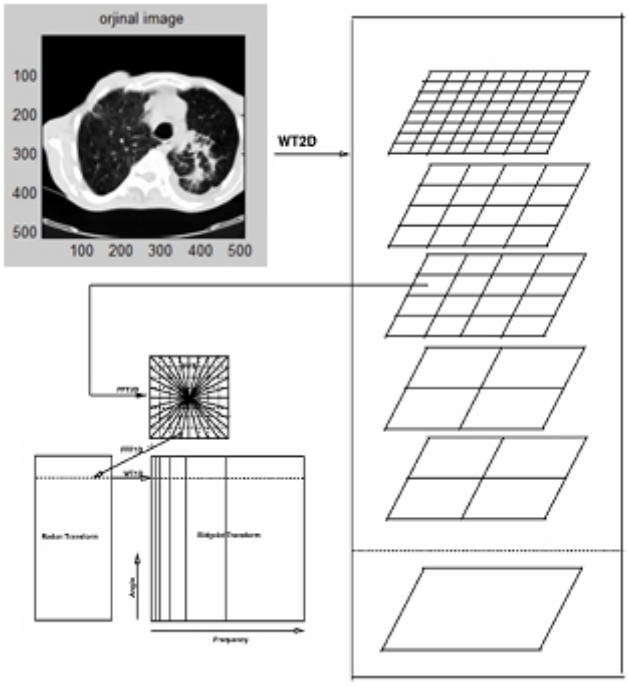

Figure 4: Scheme of curvelet transform

2.4. Peak Signal-to-Noise Ratio (PSNR)

Any processing implemented to an image may cause an significant loss of information or quality. Image quality estimation methods can be subdivided into objective and subjective methods [37, 38]. Subjective ways are based on human judgment and operate without reference to explicit criteria [39]. Objective ways are based on comparisons using explicit numerical criteria [40, 41], and several references are feasible such as the ground truth or prior knowledge expressed in terms of statistical parameters and tests [42, 43]. Given a reference image f and a test image g, both M×N sized, the PSNR between f and g is defined by:

$$PSNR(f,g) = 10.\log_{10}(255^2 / MSE(f,g)) \tag{12}$$

$$MSE(f,g) = \frac{1}{MN}.\sum_{i=1}^{M}\sum_{j=1}^{N}(f_{i,j} - g_{i,j})^2 \tag{13}$$

The PSNR value approaches infinity as the MSE approaches zero; this shows that a higher PSNR value provides a higher image quality. At the other tip of the scale, a small value of the PSNR implies high numerical distinctions between images.

3. USED DATA

In this study, 32 CT images taken from Baskent University Konya Research Hospital are used. Image collection is labeled as benign or malign by an expert radiologist using biopsy reports. This labeled image database includes 32 images (12 benign and 20 malign nodules) [44].

4. RESULTS AND DISCUSSION

Real-valued wavelet transform (RVWT), complex-valued wavelet transform (CVWT), ridgelet transform (RT), real-valued first-generation curvelet transform (RVFG CT), real-valued second-generation curvelet transform (RVSG CT), complex-valued second-generation curvelet transform (CVSG CT) are implemented on the images and their parameters are obtained. Random, gaussian, salt & pepper noises are implemented to

the image. PSNR is calculated between the noisy image and the original image. These processes repeated one hundred times for all images. Averaged value of obtained results is calculated (see Table 1). In Table 1, B signfiy an image with benign nodule and M signify an image with malign nodule. According to Table 1, highest PSNR values for removal of random noise and Gaussian noise were obtained using CWT as 34.01 dB and 32.89 dB, respectively. In case of Gaussian noise in images, PSNRs of first generation curvelet transform and complex-valued wavelet transform are around 33 dB. The ridgelet transform provides high PSNR value (30.4dB) for denoising of salt & pepper noise in images. The resulting denoised output images for random selected input image (with benign nodule) are given in Figure 5, Figure 6 and Figure 7.

	PSNR Values For Random Nosie						PSNR Values For Gaussian Noise						PSNR Values For Salt&Pepper Noise					
	RVWT	CVWT	RT	RVFG CT	RVSG CT	CVSG CT	RVWT	CVWT	RT	RVFG CT	RVSG CT	CVSG CT	RVWT	CVWT	RT	RVFG CT	RVSG CT	CVSG CT
B-1	32,6440	33,8804	29,7229	33,6186	32,6241	32,2192	31,6763	32,5944	29,0886	32,5306	31,7933	31,4275	21,6982	21,7899	29,7502	21,6883	24,8049	24,7187
B-2	31,9168	33,1369	29,0001	32,4769	32,0771	32,0423	31,2559	32,0975	28,5459	31,9603	31,6726	31,2457	21,7974	21,8845	29,0829	21,7882	24,8657	24,7591
B-3	32,7411	33,9162	30,3630	33,6897	32,2749	32,2125	32,0522	32,9599	29,8791	32,8517	32,1010	31,7098	21,7323	21,7925	30,4083	21,6346	24,7078	24,6232
B-4	32,6215	33,7781	30,7643	33,5049	33,0378	32,5606	31,8884	32,7081	30,1070	32,5294	32,1469	31,6904	21,6980	21,7873	30,6673	21,6904	24,7168	24,6300
B-5	33,3137	34,5150	30,9254	34,3893	33,5113	33,1895	32,4565	33,3914	30,3421	33,3485	32,6852	32,3520	21,5905	21,6783	30,8384	21,5810	24,8164	24,7574
B-6	32,8857	34,0716	30,5412	34,1457	33,3355	33,0131	32,1423	33,0189	29,9824	33,1741	32,5876	32,2574	21,6678	21,7589	30,5065	21,6573	24,8809	24,8184
B-7	32,8750	34,2424	30,4328	34,3519	33,3992	33,0644	32,4929	33,5741	30,0233	33,6697	32,8725	32,5701	22,0005	22,0925	30,5251	21,9920	25,2659	25,1904
B-8	33,2481	34,3380	31,2872	34,0886	32,6538	32,3283	32,9503	33,0171	30,5271	32,8677	31,8233	31,4867	21,7013	21,7871	31,3009	21,6927	24,7248	24,6603
B-9	33,3220	34,5168	30,6900	34,6796	33,8229	33,4768	32,4168	33,1114	30,1138	33,4337	32,8206	32,4982	21,7670	21,8445	30,7750	21,7588	25,0709	25,0141
B-10	33,6348	34,7585	31,1489	34,9297	34,1011	33,7876	32,6483	33,2863	30,3976	33,6347	33,0205	32,6763	21,6860	21,7615	31,0917	21,6774	25,0144	24,9551
B-11	33,5439	34,5610	31,4398	34,6175	33,2672	32,9878	32,9698	33,6288	30,8345	33,6987	32,6434	32,3282	21,6634	21,7486	31,3130	21,6543	24,7834	24,7237
B-12	32,8401	34,1292	30,3742	34,0895	33,5001	33,0747	32,1292	33,0174	29,8617	33,1484	32,6832	32,2671	21,5640	21,6571	30,2983	21,5540	24,7823	24,7128
M-1	32,6025	33,8643	30,1332	33,5121	32,5451	32,2296	31,8414	32,6270	29,5714	32,5789	31,8382	31,4958	21,6692	21,7604	30,1687	21,6596	24,8058	24,7348
M-2	32,8770	33,9145	30,4066	33,5311	32,1913	31,8054	31,9756	32,6689	29,8393	32,4776	31,4581	31,0742	21,5689	21,6606	30,3560	21,5606	24,4581	24,4338
M-3	33,1334	34,3321	30,9580	34,3004	33,8988	33,4631	32,1505	33,0553	30,2679	33,0908	32,8038	32,4422	21,7756	21,8555	30,9432	21,7667	25,0349	24,9669
M-4	31,8348	33,2893	29,1067	32,8764	32,1979	31,8282	31,3101	32,3636	28,6782	32,1303	31,5457	31,1256	21,8435	21,9476	29,1762	21,8340	24,8811	24,7799
M-5	33,1213	34,3133	30,8862	34,4461	33,8658	33,5059	32,3978	33,1982	30,2312	33,2621	32,9233	32,5567	21,5842	21,6678	30,8074	21,5551	24,7686	24,7104
M-6	33,2961	34,4918	31,0099	34,6402	34,1976	33,9166	32,5109	33,3180	30,4437	33,5665	33,2881	32,9154	21,6433	21,7183	31,0000	21,6343	24,9529	24,9001
M-7	33,3845	34,4272	31,3586	34,3518	33,0218	32,6857	32,2694	32,9028	30,4787	32,9494	31,9563	31,6682	21,5988	21,6851	31,3022	21,5899	24,7264	24,6727
M-8	32,9805	34,0843	30,8212	33,8284	32,5422	32,2135	32,2856	33,1675	30,2715	32,9554	31,9359	31,6105	21,9005	22,0015	30,8252	21,8911	24,9974	24,9197
M-9	32,8172	33,9902	30,7216	33,9751	33,5696	33,2333	32,0143	32,7400	30,0481	32,8300	32,5575	32,2136	21,5783	21,6669	30,6658	21,5689	24,7900	24,7303
M-10	32,4906	33,7936	29,8013	33,5462	32,8481	32,4051	31,8419	32,8128	29,3616	32,7896	32,2658	31,8598	21,8541	21,9498	29,8576	21,8442	25,0393	24,9471
M-11	32,8382	34,1350	30,2968	34,0318	33,2579	32,9781	32,0462	32,9038	29,6434	32,9161	32,3412	32,0587	21,6949	21,7740	30,2807	21,6858	24,9003	24,8340
M-12	32,9972	34,1538	30,8632	34,1314	33,5470	33,1622	32,3512	33,1885	30,3213	33,1270	32,6794	32,3039	21,8253	21,8999	30,9304	21,8172	25,0233	24,9521
M-13	32,2984	33,5768	29,5641	33,1792	32,4771	32,0654	31,4990	32,4508	29,0042	32,1918	31,6622	31,2545	21,8977	21,9834	29,6304	21,8894	24,9872	24,8820
M-14	32,2841	33,6478	29,7149	33,4039	33,0385	32,6039	31,7063	32,7756	29,3314	32,6300	32,3137	31,9184	21,8227	21,9216	29,7994	21,8125	25,0014	24,9196
M-15	32,6454	33,8185	30,4258	33,5106	32,1394	31,8577	31,8466	32,5991	29,8349	32,5119	31,4196	31,1022	21,8007	21,9052	30,4596	21,7903	24,8556	24,7728
M-16	32,6838	33,9236	30,1547	33,8071	33,1455	32,7727	31,7156	32,5172	29,4994	32,5464	32,1911	31,8294	21,5321	21,6132	30,0947	21,5226	24,6967	24,6345
M-17	32,5069	33,7602	29,8583	33,5375	32,8444	32,4466	31,8432	32,8566	29,4402	32,7726	32,2323	31,7952	21,8621	21,9588	29,8931	21,8527	25,0145	24,9234
M-18	32,1759	33,4131	29,6673	33,0453	32,4590	32,0033	31,2389	32,0144	29,1015	32,0025	31,5352	31,1337	21,5413	21,6310	29,6325	21,5325	24,5804	24,4971
M-19	32,3920	33,6082	29,7897	33,2149	32,0296	31,6737	31,7497	32,7353	29,2724	32,4674	31,4684	31,1357	21,8076	21,9043	29,7613	21,7989	24,8029	24,7290
M-20	32,7491	34,0070	30,3924	33,9105	33,1412	32,6950	32,0101	33,0747	29,8389	33,0343	32,4112	32,0122	21,7595	21,8450	30,3672	21,7507	24,9573	24,8758
Averaged	**32,8030**	**34,0121**	**30,4160**	**33,8627**	**33,0303**	**32,6865**	**32,0647**	**32,8962**	**29,8417**	**32,8757**	**32,2399**	**31,8755**	**21,7227**	**21,8104**	**30,3909**	**21,7102**	**24,8659**	**24,7931**

Table 1: Obtained results for medical image denoising process

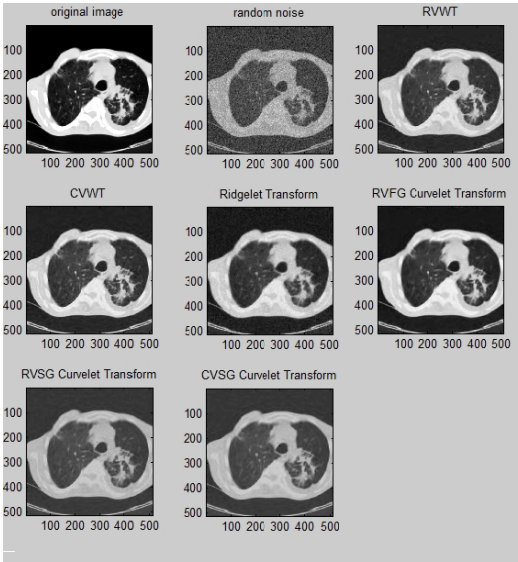

Figure 5: Denoised image outputs for *random noise* using multi-resolution analyses

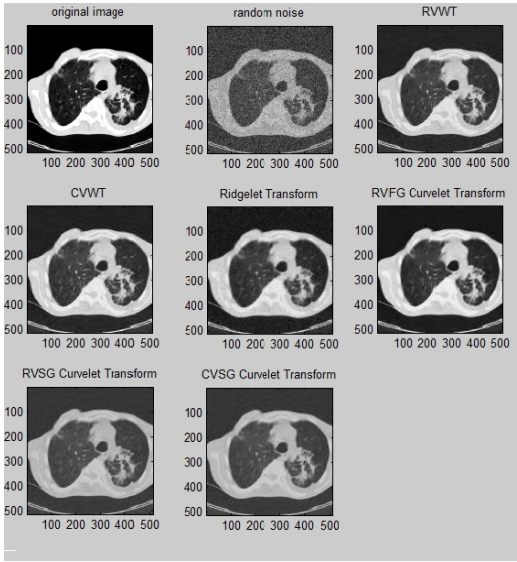

Figure 6: Denoised image outputs for *Gaussian noise* using multi-resolution analyses

5. CONCLUSIONS

In this study, multi-resolution analyses are implemented for medical image denoising and obtained results are concluded above:

1- Ability of defining images from best to worst is: curvelet transform, ridgelet transform, wavelet transform.

2- Denoising algorithm which is improved for ridgelet analysis did not provide the expected results for random noise and gaussian noise. On the other hand, although been worse than the other transformations, it was more useful for denoising salt&pepper.

3- For the future, multi-resolution analyses can improve to other medical image denoising problems. In addition, other multi-resolution analyses can be used to make the denoising scheme more effective. The performance of this study shows the advantage of proposed method: complex version of multi-resolution analyses is very suitable for noise removal from medical images.

REFERENCES

[1] Morlet J., Arehs G., Forugeau I., Giard D., "Wave Propagation and Sampling Theory", Geophysics, vol. 47, pp. 203-236, 1982.

[2] Morlet J., Arehs G., "Decompsotition Of Hardy Functions into Square Integrable Wavelets of Constant Shape", SIAM J. Math. Anal., vol. 15, no. 4, p.p. 723-736, 1984.

[3] Chui C. K., Wu S., "An Introduction to Wavelets", Academic Press, 1992.

[4] Meyer Y., "Wavelets and Operators", Cambridge Studies in Advanced Mathematics 37 , 1993.

[5] Mallat S., "A Theory For Multiresolution Signal Decomposition: The Wavelet Representation", IEEE Trans. Pattern Anal. Machine Intell., vol. 11, p.p. 674–693, 1989.

[6] Daubechies I., "Ten Lectures on Wavelets", PA: SIAM , Philadelphia, 1992.

[7] Coifman R. R., Wickerhauser M. V., "Entropy Based Algorithms For Best Basis Selection", IEEE Trans. On Information Theory, vol. 38, no. 2, 1992.

[8] Lawton W., "Applications of Complex Valued Wavelet Transforms to Subband Decomposition", IEEE Trans. Sig. Proc., vol. 41, no. 12, p.p. 3566-3568,1993.

[9] Lina J. M., "Complex Daubechies Wavelets: Filter Design and Applications", Proc.ISAAC Conf., University of Delaware,1997.

[10] Lang M., Guo H. and Odegard J. E., "Noise Reduction Using Undecimated Discrete Wavelet Transform", IEEE Signal Processing Letters, 1995.

[11] Mojsilovic A., Popovic M., Sevic D., "Classification of The Ultrasound Liver Images with The 2N X 1-D Wavelet Transform", IEEE Int.Conf.Image, vol.1, p.p. 367-370, 1996.

[12] Chang S.G., Yu B. and Vattereli M., "Adaptive Wavelet Thresholding for Image Denoising and Compression", IEEE Trans. Image Processing, vol. 9, pp. 1532-1546, Sept. 2000.

[13] Portilla J., Strela V., Wainwright M. J., Simoncelli, E.P., "Adaptive Wiener Denoising using a Gaussian Scale Mixture Model in The Wavelet Domain", Proceedings of the 8th International Conference of Image Processing Thessaloniki, Greece, October 2001.

[14] Chen G. Y. and Bui T. D., ""Multi-wavelet De-noising using Neighboring Coefficients", IEEE Signal Processing Letters, vol. 10, no. 7, pp. 211-214, 2003.

[15] Abdulmunim M. E., "Color Image Denoising Using Discrete Multiwavelet Transform", Department of Computer Science, niversity of Technology, 2004.

[16] Benjaminsen C., "Filtering of Periodic Noise Using the Complex Wavelet Transform", M.Sc. thesis, Informatics and Mathematical Modelling, Technical University of Denmark, DTU, 2007.

[17] Candes E., Donoho D. L., "Ridgelets: The Key to High-Dimensional Intermittency", Phil. Trans. R. Soc. Lond. A., vol. 357, p.p. 2495–2509, 1999.

[18] Do M. N. and Vetterli M., "The Fnite Ridgelet Transform For İmage Representation", IEEE Transactions on Image Processing, vol. 12, no. 1, pp. 16-28, 2003.

[19] Candes E. J., Donoho D. L., "Curvelets- A Surprisingly Effective Nonadaptie Representation For Objects With Edges in Curve and Surface Fitting", In: A. Cohen, C. Rabut and L. Schumaker, Editors, Curves and Surface Fitting: Saint-Malo 1999, Vanderbilt University Press, Nashville, pp. 105–120, 2000.

[20] Donoho D. L., Duncan M. R., "Digital Curvelet Transform: Strategy, Implementation and Experiments", Proceeding of the SPIE on Wavelet Application VII, Orlando, p.p. 12-30, 2000.

[21] Candes E.J., Demanet L., Donoho D.L., Ying L., "Fast Discrete Curvelet Transforms", tech. rep., Applied and Computational Mathematics, California Institute of Technology, pp. 1-44, 2005.

[22] Starck J. L., Candes E. J., Donoho D. L., "The Curvelet Transform For Image Denosing", IEEE Trans. Image Processing., vol. 11, p.p. 131-141, 2002.

[23] Gyaourova A. , Kamath C. and Fodor I. K., "Undecimated Curvelet Transforms For Image Denoising", Lawrence livermore National Laboratory, Tech. Rep. UCRL-ID-150931, 2002.

[24] Sivakumar R., "Denoising of Computer Tomography Images using Curvelet Transform", ARPN Journal of Engineering and Applied Sciences. February, 2007.

[25] Rayudu D. K. V., Murala S. and Kumar V., "Denoising of Ultrasound Images Using Curvelet Transform", The 2nd International Conference on Computer and Automation Engineering (ICCAE 2010), Singapore, vol. 3, pp. 447–451, 2010.

[26] Li C., Liao X. and Yu J., "Complex-Valued Wavelet Network", Journal of Computer and System Sciences, vol. 67, pp. 623-632, 2003.

[27] Shukla P. D., "Complex Wavelet Transforms and Their Applications", PhD Thesis, The University of Strathclyde, 2003.

[28] Fernandes F., "Directional, Shift-İnsensitive, Complex Wavelet Transforms With Controllable Redundancy", PhD Thesis, Rice University, 2002.

[29] Strang G. and Hguyen T.,"Wavelets and Filter Banks", Wellesley-Cambridge Press, 1996.

[30] Oppenheim A.V. and Lim J.S., "The Importance Of Phase in Signals", Proc. IEEE, vol. 69, pp. 529-541, 1981.

[31] Lorenzetto G. P. and Kovesi P., "A Phase Based Image Comparison Technique", DICTA99, University of Western Australia, 1999.

[32] Driesen J. and Belmasn R., "Time-Frequency Analysis in Power Measurement Using Complex Wavelets", IEEE Int. Sympo. On Circuits and Systems, ISCAS2002, pp. 681-684, 2002.

[33] Lina J.M., "Image Processing With Complex Daubechies Wavelets", Journal of Math. Imaging and Vision, vol. 7, pp. 211-223, 1997.

[34] Bulow T. and Sommer G., "Hypercomplex Signals- A Novel Extension of The Analytic Signal to The Multidimensional Case", IEEE Transactions on Signal Processing, vol. 49, pp. 2844-2852, 2001.

[35] Selesnick I. W., Baraniuk R. G. and Kingsbury N. G., "The Dual-Tree Complex Wavelet Transform", IEEE Signal Processing Magazine, vol.22, pp. 123-151, 2005.

[36] Donoho D.L., "De-Noising by Soft-Thresholding", IEEE Transactions On Information Theory, vol. 41, pp. 613-627, 1995.

[37] Kreis R., "Issues of Spectral Quality in Clinical H-Magnetic Resonance Spectroscopy And

A Gallery Of Artifacts", NMR in Biomedecine, vol. 17, no. 6, pp. 361-381, 2004.

[38] Avcibas I., Sankur B. and Sayood, K., "Statistical Evaluation of Image Quality Measures", Journal of Electronic Imaging, vol. 11, no. 2, pp. 206-223, 2002.

[39] Farrell J. E., "Image Quality Evaluation in Colour Imaging: Vision And Technology". MacDonald, L.W. and Luo, M.R. (Eds.), John Wiley, pp. 285-313, 1999.

[40] Cadik M. and Slavik P., "Evaluation of Two Principal Approaches to Objective Image Quality Assessment", 8th International Conference on Information Visualisation, IEEE Computer Society Press, pp. 513-551, 2004.

[41] Nguyen,T.B. and Ziou, D., "Contextual and Non-Contextual Performance Evaluation of Edge Detectors", Pattern Recognition Letters, vol. 21, no.9, pp. 805-816, 2000.

[42] Elbadawy O., El-Sakka M. R. and Kamel M. S., "An Information Theoretic Image-Quality Measure", Proceedings of the IEEE Canadian Conference on Electrical and Computer Engineering, vol. 1, pp. 169-172, 1998.

[43] Dosselmann R. and Yang X. D., "Existing And Emerging Image Quality Metrics", Proceedings of the Canadian Conference on Electrical and Computer Engineering, pp. 1906-1913, 2006.

[44] Ceylan M., "A New Complex-Valued Intelligent System Design on Evaulating of The Lung İmages With Computerized Tomography", PhD Thesis, Selcuk University, Graduate School of Natural and Applied Sciences, May, 2009

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COMPARISON OF RENEWABLE AND CONVENTIONAL ENERGY COSTS BY WAVELET TECHNIQUES

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Abstract- This paper aims to compare the cost of renewable energy to conventional energy sources in production. It is argued that advantage in cost of production would support competitiveness of Turkish manufacturing industry in international trade. In this paper an export model has been developed to forecast competitive advantage of Turkish manufacturing industry on international trade by using renewable energy in production. Data on the cost of energy on Turkish manufacturing industry and export performance in past 10 years were processed. This study utilizes 1D wavelet packets and continuous wavelets on historical cost and export values in Turkey. Wavelet and regression analysis have been applied to define variation in temporal and spatial patterns. Wavelet techniques detect sudden changing, increasing and decreasing trends of data and define the role of factors small and large scale effects. Actual share of energy usage in production cost and usage of renewable energy instead of conventional energy values were compared to other countries data analyses.

Keywords: *Cost of renewable energy, wavelet analysis, cost advantage, competitiveness, international trade*

1. INTRODUCTION

Turkey export has been following high and rapid growth since 1980. This growth is considered as highly successful development in comparison to the period prior to 1980. However, the driving forces behind this successful export are still a matter of debate. Some of the economists attributed this success to liberal policies on international trade while others aggressive foreign exchange policies. In this article, competitive advantage of export commodities in the foreign markets is considered as one of the important reason of the growth. It is argued the lower cost of production had contributed competitive advantage for a long time. In this analysis, contribution of lower energy cost to supply of products exported has been analyzed.

2. BASIC FACTORS UNDERLYING EXPORT & COMPETITIVENESS

Income level of target export market is important determinant of the export level. In early years of 1980s, demand originated in Middle East countries are considered as important factor for rapid growth of export. These export markets were the upper middle and upper income level countries (Arslan, I and Winjbergen, 1991). The Customs Union between Turkey and the European Union (EU) has been considered as an important source of export growth since all tariffs and quotas were removed in trade between the EU and Turkey. On the other hand, exporting country should have capacity for competing in these markets. A large number of definitions for competitiveness have been proposed in the economic and business literature.

Firstly, Adam Smith explained international trade due to the differences among the nations and specialization on production of good countries has absolute advantage. Later, Ricardo extended the analysis of international trade theoryies by adding wages and productivity concepts to the absolute cost advantage in determination of competitiveness. Ricardo argued trade would be beneficial even if the first country held an absolute cost advantage over the other country in both commodities at his two nations-two commodities example (Ricardo,1814(1932;111).In simple one factor Ricardian model, labor is the only important resource for production. Labor productivity only varies across countries depending on differences in technology. But labor productivity in each country is constant across time as well the supply of labor is constant. Only two goods are important for production and consumption. Labors receive competitive wage due to their productivity (Krugman and Obstfeld, 2006:26).The benefits of higher productivity in one country can be transmitted from one country to another through trade. Therefore, movements of goods provide a substitute for movements of factors between countries. And each can employ its own resources

where they are relatively most efficient or relatively least inefficient.

Although, comparative advantage is the cornerstone of the original theory of international trade, it was not able not explain what goods would be exported and imported. Later, by introduction of the terms of trade comparative advantage provides the answer to problems of country's both growth and efficiency in resource allocation (Wexler, 1972:54). If one country has an absolute advantage in the production of both goods (as assumed by Ricardo) then real wages of workers (i.e., the purchasing power of wages) in that country will be higher in both industries compared to wages in the other country. Workers in the technologically advanced country would get a higher standard of living than in the technologically inferior country since in the country that is more productive, workers get higher wages.

A substantial explanation of the causes underlying trade and competitveness has grown by Heckscher-Ohlin (H-O) Model. Based on two essential assumptions that countries are differently endowed with productive resources and in perfectly competitive markets, H-O model argues that trading countries would benefit by exporting those goods that are relatively intensive in the country's abundant factor and import those goods that are relative intensive in the use of the country's scarce factor. When society decides to produce more of capital intensive good, they have to produce less of labour intensive good. H-O model says differences in labour skills, phsyical capital and land between countries cause productive differences leading to gains from trade (Krugman and Obstfeld, 2006:51).

The Stolper Samuelson Model criticizes the H-O model and states a rise in the price of a good will increase the real price of the factor used intensively in the sector and decreases the real price of the other factor. The crucial effects on income of an openning of trade depend on the flexibility of the affected factors.

The Rybczynski theorem explains the relationship between changes in national factor endowments and changes in the outputs of the final goods in 1950s(Winters, 1991:39). According to theorem, an increase in country's endowments of a factor will cause an increase in output which uses that factor intensively and a decrease in the output of the other good.Therefore,countries produce and export more of labour intensive goods.

Although, the traditional general equilibrium approach to international trade is considered as powerful intellectual analytical structure explaining and providing many useful insights about a trading world economy, Helpman and Krugman (1985) explain four major subjects in which traditional trade theory seems to be inaduqate in explaining the empirical observations: failure to explain the volume of trade, the composition of trade, the volume and role of intra-industry trade and direct foreign investment and the welfare effects of trade liberalization (Helpman and Krugman, 1985:2).

Balassa (1995) focused on the essential characteristics of producers in competition for market share and profits and the ability to export. Durand and Giorno (1987) argued the ability to compete depends on price ratios and cost competitiveness. Turner and Gollup (1997) and Siggel (2007) introduced more complex and multi-dimensional indicators about competitiveness. Kotan and Sayan (2001) showed a relatively higher price charged by an exporter will reduce its market share relative to other in the case of the technology intensive products in Turkey. High prices are considered due to high cost.

Traditionally, cost of production is considered as main factor determining competition. Labor wage, cost of raw materials and energy used in production would be considered as main factors of production. Besides labour cost and cost of raw material, energy is an important factor contributing to production. Here, mainly cost of energy has been analyzed to compare cost effectiveness of renewable energy. Electricity, fuel oil, coal has been used to generate electricity in Turkey.

In practice, nearly half of the world's trade consists of trade between industrial countries that are relatively similar in their factor endowments. Further both the share of trade among industrial countries and the share of this trade in these countries incomes rose for the last decades, even as these countries were becoming more similar by most measures.In some cases, the government policies would restructure some of the adverse effects of these market imperfections (Stiglitz,1989:197). If commodity price are chosen properly to reduce the risks that producers may face, this price may lead to higher level of production and investment. One of the factor determining the price is cost, in Turkey, large part of cost seems to be in energy cost. The Energy markets are in general imperfectly competitive markets. In this case, the government would support the producers to reduce energy prices by different kind of incentives given to energy producers. Government may also eliminate some taxes that worsen the risks facing energy producing firms. At that time this would be considered as positive role of government for the economy through taxes and subsidies(Stiglitz,1989:197). Subsidies given to the producers who use renewable energy resources would may provide sustainable production and export opportunities to the countries.

According to argument of Baldwin, new trade theory is that a country may increase its welfare through strategic trade-policy behaviour when its firms are competing in imperfectly competitive international markets (Baldwin,1992:806). Additionaly, this net gain earned by the firm in imperfectly competitive domestic market may behave strategically, the net gain from the international trading will be more than the net gain under the perfectly competitive markets. The most controversial suggestion by the new trade theory was that government intervention can raise national welfare by shifting monopoly rents from foreign to domestic firms (Brander, 1981).

Trade policy can serve for a given country as a tool or obtaining as large a share of these international profits as possible. Brander states implementing strategic policies might" allow the country to capture rents that would otherwise go elsewhere"(Brander, 1988). The government should play more active role in international trade by following two basic policies : Shifting rents supporting and more external economies. Energy is one of the important example of externam economies. Either its production or consumption has direct and indirect influences on economy, ecology and society. Traditionally, sustainability has been framed in the three pillar model: Economy, ecology and Society are all considered to be interconnected and relevant for sustainability (BMU, 1998). The relationship between RE and sustainability can be viewed as a hierarchy goals and considerations. The energy sector has generally been perceived as key to economic development with an economic growth and expansion of energy consumption. Indicators such as GDP or per capita GDP have been used as proxies for economic development for several decades such as in integrated models .

The United Nations Conference on Environment and Development (UNCED) held in Rio de Jane Rios, Brazil, in June 1992 stated target of worldwide sustainable development. The goal of sustainable development cannot be realized without major changes in the World's energy system. Accordingly, Agenda 21, called for "new policies or programs, as appropriate, to increase the contribution of environmentally safe and sound environmentally safe and sound and cost effective energy systems, particularly new and renewable ones, through less polluting and more efficient energy production, transmission, distribution and use" (Johansson, T. Kelly H. Amulya K.N.Reddy, R.Williams,1993)

If the world economy expands to meet the objectives of countries all over the World, energy demand is likely to increase even if energy use should be more efficient.

Given adequate support, renewable energy technologies can meet much of the growing demand at prices lower than those usually forecast for conventional energy. By the middle of the 21st century, renewable sources of energy could account for three fifths of the world's electricity market and two fifths of the market for fuels used directly. Moreover, making a transition to renewable intensive energy economy would be reduced to 75 percent of their 1985 levels provided that environmental and other benefits not measured in standard economic accounts.

Renewable energy systems have benefited from developments in electronics, biotechnology, material sciences and in other energy areas. Renewables can play major roles in the global energy economy in the decades ahead. In the global energy demand scenario adopted for this study, global electricity production would more than double by 2025 and more than triple by 2050 ( ). By 2050, renewable energy sources can play a central role in the world energy markets. They can do this even if world energy prices increase very slowly and without subsidies or credits to reflect external benefits not tracked in standard economic accounting.

3. CONVENTIONAL ENERGY RESOURCES AND THEIR COST IN PRODUCTION

Unfortunately, energy resources are not sufficient in Turkey. National energy resources would only meet 35% of the energy demand in Turkey. It is also forecasted this ratio would to decrease to 25% while energy demand for manufacturing industry is forecasted as the amount more than 4 times required in 2000s. Turkey need to find out energy resources at cheaper prices and renewable to maintain sustainable growth, development and export (Under Secretariat of Treasury, R.T. 2010: 10)

Turkey has hard coal, lignite, asphalt, petroleum, natural gas, hydroelectric energy, and geothermal energy sources. Turkey does not have own large fossil fuel reserves (Akan, Dogan, Isik, 2011:). Baris (2011) analyzed the current and future role of coal in energy strategy of Turkey and the compatibility of energy policies of Turkey to the EU policies. Coal and hydropower are considered as the most important indigenous energy sources in Turkey since their supplies are stable. Turkish government set targets to fully utilize coal reserves of the country in next decades. Electricity production of Turkey was 46.998 in 2010. It was largely based on thermic sources (59 %); hydro sources (33 %) and wind (3.8%). Baris(2011) forecasted the capacity for electricity would

increase 2014 to 55.691. The share of hydro and wind sources would increase to 36%.

The cost of renewable energy declined over the past thirty years due to efficiency obtained n thermal energy; reduction in manufacturing cost; developed architectural designs (Sovacool, 2007: 111) New wind technologies are operating at lower wind speeds and employing stronger materials and dollar technologies have greatly improved efficiency, lowered cost and enhanced performance (Sovacool, 2007: 111). The competitiveness of renewable energy technologies has been further heightened by improvements in energy storage (Sovacool, 2007: 111).

There are several alternative technological ways to generate electricity and reduce green house gas emissions cost effectively. Sometimes plant design would offer more efficient power generation conversion of fossil fuels, greater use of renewable energy or nuclear power and the capture and disposal of CO_2. The choice in terms of cost saving and carbon emission reduction benefit. The global electricity sector has the potential to lower its carbon emission reductions by between 1.5-4.7% by 2010 and 8.7-18.7% by 2020 (Sims, Hans and Gregory, 2003:1324). Gokcecinar and Uyumaz (2008) (Table 1), compared endogenous and exogenous cost of coal, natural gas and wind, coal has 4.8 endogenous cost but its exogenous cost is 5.0; natural gas has 4.0 endogenous cost but is exogenous cost is 2.5 and wind has the lowest exogenous cost 0.1.

The figure below shows the cost per kilowatt hour (Table 2). Renewable energy cost is more than fuel cells source.

Table 1. Comparison of Alternative Energy Cost / 2008 (Gokcecinar and Uyumaz (2008)

Energy Source	**Typical Installation**	**Cost Per Kilowatt Peak and Per Kilowatt hour**
Fuel Cells	1-200 kilowatts	1500-3000 kwp 5-10 cents per kwh (Lower number associated with larger Wind Farms)
Biomass Generator	1-1 Megawat-Multi mW	$1500-$1800 per kWp 5-10 kWh

Table 2. Comparison of Alternative Energy Cost 2012 (Sabuncu and Colakoglu, 2012)

Energy Source	**Typical Characteristics**	**Typical Energy Cost (US cents kilowatt hour)**
Large Hydro	10 MW-18.000 MW	3-5
Small Hydro	1-10 MW	5-12
On Shore Wind	1.5-3.5 Rotor Diameter: 60-100 m	5-9
Off Shore Wind	1.5-3.5 MW; Rotor diameter: 70-125 m	10-20
Biomass Power	1-20 MW	5-12
Geothermal Power	1-100 MW	4-7
Solar PV	Crystalline 12-19 %;thin film 4-13 %	
Solar PV (Concentrating)	25%	
Rooftop Solar PV	2-5 kW peak	17-34
Utility- Scale Solar PV	200 kW to 100 MW	15-30
Concentrating Solar Thermal Power	50-500 MW to 10-20 MW (tower)	14-18

Fossil fuels continue to dominate as the main sources of energy produced and consumed worldwide despite the growth of the share of renewables in both production and consumption. However, the use of fossil fuels has stalled when it comes to electricity production through its use has continued to dominate the transport sector. Oil is the main fossil fuel used and has remained so since the end of the Second World War. It has a near monopoly as the main source fuel for the transport sector. However, the use of petroleum fuels to produce electricity has drastically declined with the exception of natural gas. This is due to the oil shock of 1973-1974 that decreased economic growth in every oil importing nation and lead to a drastic hike in electricity tariffs.

As nations like Japan and Germany plan to shut down their nuclear power plants. Many developing

nations like Nigeria, Jordan and Ghana are making plans to build nuclear power plants thus in future most nuclear power plants may be located in developing countries in future. However, in all nations renewables are taking a larger and larger share of energy produced and consumed. However, in all nations, renewables are taking a larger and larger share of energy produced and consumed. Already in Paraguay, 100% of all the electricity generated is from hydropower. Spain, in its efforts to reduce reliance on fossils in energy production has some of the largest solar and wind power projects in the world. Germany exports wind power energy to the EU. Morocco, Egypt and Kenya have large wind power plants which are helping them keep up with the growing energy consumption as the USA, Indonesia, Iceland and Kenya are making strides in developing geothermal energy.

The 9.8 magnitude earthquake in Japan just made nuclear energy producers to rethink their energy resources in all countries all over the World. The most significant reaction was from Germany and Italy. German government declared that the life span of the Country's 17 nuclear power plants, which originally had to be closed for 12 years on average. However, the Fukushima crisis introduced a change in plans. Initially, the German government closed the nuclear reactors built before 1980. 23% of German electricity comes from nuclear power. However, even German government takes the risk to import electricity and changed their production for renewable energy.

World energy consumption has been on the rise worldwide as developing nations begin to industrialize and as consumers in developed national buy more energy consuming appliances to make life more comfortable. If the current trends continue, we may face an energy shortage in future.

In Turkey, the renewable energy sector and government policies have interacted and changed at drastic speed over the last few years. Supporting renewable energy has been a great experiment for policymakers all around the world. Policy reversals in the US, Germany, Italy and Spain have already started to reduce investment.

Despite the global financial crisis, the renewable energy sector has achieved important advances in technology and power project development over the past few years. In 2010, 195 GW of new power generation capacity was established globally and approximately half of this capacity is based on renewables. Renewables constitute nearly 25% of global installed capacity, whereas in power generation the share of renewables is around 20% (Sabuncu and Colakoglu, 2012)

As it is shown at Table 3 and 4, the use of renewable energy resources growing so rapidly. However, at 2009 statistics, fossil energy resources were still the largest energy resources consumed.

Table 3. Renewable Energy Share of Global Final Energy Consumption, 2009 (Renewables 2011 Global Status Report) (Sabuncu and Colakoglu, 2012)

Type of Energy Resource	**%**
Nuclear	2.8 %
Renewables	16.2%
Fossil Fuels	81%

Table 4. Growth Rates of Renewable Energy Capacity and Production, 2005-2010

Type of Energy Resource	**Annual Average Growth Rate**
Biodiesel Production	38 %
Ethanol Production	23 %
Solar hot water –heating	16 %
Hydropower	3%
Geothermal Power	4%
Concentrating Solar Thermal Power	25%
Wind Power	27%
Solar PV	60%
Solar PV	49%

Turkey energy demand has been increasing so rapidly due to its economic growth and increase at export.
Turkey energy demand will increase more than what its past demand in the future depending on its target expected change in demand in economy and technology.

Table 5. Electricity Demand Forecast During the Period Between (Electricity Market Development Report, 2011 (http://www.epdk.gov.tr/documents/elektrik/rapor_yayin/Elektrik_Piyasasi_Gelisim_Raporu_2011.pdf)

2011	227.000
2012	241.300
2013	257.060
2014	273.900
2015	291.790
2016	310.730
2017	330.800
2018	352.010
2019	374.430
2020	398.160

Table 6: Turkey Energy Demand During the Period From 2002 to 2011 (http://www.epdk.gov.tr/documents/elektrik/rapor_yayin/Elektrik_Piyasasi_Gelisim_Raporu_2011.pdf)

	Puant Power Demand (MW)	**Change %**	**Energy Demand**	**Change %**
2002	21.006	7.1	132.553	4.5
2005	25.174	7.2	160.018	6.3
2006	27.594	9.6	174.637	7.2
2007	29.249	6.0	190.000	8.6
2008	30.517	4.3	198.085	4.3
2009	29.870	-2.1	194.079	-2.0
2010	33.392	11.8	210.434	8.4
2011	36.122	8.2	229.319	9.0

4. APPLICATION OF WAVELET TECHNIQUES

Second part of this study is based on wavelet techniques and their applications on energy prices and economic parameters (export and crude oil prices). In this section, the basic definitions has been given about the wavelet transform. Wavelets are families of small waves generated from a single function f(t) which is called the mother wavelet. A sufficient condition for f(t) to qualify as a mother wavelet is given as below (Meyer, 2000; Siddiqi et al., 2002; Kenisarina et al. 2006; Aslan and Caglar, 2011, Aslan and Gencoğlu, 200; Tolun et al., 1995; Turksoy 1995):

$$\int_{-\infty}^{\infty} | f(t) |^2 \, dt < \infty \qquad 2(a)$$

The Fourier transform F of f(t) is defined as

$$F(w) = \int_{-\infty}^{\infty} f(t) e^{iwt} dt \qquad 2(b)$$

A function ψ(t) satisfying the following condition is called a continuous wavelet:

$$\int_{-\infty}^{\infty} | \psi(t) |^2 \, dt = 1 \qquad 3(a) \text{ and}$$

$$\int_{-\infty}^{\infty} | \psi(t) | \, dt = 0 \qquad 3(b)$$

It may be observed that the scalogram can be represented either as three-dimensional plot or as a two-dimensional grey scale image. As mentioned above, a, b parameters represent the scaling factor and the location in time, (Siddiqi et al., 2005). Different variability of time scales from inter-monthly fluctuations (2,0 – 3,1 months) to decadal – centennial changes (10,6-110,7 years) have been considered to analyze data. In the following sections, f(t) will be considered as monthly and annual average values of export and crude oil prices in Turkey.

5. WAVELET ANALYSES OF EXPORT

Figures 1 (a-d) show wavelet analyses of export. Fig. 1a shows an increasing trend all period. Some decreasing trend has been observed in 2008. Amplitudes of small (d1, high frequencies) and large scale (d6, low frequencies) influences on monthly export in Turkey increase in the second part of the period.

Frequency distribution of export values does not show a very well bell shape distribution. There is a negative skewness, (Fig. 1.b).

Figure 1c shows the role of different scale effects on monthly export values. In 2008 there are large scale factors on this variation with the periodicity of 20 to 30 months (inter-annual variations). Regression estimation explains the linearly increasing trend of export data (Fig. 1d).

6. WAVELET ANALYSES OF CRUDE OIL PRICES

Figures 2 (a-d) show wavelet analyses of monthly crude oil prices. Fig. 2.a shows an increasing trend in most part of the period. Some decreasing trend (similar trend in Fig. 1) has been observed in 2008.

Amplitudes of small (d1, high frequencies, medium scale (level d4) and large scale (d6) influences on monthly crude oil prices in Turkey increase in the second part of the period. Frequency distribution of crude oil does not show a very well bell shape distribution. There is a three modal distribution, (Fig. 2b).

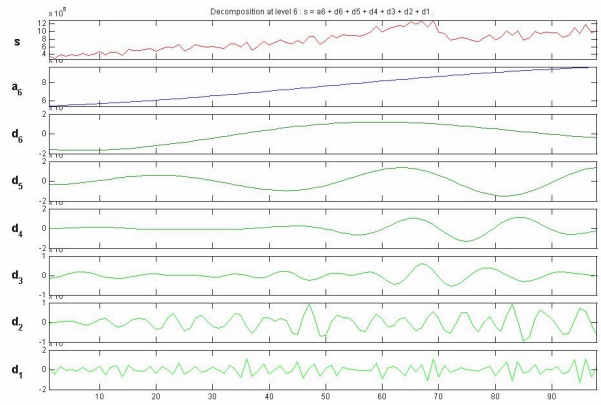

Fig. 1a-Monthly Export, January 2003 – February 2011, 1D Wavelet, DMeyer, Level 6

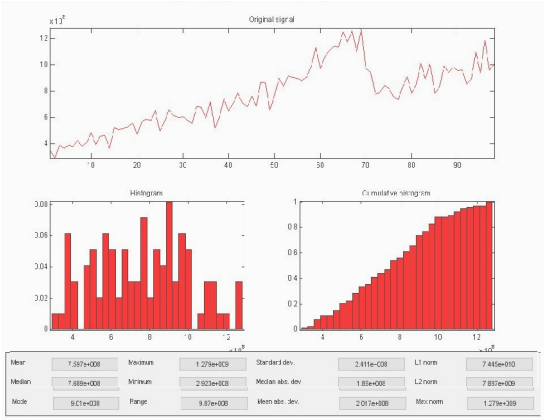

Fig. 1b- Statistical Descriptive of Monthly Export, January 2003 –February 2011

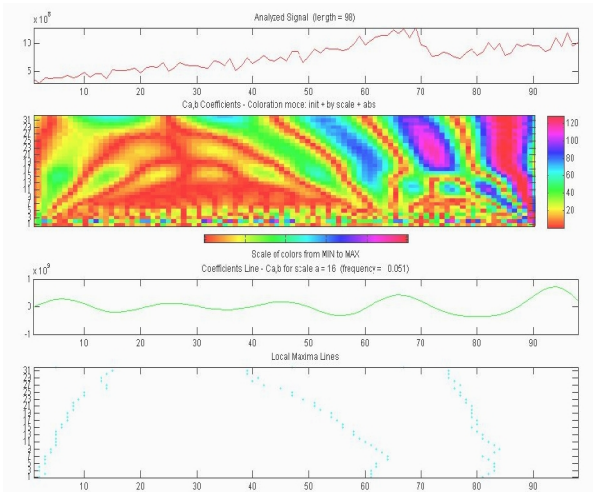

Fig. 1c- Analyses of continuous wavelet 1-D, Morlet, Level 1, Monthly Export, and January 2003 –February 2011

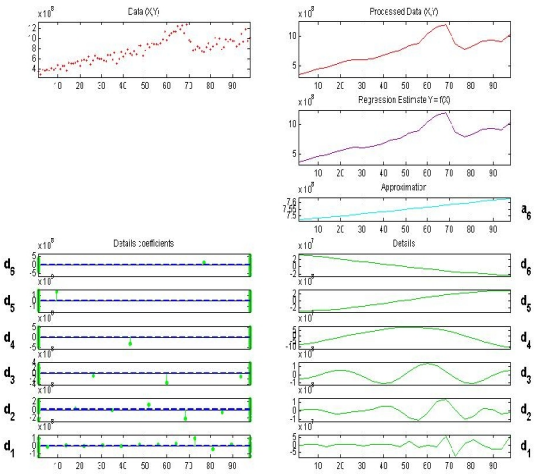

Fig. 1d- Analyses of Regression estimation for export, Fixed design 1-D, DMeyer, Level 6.

Figure 2c shows the role of different scale influences on monthly variation of crude oil prices. In 2008 there is a large scale influence on this variation with the periodicity of 7 to 30 months. Roles of large scale effects on export follow observation of similar effects on crude oil prices in figure 2c. These variations are associated with semi-annual cycle and inter annual variations. Regression estimation explains the increasing trend of crude oil prices except the period between November 2008 and February 2009 (Fig. 2d).

7. RESULTS AND CONCLUSION

Despite serious development in renewable energy technologies, renewable energy sources are still at competitive disadvantage. However, not only for increasing the level of export but also international agreements are binding for Turkey, Turkey has to use renewable energy source more. Due to obligations arises with Kyoto Protocol, Turkey should limit CO_2 emission together with other greenhouse gases. Coal is a very important domestic energy source for Turkey but new policies have to be developed and adopted immediately, and more realistic targets for the country should be set accordingly.

The first part of this study covers multiple regression analyses of export, energy price and label cost. There is sufficient evidence (α=0,05) to support a linear correlation amongst these variables. In the model set in this article sets clearly, the negative relationship between the energy cost and level of export. If Turkey succeeds to decrease cost of energy, the level of export will increase. The competitive cost advantage is one of the important factors, however, the international agreements and sustainable development policies also require clean and sustainable energy policies.

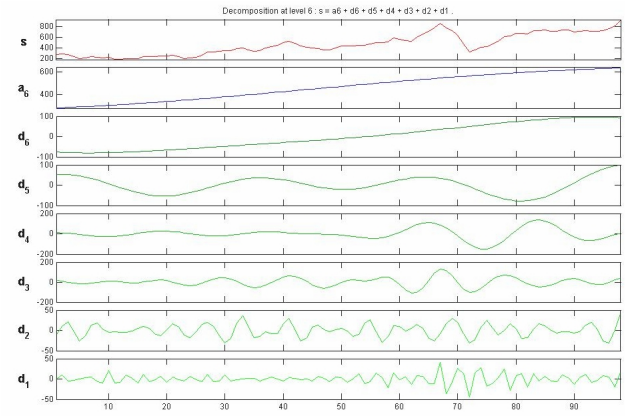

Fig. 2a- Monthly variation of crude oil prices, January 2003 – February 2011, 1D Wavelet, DMeyer, Level 6

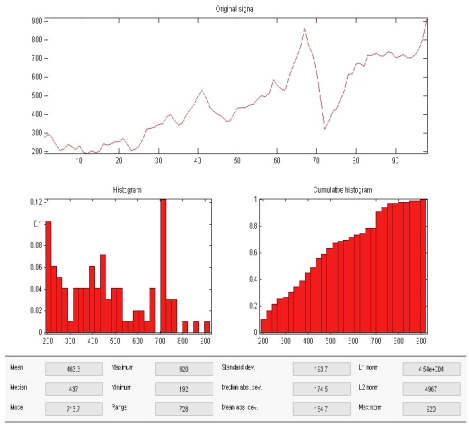

Fig. 2b- Statistical descriptive of monthly crude oil prices, January 2003 –February 2011

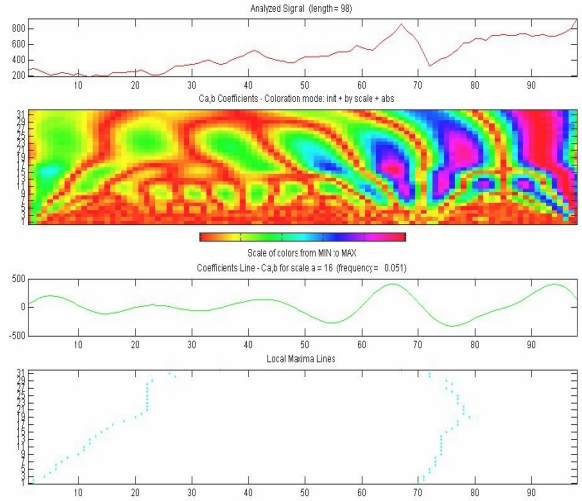

Fig. 1c- Analyses of continuous wavelet 1-D, Morlet, Level 1, monthly crude oil prices and January 2003 –February 2011

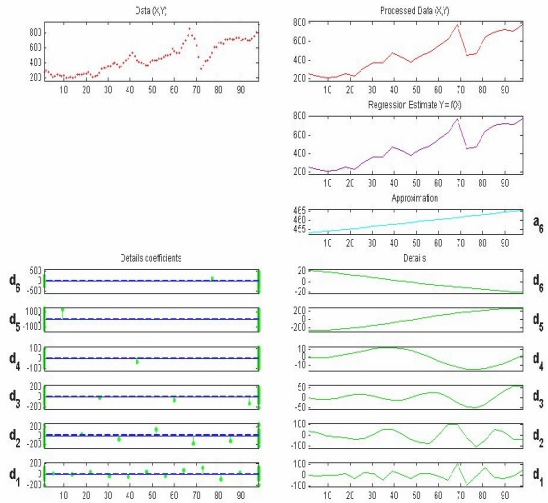

Fig. 1d- Analyses of Regression estimation for crude oil prices, Fixed design 1-D, DMeyer, Level 6.

Crude oil prices and other economical parameters analyzed above by using wavelet techniques seem will be persist in longer term. As a result of these analyses installation of renewable energy systems (like solar and wind) will support national energy consuming as environmentally friendly energy sources. The total number of wind power plants under operation in Turkey is 41 (TWEA, 2011). In general at Aegean Sea Region at different 41 wind parks, there are 700 wind energy converting systems (WEcS) and they transfer 1414, 50MW wind energy to interconnected system. Furthermore, 19 different Wind Parks with 750MW generating capacity is under construction in Turkey.

REFERENCES

[1] Akan,Y, Dogan, M and Cem Isik``The Casuality Relationship Between Energy Consumption and Economic Growth? The Case of Turkey.`` Energji. Piyasa ve Duzenleme . Vol.1.No.1.pp: 101-120

[2] Aslan, Z., ve H. Gençoğlu. Rüzgar-Güneş Enerji Sistemlerinden Yararlanma Olanakları, V. Ulusal Üretim Arastırmaları Sempozyumu, Istanbul Ticaret Üniversitesi, 25-27 Kasım 2005, s. 547, 2005.

[3] Aslan, Z., and N. Çağlar. Wind Speed and Energy Characteristics Based on Statistical Analyses, I. International Symposium on Global Climate Change, Environment and Energy: Global Challenges and Opportunities to Global Stability, IAU, April 24, Istanbul, 2011

[4] Arslan, Ismail & van Wijnbergen, Sweder (1990). "Turkey : export miracle or accounting trick?," Policy Research Working Paper Series 370, The World Bank

[5] Balassa, Bela (1995). Trade Liberalization and Revealed Comparative ``, Manchester School of Economic and Social Studies, 33, 99-123,

[6] Baris, K.(2011). " The Role of Coal In energy Policy and Sustainable Development of Turkey: Is it Compatible to the EU Energy Policy? `` Energy Policy, Vol.39 Issue 3. March 2011. pp: 1754-1763.

[7] Bubula, A and İnci Robe-Otker (2002). The Evolution of Exchange Rate Regimes Since 1990: Evidence from the De Factor Policies. IMF Working Paper

[8] Dooley,M.,L. Folkerts and Peter Garber (2009). Bretton Woods II Still Defines The International Monetary System".http://www.nber.org/papers/w14731

[9] Durand and Giorno (1987). Indicators of international Competitiveness: Conceptual Aspects and Evaluation. OECD Economic Studies. Vol.9

[10] Hassett, K, Hubbard Glenn and Matthew H.Jensen (2011) Rethinking Competitiveness. American Enterprise Institute for Publicy Policy Research" " Is Competitiveness Worth Defending?" Prepared for the American Enterprise Institute International Monetary Fund (2009)," Review of Recent Crisis Programs" Approved by Reza Moghadam, R (2009)

[11] Maltsoglu, Irini (2009)"Simulating exogenous and endogenous technology when depletables renewables and pollution co-exist: how to achieve sustainability?"http://dspace.uniroma2.it/dspace/bitstream/2108/1007/3/Paper+II_Maltsoglou_June09.pdf

[12] Melek, M., A. Tokgozlu and Z.Aslan (2008) Wavelet Analyses of Oil Prices, USA Variations and Impact On Logistics.

[13] Obstfeld, M. and Kenneth Rogoff (2007). The Unsustainable US Current Account Position RevisitedURL: http://www.nber.org/chapters/c0127

[14] Obstfeld, M and Kenneth Rogoff(2007) G7 Current Account Imbalances: Sustainability and Adjustment. Volume URL: http://www.nber.org/books/clar06-2

[15] Ozturk, İ.(2006). "Exchange Rate Volatility and Trade : A literature Survey" International Journal of Applied Econometrics and Quantitative Studies Vol.3-1(2006)

[16] Parrinelo,Sergio (2009). "The Notion of National Competitiveness In A Global Economyniversity of Rome" La Sapienza" Forthcoming in "Economic Theory and Economic Thought: Essays in Honour of Ian Steedman edited by J Vint S Metcalfe, H.Kurz, P. Samuelson and N.Salvadori, Routhledge

[17] Johansson, T. Kelly, Amulya K.N. H. Reddy, R.Williams (1993).Renewable Fuels and Electricity For a Growing World Economy. Island Press. ISBN 1 55963

[18] Turner, Anthony G and Golub, S (1997). Multilateral Unit Labor Cost Based Indicators of Competitivees for Industrial, Developing and Transition Economies.IMF Staff Studies for the World Economic Outlook.

[19] Gokcecinar, R.and Uyumaz, A.(2008). "Rüzgar Energisi Maliyetleri ve Teşvikleri" Incentives for Wind Energy. VII Ulusal Temiz Enerji Sempozyumu, UTES 2008. Istanbul.

[20] Kenisarina, M., V. M. Karslı and M. Caglar, Wind power engineering in the world and perspectives of its development in Turkey, Renewable and Sustainable Energy Reviews, 10, 341–369, 2006.

[21] Kotan, Z and S.Sayan, (2001) ``Comparison of the Price Competitiveness of Turkish and South East Asian Export in the European Union Market in the 1990s". Research Department. Discussion Paper No: 2001 / 2. The Central Bank of The Republic of Turkey.

[22] Leelahaphan, T. J (2009)."Crude, Oil Price, House Price and UA Canada Imbalance.

[23] Mandeng, O (1991). International competitiveness and international specialization, Eclac Review, Nº 45

[24] Meyer, Y. The role of oscillation in some nonlinear problems, School on Mathematical Problems in Image Processing, ICTP, SMR 1237/4, pp. 4-22, 2000.

[25] Sabuncu,F.and M.Colakoglu(2012)."Turkey's Renewable Energy Sector from a Global Perspective"www.pwc.com

[26] Siddiqi, A., Aslan, Z. and Tokgozlu,A. Wavelet based computer simulation of some meteorological parameters: Case study in Turkey", Trends in Industrial and Applied Mathematics. H. Siddiqi and M. Kocvara (Editors), pp. 95-105, Kluwer Academic Publishers, London, 2002.

[27] Sims, R. Hans, H. Rogner and Ken Gregory,(2003) "Carbon Emission and Mitigation Cost Comparison between fossil fuel, nuclear and renewable energy resources for electricity generation". *Energy Policy* 31.pp: 1315-1326.

[28] Rich, D. and L. Karp "Climate Change,

Carbon Taxes and International Trade: An Analysis of the Emerging Conflict Between the Kyoto Protocol and the WTO. 2004.

[29] Ricardo,D.(1814:1932).“Political Economy On Foreign Trade”, Principles of Political Economy and Taxation. Edited with introductory essay, notes and appendices, by Sir E.C.K.Gonner, G.Bell and Sons Ltd.London.pp:108-130.

[30] Sovacool, B. (2007) Coal and Nuclear Technologies: Creating a False Dichotomy for American Energy Policy. Policy Sciences, Vol. 40, No. 2, pp. 101-122.

[31] Siggel.E. (2007). International Competitivenes and Comparatıve Advantage: A Survey and Proposal for Measurement. CESIFO Venice Summer Institute. 2007.

[32] Tolun S., Mentes S., Aslan Z., Yukselen M. The Wind Energy Potential of Gokceada in the Northern Aegena Sea, 1995, Renewable Energy, Vol. 6, No. 7, pp. 679-685, 1995.

[33] Turksoy F. Investigation of wind power potential at Bozcaada, Turkey”, Renewable Energy, 6(8), p. 917–23, 1995.

[34] TEIAŞ.(2011) Türkiye Elektrik Üretimi – İletim İstatistikleri, Statistic for Turkey’s Electricity Distribution

[35] Under Secretariat of Treasury, Republic of Turkey(2010).Dis Ticaretin Onundeki Temel Sorunlar.Main Problems For Export. http://www.treasury.gov.tr/irj/portal/anonymous

[36] TEIAS.(2005) Türkiye Elektrik Enerjisi 10 Yıllık Üretim Kapasite Projeksiyonu.

[37] OECD Fact book, 2010: Economic, Environmental and Social Statistics.ISBN 92-64-08356-2

[38] World Economic Forum (WEF), (2011): Green Investing 2011: A Preview

[39] TWEA, (2011): Turkish Wind Energy Association, April 30, 2011.

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USE OF LASER SCANNING FOR CULTURAL HERITAGE DOCUMENTATION

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Abstract- In terms of raising an awareness of the historical, national and cultural properties in our country and ensuring a transfer of information to posterity, it is of vital importance to take inventory of the cultural and natural real properties located in protected sites.

Many fields, such as medical science, construction, ground engineering, geodetic engineering, and architecture, make use of the present-day laser scanning technology. Even if contemporary and current scientific methods are used for the inventory and documentation studies related to cultural and natural real properties in the PROTECTED SITES in the field of architecture; acquiring data of the entirety of a protected site using these methods is a time consuming process. Among the scientific methods applied, laser scanning technology has the utmost importance in the latest years.

The laser scanning devices for the detection of cultural, natural and historical properties in archeological, historical, urban or mixed protected sites in Turkey, eliminate challenges such as the enormity of sites, the difficulty of working in the sites, intense work hours, and the necessity of having a thorough knowledge of the site.

In the scope of this study, the usage, application, facilities, advantages and attainments of geodetic laser scanning systems in conducting surveys on facade, street or avenue silhouettes in the protected sites, where historical buildings within field of architecture are widespread, will be examined.

Keywords: *Laser scanning, survey, cultural heritage*

1. INTRODUCTION

With the effect of the technological and scientific progress changing in the world, laser scanning systems used in surveying historical buildings have been frequently preferred in the latest years, due to their fast, accurate and intense data production.

For many years, geodetic photogrammetric method and technologies are successfully being used for the documentation studies of cultural properties. The developments in the computer and communications technologies after the 1980s have been used in the geodetic photogrammetric studies and enabled the production of 3-dimensional digital orthoimages and digital surface models using the data acquired in the field. This process brought along the usage of a new technology in documentation works. This technology, known as Geodetic Laser Scanner, enables production of a highly intensive 3-dimensional point cloud data with high accuracy on the surface of an object. From the 3-dimensional point cloud data provided by these technologies, using appropriate software, 3-dimensional surveying–drawing–modeling can be produced. Consequently, it is possible to talk about 3-dimensional accurate digital documentations which has an accuracy at the level of millimeters and surveying–restoration studies have taken on new and different dimensions.

2. THE USE OF LASER SCANNING TECHNOLOGY IN SURVEYING

Today several methods are being used for the documentation, quantification and surveying of cultural and architecture heritage. These methods may be listed as; surveys using conventional instruments, topographic and photogrammetric surveys, surveys using laser scanning. The documentation in the surveying studies of either a single structure, or an architectural heritage in the scale of a whole area, using digital imaging or 3-dimensional laser scanning devices is a technique which is applied in the latest years. The beam sent from the laser scanning device, to the object or surface across, returns as millions of point data in the computer environment and can be seen as an object formed by the point cloud in digital media. This object or surface is now coordinated according to its ground level, in its actual size and in high accuracy.

The object or the surface can be defined in millions of 3-dimensional coordinates in several minutes. All the points in the point cloud in the system has 3-dimensional coordinates (x, y, z values). The coordinate system can be defined specifically to the object or the surface, and also can be attributed to the global coordinate system when required. This scanning can also be brought into the metric system (figure 1). This cloud points can be seen directly in the software for architectural drawing, or using several drawing interface software and it can be qualified in metric system, drawings can be plotted via those points. In this case, it is possible to measure any point on the object or the surface in its actual size. Virtual copies of the existing situation, with a high accuracy rate and millimetric precision are rapidly produced. For example, if this object is a structure, you can acquire the ground clearance of any window on it, the distance between two windows or all the dimensions of the stone jamb framing the window.

This situation greatly shortens the period of surveying with technical equipment, other than laser or with one-to-one labour force in the site. In cases where it is hard to reach using conventional methods, or scaffolds are required, e.g. eave soffits, measuring can be easily conducted via laser cloud points. The point to consider in surveying is the extent to how detailed the object or surface will be drawn. The scale of the detail to be drawn is directly related to the density ratio of the laser beams being reflected on the structure. Detail intensity of the architectural elements (concave or convex curves) on the facade of the structure, and the incidence angle of the laser beams to the surface are important factors.

In situations where the scanning angle is not appropriate, several scans can be conducted and the data can be combined or overlapped. The greater is the intensity of the points acquired, the clearer will be the point details on the facade of the structure (bay window, mutule, corbel etc.) or the straight edges, e.g. door-window openings, jambs, decorations, or eave line. This situation leaves no part open-ended while the architectural drawings are being prepared and the facade of the structure can be measured with maximum accuracy. When the point cloud data of a measured surface is observed, a colored or monochrome (optional) exact copy of the surface can be seen in the digital environment. The produced image is a virtual survey.

3. THE IMPACT OF LASER SCANNING DEVICES ON MEASURING AND DRAWING

While some scanning devices used today are appropriate for middle distances and internal spaces (100 meters), some are appropriate for long distance and external spaces (several hundred meters). Scanning devices for strictly particular details of historical buildings, such as column caps on the facade, relief and decorations, muqarnas on portals, interior hand-carvings, i.e. for close distance (several meters) measurements which require high accuracy are also available.

The data acquired from 3-dimensional laser scanning devices is an image which consists of millions of points. In this image, empty and full surfaces, all the curves, indents and juts can be observed as sharp lines formed by the points. As each point in the image has its own coordinate value, the lines formed by these points can be gripped and combined to produce drawings in CAD environment (figure 2).

Selection of the laser scanning device is directly relevant to the surveying activity to be conducted. In a project where only a street silhouette is to be acquired, measuring can be conducted by sending sparser laser points, much more rapidly. However, in a survey where the details on a structure are to be drawn, intense scanning should be conducted and every curve should be clearly observed. Yet, it should be considered that an image with intense point clouds has a vast number of points and is a slow image. Therefore it is also more difficult to make drawings via intense data. In sparse point cloud images, details are less observed. So, the right way would be to determine the scanning method appropriate for the project, prior to commencement of the work.

Photogrammetric surveying is the conventional method which has been applied for many years for surveying streets in protected sites. However, in the latest years, 3-dimensional laser scanning devices are also being used in the field of architecture. I will try and illustrate the contribution of 3-dimensional laser scanning devices to the surveying process, using an example which was conducted in Istanbul, Fatih District, in 2011. In this project, the silhouette of a street with 10 adjacent duplex houses was surveyed using 2 different methods and drawings were produced using the data acquired.

- The technical team employed in the survey was chosen from skilled experts and both surveys were conducted by the same team.
- Survey drawings were produced by the same experts, on another day and the same interface drawing software was used.
- The survey was produced by 1/200 measurement, appropriate for the drawing technique (more sparse point cloud data)
- In both surveys, the period for the work on the coordinate system were not included in the evaluation work period.
- 1 work day is considered as 8 hours.

The data acquired is demonstrated in Table 1 below.

Table 1: Surveying with two methods

Method	**Equipment used**	**Measuring technical team**	**Field Work**	**Office work**			**Total duration**
			Survey duration	Process duration*	**Technical Drawing team**	Survey	
1. Photogrammetric Survey	1 total station, 2 calibrated photo cameras, 12 laser measures, 2 steel tape measures,	1 survey engineer, 1 cadastral mapping technician	6 days (8 x 6 = 48 hours) 48 x 2 persons = 96 hours	2 days (2 x 8 = 16 hours) 16 x 2 persons = 32 hours	1 Master Architect restorator, 1 restorator	20 days (20 x 8 = 160 hours) 160 x 2 persons = 320 hours	96+32+320= 448 hours
2. Virtual Survey (Surveying with laser scanning device)	1 laser scanning device with auto camera, 1 steel tape measure	1 survey engineer	3 hours 3 x 1 person = 3 hours	2 hours 2 x 1 person = 2 hours	1 Master Architect restorator, 1 restorator	8 days (8 x 8 = 64 hours) 64 x 2 persons = 128 hours	3+2+128= 133 hours

**Process is conducted by the Mapping team.*

In the light of this experience, it can be stated that the surveying of this site can be completed in 448 hours = 56 work days, using photogrammetric method, and 133 hours = 17 work days , using 1 laser scanning device. A total gain of time in 3 times more can be achieved. In such a case, many advantages are acquired in the entirety of large-scale survey works.

4. THE IMPACT OF WHOLISTIC DOCUMENTATION OF PROTECTED SITES TO PROJECT AND PLANNING DECISIONS

Protected sites, intertwined in the daily life, are being rapidly falling into ruins with the intense pressure of the urban development surrounding it. This devastation is at a higher rate in urban protected sites, than archeological and natural protected sites (such as Side, Ephesus) which our not in urban areas. The management of protected sites are defined in accordance with the Reconstruction Plans for Protection, with the law number 2863 in Turkish Republic.

Due to the differences in both quality and quantity of the natural and historical properties in all the protected sites, and since they are under the authority and responsibility areas of different managements (Ministry, Municipality etc.) it gets more difficult to protect the historical properties as required.

The planning and improving works to be conducted for the historical heritage, natural and urban properties in our cities, enables the city to reach higher values.

The content of the works required by the relevant legislation includes the assessments and drawings of the case with high accuracy surveys. Since urban data such as;

- The relation between historical buildings and recent reinforced concrete buildings.
- Extensions on the historical building, unlicensed constructions,
- The relation between historical buildings and streets and squares,
- Actual situation of the buildings in terms of function, clearance and aesthetics,
- Free space assessment,
- Actual accession situation,
- Ground, garden, road and pavement levels,
- Plant elements, trees,
- Urban furniture such as street lamps, waste bins etc.

These can be assessed for all structures in 3-dimensional laser point clouds conducted in the field, these data shall lead new planning decisions to be taken from time to time. They will ease decisions on color, material and texture features of new architectural elements to be applied in the area (figure 3). It will be possible to complete the preliminary preparations and decisions for the design works to be conducted in the area, via combined 3-dimensional laser point clouds, when the survey drawings are still being continued. With such an operation, the duration of the project shall be shortened in the end. The possibility to see and examine the area defined as a protected site in the digital environment as a whole, ensures rapid and accurate decisions by experts.

For example, when it is considered that the roof configurations applied in the protected site under study are acquired using 3-dimensional scanning, the most common roof profile throughout the region shall have been detected. When a proposal for a new construction in the protected site is brought forward, information on the roof configurations which has been conventionally applied in the area shall be already available, and knowledge and foresight on the style in which the new structure should be, shall already be present. In this way, typologies on the protected site under study can be defined in a short period, in a rapid manner. Supporting these data with photographs shot in the area, shall also shorten the duration of examination and decision processes. This also ensures a possibility to examine the harmony of the proposed new buildings to the old site, in terms of level and clearance, for reconstruction plans for protection in protected sites. Affects the decision making process positively during the constitution of the terms for new structures.

Although cadastral maps include structure, parcel, plot, field etc. Border information, this data may be insufficient in some cases. Therefore, in the scope of the planning works, a possibility of producing 3-dimensional laser data or 3-dimensional cadastral maps based on this data arises.

Since, with the contributions of technology, most real-like surveys can be conducted on vast areas, and 3-dimensional data can be associated with the Geographical Information System, it is also possible to examine 3-dimensional images. By producing city models via 3-dimensional city surveys, this technology can be provided to the uses of many administrations. Cross examinations requested by the Geographical Information System can also be conducted.

5. ATTAINMENTS PROVIDED BY 3 DIMENSIONAL LASER SCANNING TECHNOLOGY IN DOCUMENTATION OF PROTECTED SITES

Since ground scans, i.e. scans conducted from the road level, lack data about the roofage, all the data on the area is acquired through combining aerial scans or scans conducted from a high location in the area with ground scans.

When 3-dimensional laser point clouds are supported with calibrated photography, all architectural features such as mass, volume, color, material, texture, pattern, and spatial data can be observed in 3 dimensional form. This possibility offers the expert working in the site a chance to comprehend and perceive the workspace as a whole, in a short time.

The details of the work to be conducted at the site, defines the quality and the quantity of the laser scanning to be performed in the area. However, for laser scans in protected sites, to conduct the scanning as detailed as possible and to acquire detailed site related data will be of great help for any kind of subsequent work at any scale in the site.

Laser scanning devices enable the sites where historical buildings are ample, to be surveyed in a rapid and effective manner. The advantages of using laser scanners in the protected sites where monumental buildings such as mosques, baths, churches and examples of civil architecture exist together, can be listed as such:

- As it can both possible to scan a single historical building with high accuracy and speed, and also scan several adjacent buildings together, the relations between the buildings and details can be examined. For example, all the details such as the distance between the buildings, their corresponding dominance, effect, eave levels, balcony, bay windows, garden walls, stairs, pavement level can be detected all at once.
- Small areas scanned in bits can be combined later, in digital environment to enable knowledge of the entirety of the site. This provides the possibility of observing, assessing and interpreting all the historical characteristics of the site together.
- Human labour is decreased by 70%. Surveying can be conducted with fewer personnel. This affects the project production and delivery dates positively.
- On-site working hours are decreased by 90%. In view of experience, the number of days in which the work is suspended due to negative external factors such as weather conditions did not exceed 1% of the total working days.
- Detail works overlooked in the site can be realized in the office, as the building or all of the buildings can be seen together in digital environment.
- It is possible to miss some details or overlook measurements in conventional surveying methods. But in laser scanning, the fact that all the details are acquired at once eliminates this possibility.
- It brings forward the ease of remote surveying in complicated, inaccessible or dangerous places

where conventional techniques are inadequate.

- The possibility of working without a need for daylight (in night hours) is an important factor, and is a reason for preference in some cases.
- It also helps analyses of panoramic data and urban conditions, apart from the buildings in the site.
- Data acquired from the site are multipurpose;

e.g.

Assume that a sectioning is being conducted which proceeds as road – city block – road – city block – road, like the city blocks in Chart 1. In a situation as such, the common method is to draw a section of each building, to place them on the road level, and then to draw the section of another building which has a facade to the roar, and to place them on the road level. Here, in case of a mathematical calculation error, the section which is being formed can take more time than expected. Many professionals know from the experience that a 10 cm error on the road level can have huge consequences in the architectural section. However, data acquired from 3-dimensional laser scanning devices offers great ease at this matter. Combined point cloud data of the site, offers possibilities of sectioning and drawing from any point desired.

Hence, if in a protected site, the data is acquired through laser scanning, it affects the work flow of the project in terms of duration, quality and accuracy in an utterly positive manner. This positive effect ensures the timely handover of the project to the management or the party who orders the work, and move on to application sooner. It offers a chance to interfere and repair our buildings which are on the edge of withering.

Laser scanning surveys provide benefits not only in project production, but also in other architectural processes. For example, assume that paint and white wash works are required for the facades of all the buildings, whether registered, or unregistered, in a protected site. This quantity survey can be priced conducted without a necessity of a drawn survey, using point cloud data. So, when a quantity survey is required, the scanning data, i.e. 3-dimensional images which consist of point clouds can be used, without a necessity of a drawn survey (figure 4, 5, 6). Since deformation and sensitivity which have occurred on the historical buildings, can be detected using laser scanning, the method and process to be determined prior to the restoration application is also positively affected in a direct fashion.

6. CONCLUSION

It should be noted that it is necessary for the relevant ministry, in charge of the evaluation of cultural and natural properties and protected sites to be equipped with contemporary method, technology and techniques and should resort to employ qualified personnel to work on this subject.

In the event that documentation and surveying works of the protected sites country-wide to be conducted by the relevant authority, historical buildings which require protection would be recorded rapidly and in the case of future corrosion of the building, it would be possible to make use of the archived documents.

3-dimensional data acquired in the protected sites support the 2-dimensional base maps on which the work is conducted. Updating the site in 3-dimension ensures an accurate evaluation of present urban settlement, and correct comprehension of structural fittings and architectural elements such as:

- Height of building,
- Protection situation of the building,
- Building – eave relation,
- Building – garden relation,
- Building – road,
- Building – pavement,
- Garden – road relation,
- Bay and corbels,
- Facade decorations (mutules, console elements, window jams etc.),
- Roof types,
- Street lights,
- Garden walls

Therefore, as it enables an ease for right decision-making and healthy planning for new urban applications to be performed on the field, they should be popularized.

It is necessary to delve into much more detailed studies for the applications in the protected sites, make examinations and synthesize the data with a holistic approach. This is the only way to ensure the conformity of any kind of application planned to be conducted in the site, with protection and goal criteria. To benefit from the improving technology all over the world, makes a dramatic difference in quick and accurate analyze, evaluation, synthesis processes in many respects.

When documentation and surveying works are to be conducted in protected sites larger than a specific size, virtual surveying – surveying acquired through 3-dimensional laser scanning – should be preferred as it is more efficient, effective, healthy, accurate and fast than other surveying methods.

Figure 1: Acquiring data via laser scanning

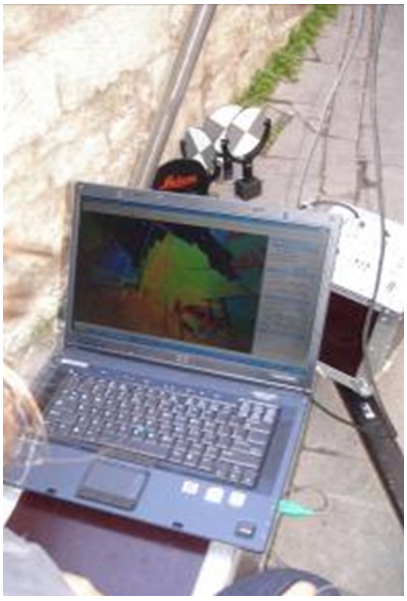

Figure 2: Data control and data transfer (Data is observed on the monitor, the frequency is determined, if scanning frequency is inadequate, a scanning with more frequent intervals is conducted –considering the lengthy duration, and a more detailed image of the facade of the building is acquired.)

Figure 3: Street silhouette acquired via laser scanning. (This image is in sheer scale and level, and it can be brought to any desired scale.), Istanbul Fatih, Süleymaniye, IMP, Bimtaş A.Ş.

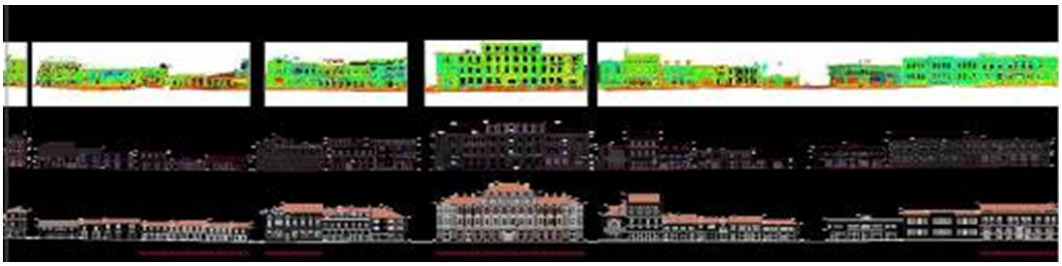

Figure 4: Street silhouette of several city blocks (In area-wide works, project design process takes less time than expected and the prepared projects are in accurate scale and level.), IMP, Bimtaş A.Ş.

Figure 5: An example of surveying and restoration work on the street scale, Istanbul Fatih, Süleymaniye, IMP, Bimtaş A.Ş.

Figure 6: An example of urban design project (surveying and design works) prepared in a protected site which hosts many examples of civil architecture or monumental buildings, İstanbul, Eminönü, IMP, Bimtaş A.Ş.

REFERENCES

[1] Istanbul Metropolitan Municipality, Bimtas Metropolitan Planning Directorate, Site works in various localities between, 2005-2012

[2] H. Karabork, A. Goktepe, H. M. Yilmaz, O. Mutluoglu, F. Yildiz, M. Yakar, "*3D modeling of historical and cultural properties via laser scanning and laser point measuring technologies and sensitivity research in 3d modeling and determination of application model*", Union of Chambers of Turkish Engineers and Architects, The Chamber of Survey and Cadastre Engineers, 12th Turkey Surveying Scientific and Technical Congress, 11-15 May 2009, Ankara.

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BAYESIAN NETWORKS FOR SUB-GROUPS OF MULTIPLE SCLEROSIS

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Abstract- *In this study, patients with multiple sclerosis "sub-groups" characteristics in relation to detection of a statistically (SPSS) and are provided in the Bayesian network. The main objective of this study, regarding the appearance of MRI lesions in patients with Multiple Sclerosis information and / or EDSS scores to investigate the possible attack of multiple sclerosis subgroups. Bayesian networks, reflects the level of sub-groups in multiple sclerosis patients. Analyzes were conducted to determine the change of these properties. MR images of the input data is discussed for the MS patients, the sub-groups of MS, "Remitting Relapsing Multiple Sclerosis", "Secondary Progressive Multiple Sclerosis" with their patients' clinical brain MR images, brain stem, and the Upper Cervical Regions of the corpus callosum-periventricular lesions created in the information. Multiple Sclerosis is owned by the input data is created correctly identify disease subgroups of MS patients for the number of lesions in MR images and MR image of the three regions for the year for which the information used in the EDSS score. Of MS is RRMS, SPMS correctly identify sub-groups of the brain with Brain Stem, and upper cervical regions of the corpus callosum-periventricular lesions in these three points for the region and / or EDSS score information can be emphasized by using the Bayesian networks play an important role in the analysis.*

Keywords: Multiple Sclerosis (MS), Relapsing Remitting Multiple Sclerosis (RRMS), Secondary Progressive Multiple Sclerosis (SPMS), Bayesian Network

1. INTRODUCTION

In order to make the interaction between mathematics and multiple sclerosis more understandable and smooth, researchers are trying design smart interfaces. These interfaces are Magnetic Resonance Imaging (MRI), Expanded Disability Status Scale (EDSS), and Cerebrospinal Fluid; with the help of these interfaces the diagnosis of the disease could be achieved. By using the Magnetic Resonance images and lesion numbers, after assessing their magnitudes, with EDSS scale, the limit of the patient's movements in its life can be determined.

In this study, two sub-groups among Clinical Progress Types of the disease Multiple Sclerosis have been examined;

Relapsing Remitting Multiple Sclerosis (RRMS): This group composes 25 percent of the MS patients. Generally, it looks like the benign type at the initial phase, full recovery follows subsequently. The full or half recovery period following acute attacks exists. However, after repeating attacks several sequels could remain. These attacks can last for days, weeks or months. During the transitions between attacks no progression of the disease happens [1, 2-6].

Secondary Progressive Multiple Sclerosis (SPMS): The emergence of this type is much like the Relapsing Remitting MS type. The early phase lasts 5 or 6 years, after the early phase, the disease goes through secondary progressive period. Succeeding the attacks and healing period, while the number of attacks declines and healing is relatively slow, impairment becomes much worse [1, 2-6].

Extended Disability Status Scale

Extended Disability Status Scale (EDSS) relies on the estimations of eight zones, also known as functional system, of the Central Nervous System. This scale, at the beginning, measures how severe the trouble is in the systems, such as temporary numbness at the face and fingers or visual impairment. Afterwards, by checking the walking

distance of the patient interdependence during mobility is measured [5, 6].

Magnetic Resonance Imaging (MRI)

Magnetic Resonance Imaging (MRI) is a priceless way, as it displays the distribution, magnitude and number of lesions created by Multiple Sclerosis disease in the brain and spinal cord and also documents their alteration in time. The history of the disease, the results of neurological examination and MR images are secure indicators for Multiple Sclerosis disease.

In situations that include cases about Multiple Sclerosis and cases related with Multiple Sclerosis, the essence of MR images is indispensible. Magnetic Resonance is a sensitive examination in determining lesions; however, in order to make the final diagnosis, there are some other criteria that need to be made use of. While diagnosing Multiple Sclerosis according to McDonald Criteria, in different parts of demyelinating lesions' nervous system, to present that they are formed in different times (features known as time, brain and spinal cord), the value of Magnetic Resonance is stressed [1, 4, 5].

In this study, early prevention strategy for Alzheimer's disease and mild cognitive (mental) disorder (MCI) for the diagnosis of MR images of the patients and clinical / cognitive variables in a Bayesian network is proposed that combines data between. To do this, MMSE (mini-mental state examination), ADL (activities of daily living), CDR (Clinical Dementia Rating scale), ANT (Attention Network Test) and STM (short-term memory test) tests, the 25 MCI patients with pre-selected. Then, MCI patients with 25 of these MR images were obtained. MR images and clinical / cognitive function variables are combined by using Bayesian network. For analyze, 17 variables were selected: age, sex, education, degree, CDR score, MMSE score, ADL score, ANT score, STM score, left / right thalamus, left / right perirhinal and MCI function variable. As a result of the analyze, Mainly MCI was found to depend on the hippocampus, thalamus, and entorhinal [7]. In this study, 8 of the 64 repeated 314 volunteer patients' auditory brainstem responses (ABRSM) and 128 repeated 155 auditory brainstem responses (ABRSM) were used. A wavelet transform applied to the values of all ABR ABR wavelet coefficients of the most important properties have been obtained, these features are obtained subsequently inserted and ABR classification is made variable Bayesian network. Afterwards, each record by the audiologist results "have reacted" and "no response" in the form of training and assessments for later re-classified and is more than the number of ABR could be used for the analysis of data to [8]. In this study, for the pursuit of human weariness noise, light, temperature, humidity, sleep time, employment status, age, sleep disturbance, food availability, workload, work with variables such as type of Bayesian network analysis is created and fatigue as a result of physiological, environmental, and physical several factors have effect [9]. In this study, Bayesian network and Markov Random Field (MRF) image segmentation algorithm effectively controlled by combining models is presented. Training with Bayesian network learned the conditional probability density function of a set of data for each pixel the probability map was constructed. MRF model proposed by minimizing the energy function is a logical segmentation is obtained. In this algorithm, the GE Signa 1.5T MRI, 26 patients viewer carotid endarterectomy (CEA) is used for the MR images were obtained. Multi - contrast MR images was used. As a result, to increase the accuracy of the result of segmentation intensity concluded that combining the morphological information [10]. In this study, Bayesian network and Markov Random Field (MRF) image segmentation algorithm effectively controlled by combining models is presented. Training with Bayesian network learned the conditional probability density function of a set of data for each pixel the probability map was constructed. MRF model proposed by minimizing the energy function is a logical segmentation is obtained. In this algorithm, the GE Signa 1.5T MRI, 26 patients viewer carotid endarterectomy (CEA) is used for the MR images were obtained. Multi - contrast MR images was used. As a result, to increase the accuracy of the result of segmentation intensity concluded that combining the morphological information [11]. In this study, human multiple sclerosis (MS) which are critical for the development of autoimmune diseases, T-cell activation gene controls were made to model the network. For this purpose the quantitative-based network for the genes of 104 patients was 20 the immune system. As a result, complex diseases and quantitative network approach in medicine for the discovery of new therapeutic approaches can be regarded as a useful tool. In particular, the Jagged1-Notch way is a good candidate for use in the treatment of MS and sensitivity [12]. In this study, serum PSA Turkey Logistic Regression and Bayesian networks in order to improve the accuracy of diagnosis is made with the application of the two methods were compared. In this study, 983 patients with prostate cancer, demographic data, laboratory data, and pathology reports were examined. As a result, the logistic regression model to predict prostate cancer tumor based on Bayesian network model, we concluded that the better results [13]. Artificial intelligence paradigms, shows the possible relationships between them. Different from the final relationship between seemingly unrelated variables, which visually represents the Bayesian network model to create an artificial intelligence

paradigm, scalp and sleep electroencephalography, mild neurologic signs, dexamethasone suppression, thyrotrophic-releasing hormone stimulation tests consecutive 20 patients with BPD can be obtained on the data collected. Bayesian network model, detects the relationships between many variables. Most of the variables that affect the EEG and TSH others are especially the sleep parameters. Mild neurological signs, EEG, TSH, and sleep parameters connected. The results in the future to strengthen the validity of diagnostic criteria and nosological characterization of the BPD suggest the possibility of using objective neurobiological variables [14]. Sepsis is a serious medical condition caused by the irregularity of the immune system against infection. The early diagnosis of sepsis symptoms, the more severe phases of the disease is important to prevent the progression of this disease destroys one-fourth of the effects. The patient's electronic health records in 1492, 233 cases of sepsis, sepsis gauge cluster analysis was used to describe the features and Bayesian inference can be used to develop a network. Bayesian network, systemic inflammatory response syndrome criteria, mean arterial pressure, lactate levels in patients with sepsis are configured using. The resulting network is a close relationship between lactate levels and sepsis revealed. In addition, lactate levels, SIRS criteria can be shown to the authenticator. In light of this, patients with sepsis, Bayesian networks, the future held the promise of providing a clinical decision support system [15].

2. MATERIALS AND METHOD

2.1 Bayesian Network Model

Bayesian networks are graphical models that present information by using probabilistic calculations in order to reason and decide during elusive times. Bayesian networks are composed of structures that show conditional dependencies between variables and this structure is in the form of directed acyclic graph (DAG) [16,17]. In directed acyclic graph, (DAG) $\mathcal{G} = (V(\mathcal{G}), E(\mathcal{G}))$, the set of random variables in the model is denoted by $V(\mathcal{G})$ and the set of arcs is denoted by $E(\mathcal{G})$ [18]. In the graph, nodes represent the variables and the arcs represent the conditional dependence relations between variables. The direction of the arcs does not always marks a cause-effect relation. If there are two nodes in the graph connected with an arc, the node at the beginning of the arc is the parent node and the node in the end is the child node.

In Bayesian network X = $\{X_1, X_2, \ldots, X_n\}$ are the set of variables, each X_i node (i=1,2,…,n) has a conditional probability distribution, when they are associated with their parents, $P(X_i \mid X_{pa(i)})$. For X_i variable $P(X_i)$ indicates the prior probability and

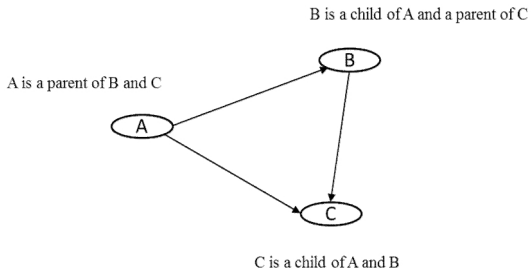

Figure 1. A sample of DAG structure describing conditional dependencies between three nodes

$P(X_i \mid X_{pa(i)})$ indicates the conditional probability of X_i when $X_{pa(i)}$ parent variable/s are given. If X_i does not have a parent, then there is a marginal probability distribution $P(X_i)$. Conditional probabilities express the strength of relationship between variables and these probabilities are shown on tables named conditional probability table [18]. In this way, for every state of child node, according to the state of parent nodes, it is likely to detect conditional probabilities. With multiplication of conditional probability distributions in Bayesian networks the joint probability distribution of all profanities in the network is calculated [17];

$$P(X) = P(X_1, X_2, \ldots, X_n) = \prod_{i=1}^{n} P(X_i \mid \text{Parents} X_i) \quad (1)$$

Bayesian networks could be created in different forms like causal network that presents cause-effect relations between variables and networks that shows only the conditional probability relations between variables without stating the cause-effect relation. In this study, Bayesian network in which there is no cause-effect relation between variables from the data will be formed.

2.2 Kruskal – Wallis Test

(One-way ANOVA) Kruskal-Wallis test, which is the non-parametric alternative of one-way variance analyses among groups, examines if there is a significant difference between groups by comparing independent k number groups' data of interdependent variables. In this test, while comparing the values belonging to the groups, median values are used not mean values. In Kruskal Wallis test hypothesis are created like the following forms;

H_0: k numbers of groups' medians are equal.

H_1: median value of at least one of the groups is different.

In Kruskal – Wallis test, when H_0 hypothesis is rejected, one of the methods used in order to detect, which group or groups' median values are different,

is multiple comparison method. In multiple comparison method [19];

n : universe sample unit number,

n_j : sample unit number of the group j., (j = 1, 2, …, k)

$\bar{R}_j$: Average sequence order of the group j. the data value that is put in a successive order in the analyses.

u : the repetition number of the repetitive values in and among the sample.

As it appears; ($i \neq j$ ve i, j = 1, 2, …, k);

$$|\bar{R}_i \quad \bar{R}_j| > Z_{\alpha/2}\sqrt{\frac{[n(n^2-1)-(\Sigma u^3 - \Sigma u)]\left[\frac{1}{n_i}+\frac{1}{n_j}\right]}{12(n-1)}} \qquad (2)$$

If we get inequality, that means in group i. and j. the means are different. In a universe with k number of groups, $\frac{k(k-1)}{2}$ number of dual samples are examined, as a result, it is determined if median values of groups have significant difference from each other or not.

2.3 MS Data for Bayesian Network

In our study, Neurology and Radiology, Hacettepe University Faculty of Medicine, Magnetic Resonance Imaging in the center of primary followed by the McDonald criteria in patients with clinically definite multiple sclerosis, between the ages of 20 and 55, RRMS, SPMS and 19 individuals (not MS) with 114 patients as a control group without any history of drug use with the complaint and decide whether the MR image is given as a result of 19 healthy subjects were patients with Multiple Sclerosis. Degrees of disability in MS patients Disability Status Scale (EDSS) respectively, MRI 1.5-Tesla (T) power (Magnetom, Siemens Medical Systems, Erlangen, Germany, Intera Achieva, Philips, Netherlands, or GE Healthcare, Milwaukee, Wisconsin, USA), withdrew from the MR devices. Is gained from outside the Hacettepe Hospital magnetic resonance imagines compact discs (CDs) through PACS (Picture Archiving and Communication System-Picture Archiving and Communications System) are loaded. The lesions on T2-weighted turbo spin-echo (TSE) sequences using the millimeter (mm) were counted in metric units. The brain stem, corpus callosum-periventricular region, including the upper cervical spine lesions in the three regions is included in the information. Magnetic Resonance Imaging read for three regions (MRI) lesion in the years to the information changes (number of increments / reductions in size) were compared, according to the EDSS scores of years, changes within the clinical diagnostics compared with Multiple Sclerosis. Duration of the disease observed in patients with Multiple Sclerosis 1. 2. MR of films are a minimum of three years, a maximum of 8 years of 2.MR 3.MR are with.

In data set, when patients are diagnosed Normal (not an MS patient), existence of RRMS and SPMS diagnosis is "1" and in their non-existence, "0" stands for that. For example, if a patient is diagnosed with RRMS, the codification is; Normal=0, RRMS=1, SPMS=0. The score of EDSS and the number of lesions are categorized into four groups in Table 1 [20]. There is no one with missing data in our data set. The state of variables in data set and their prior probability are presented in the table below;

Table 1. Prior Probability Table

Nodes	State	Prior Probability
Normal	0 (no)	86%
	1 (yes)	14%
RRMS	0 (no)	43%
	1 (yes)	57%
SPMS	0 (no)	71%
	1 (yes)	29%
EDSS	0	14%
	$0 < \cdots \leq 4.5$	53%
	$4.5 < \cdots < 7.5$	29%
	≥ 7.5	4%
Number of Lesions	0	14%
	$0 < \cdots \leq 7$	21%
	$7 < \cdots < 15$	18%
	≥ 15	47%

The EDSS quantifies disability in eight Functional Systems (FS) and allows neurologists to assign a Functional System Score (FSS) in each of these are shown in Table 2 [21];

3. METHODOLOGY & RESULTS

In order to learn Bayesian network from our data set Microsoft program WinMine Toolkit is made use of. This software separated coincidentally our training and test set proportionally, the former is 70% and the latter is 30%. In this way, the data set composed of 133 subjects is divided into two groups, 93 subjects in training set and 40 in test set. All of the variables in the network are used as input-output variables. Bayesian network belonging to five different variables created by using WinMine program is suggested in the figure 2.
In Bayesian network, according to the states of parent variables, it is aimed at predicting the future

Table 2. Description of EDSS Scores

Score	Description
1.0	No disability, minimal signs in one FS
1.5	No disability, minimal signs in more than one FS
2.0	Minimal disability in one FS
2.5	Mild disability in one FS or minimal disability in two FS
3.0	Moderate disability in one FS, or mild disability in three or four FS. No impairment to walking
3.5	Moderate disability in one FS and more than minimal disability in several others. No impairment to walking
4.0	Significant disability but self-sufficient and up and about some 12 hours a day. Able to walk without aid or rest for 500m
4.5	Significant disability but up and about much of the day, able to work a full day, may otherwise have some limitation of full activity or require minimal assistance. Able to walk without aid or rest for 300m
5.0	Disability severe enough to impair full daily activities and ability to work a full day without special provisions. Able to walk without aid or rest for 200m
5.5	Disability severe enough to preclude full daily activities. Able to walk without aid or rest for 100m
6.0	Requires a walking aid - cane, crutch, etc - to walk about 100m with or without resting
6.5	Requires two walking aids - pair of canes, crutches, etc - to walk about 20m without resting
7.0	Unable to walk beyond approximately 5m even with aid. Essentially restricted to wheelchair; though wheels self in standard wheelchair and transfers alone. Up and about in wheelchair some 12 hours a day
7.5	Unable to take more than a few steps. Restricted to wheelchair and may need aid in transferring. Can wheel self but can not carry on in standard wheelchair for a full day and may require a motorized wheelchair
8.0	Essentially restricted to bed or chair or pushed in wheelchair. May be out of bed itself much of the day. Retains many self-care functions. Generally has effective use of arms
8.5	Essentially restricted to bed much of day. Has some effective use of arms retains some self care functions
9.0	Confined to bed. Can still communicate and eat
9.5	Confined to bed and totally dependent. Unable to communicate effectively or eat/swallow
10.0	Death due to MS [21].

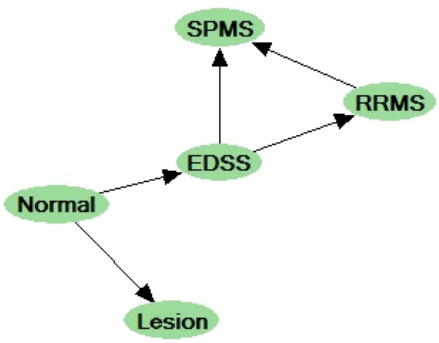

Figure 2. Bayesian Network Model for Multiple Sclerosis Disease

states of variables by calculating the conditional probabilities of them. In the Figure 2, in the Bayesian network attained from the training set, conditional probability relations of between all of the five different variables are demonstrated by pointing all of the possible arcs and their directions.

For example, if we take a look at the Bayesian network in the Figure 2, RRMS node (variable) is associated as the child node of the EDSS node and the parent node of SPMS node by checking their probabilities. The RRMS node cannot be considered as a result of EDSS node, and as the cause of SPMS node. In the Bayesian network we generated, as the normal node does not have a parent node, there are no conditional probabilities of this variable, but the marginal probabilities are acquired. There are conditional probabilities for RRMS and SPMS which are the sub-groups of MS disease, as they have parent nodes. For the normal node attained from Bayesian network presented in the Figure 2, marginal probability table is indicated in Table 3, the conditional probability table for RRMS node is graphed in Table 4, and the conditional probability table for SPMS node is presented in Table 5. In conditional probability tables, according to the state of parent node, the materialization possibilities of child node are presented.

Table 3. The Marginal Probability of Normal

Marginal Probability of Normal = 0	Marginal Probability of Normal = 1
0.86	0.14

Table 4. The Conditional Probability Table of RRMS Given Its Parent EDSS

States of EDSS	Conditional Probability of RRMS = 0	Conditional Probability of RRMS = 1
0	0.95	0.05
$0 < \cdots \leq 4.5$	0.05	0.95
$4.5 < \cdots < 7.5$	0.78	0.22
≥ 7.5	0.86	0.14

From the Bayesian network in Figure 2, materialization possibilities could be posited whether a subject whose EDSS scores are known, have RRMS or not. While there is no information about EDSS scores belonging to patients in Table 1, for the state RRMS=1, the prior probability is calculated as 57%. When we analyze the conditional probability table acquired from the network for the RRMS node, according to our data set, if the interval for the EDSS score which is the parent node of RRMS, is $0 < \cdots \leq 4.5$, RRMS=1 will appear most probably as 95%.

Table 5. The Conditional Probability Table of SPMS Given Its Parents RRMS and EDSS

States of RRMS	States of EDSS	Conditional Probability of SPMS = 0	Conditional Probability of SPMS = 1
0	0	0.95	0.05
0	$0 < \cdots \leq 4.5$	0.2	0.8
0	$4.5 < \cdots < 7.5$	0.03	0.97
0	≥ 7.5	0.14	0.86
1	0	0.5	0.5
1	$0 < \cdots \leq 4.5$	0.99	0.01
1	$4.5 < \cdots < 7.5$	0.9	0.1
1	≥ 7.5	0.5	0.5

When we examine the conditional probability table we get from the generated Bayesian network for the SPMS node, under the states when RRMS=0 is provided (RRMS is one of the parent nodes of SPMS), and if the EDSS score is $\geq$7.5 according to our data set, the possibility of materialization of SPMS=1 state is 86% percent. When the highest materialization possibility of SPMS=1 state occurred 97% percent, happens if RRMS is equal to 0 and the interval for EDSS score is between 4.5<…<7.5.

For lesions and EDSS nodes, conditional probability tables are given in Table 6 and 7;

Table 6. The Conditional Probability Table of EDSS Given Its Parent Normal

States of Normal	Conditional Probability of EDSS = 0	Conditional Probability of EDSS=$0 < \cdots \leq 4.5$	Conditional Probability of EDSS=$4.5 < \cdots < 7.5$	Conditional Probability of EDSS=≥ 7.5
0	0.01	0.61	0.33	0.05
1	0.88	0.04	0.04	0.04

Table 7. The Conditional Probability Table of Lesion Given Its Parent Normal

States of Normal	Conditional Probability of Lesion = 0	Conditional Probability of Lesion=$0 < \cdots \leq 7$	Conditional Probability of Lesion=$7 < \cdots < 15$	Conditional Probability of Lesion=≥ 15
0	0.01	0.25	0.21	0.53
1	0.88	0.04	0.04	0.04

When we analyze the conditional probabilities in our data set from Table 6, for a normal subject who does not have a disease, the probability of getting 0 EDSS score is 0.88 and for not a normal subject, 0.61 is the probability which states when the EDSS score is $0 < \cdots \leq 4.5$.

When we examine the conditional probabilities belonging to lesion node in Table 7, according to data set, a normal person does not have lesion proportionally 0.88 and if we take a look at the lesion distributions of the MS patients, 53 percent of the patients' lesion numbers is over 15.

When we study Table 4, 5, 6 and 7, for a person whose EDSS scores are known, if we analyze the variances where the normal, RRMS and SPMS variables' probability of materialization is maximum, a normal subject will get 0 EDSS score with a 0.88 possibility, if a subject's EDSS score is between $0 < \cdots \leq 4.5$, the possibility of being diagnosed as RRMS is 0.95, if the EDSS score is between $4.5 < \cdots < 7.5$, and if the person is not an RRMS patient, the diagnosis will be 0.97 possibility, SPMS. On this basis, between people

not having MS disease and people diagnosed with the sub-groups of MS disease (RRMS, SPMS), the EDSS score differs and as the progression of the disease increases, the EDSS score again raises. We can also examine the scores we evaluated according to the conditional probability tables, by applying the Kruskal-Wallis Test, which is a statistical test. For this test, people who are not MS patients and people who are diagnosed with RRMS, SPMS are categorized, and whether these diagnoses differ or not according to their EDSS scores. Diagnosis variable are divided into three categories as subjects not having MS disease as first group, RRMS patients in the second group and SPMS patients in the third group, where the scale is nominal. The EDSS score is an ordinal scale variable categorized as it is used in Bayesian network. The hypothesis belonging to the test are given below;

H_0 = Normal, RRMS, SPMS diagnosis and EDSS scores are independent of each other. (Medians of the groups are equal.)

H_1 = Normal, RRMS, SPMS diagnosis and EDSS scores are not independent from each other. (On group median at least is different than the other group medians.)

This analysis is implemented in SPSS program according to 1% confidence level, and the acquired values are presented in the Table 8.

Table 8. MS diagnosis and Kruskal-Wallis analyses results for EDSS score

Test Statistics[a,b]	
	EDSS
Chi-Square	105,448
Df	2
Asymp. Sig.	,000
a. Kruskal Wallis Test	
b. Grouping Variable: diagnosis	

At the end of the analyses, the Asymp. Sig. value appears to be 0.00 and it is smaller that 0.01 Alfa value. For this reason H_0 hypothesis is denied and with 99% probability, the diagnosis of different subjects showed a statistically significant difference in terms of their EDSS scores. For that reason, in order to determine which groups' median values are different, the values below are found by applying multiple comparison technique;

$\bar{R}_1 = 10 \qquad \bar{R}_2 = 60{,}74 \qquad \bar{R}_3 = 108{,}03$

$|\bar{R}_1 - \bar{R}_2| = 50{,}74 > 23{,}85$

$|\bar{R}_1 - \bar{R}_3| = 98{,}03 > 25{,}5$

$|\bar{R}_2 - \bar{R}_3| = 47{,}29 > 18{,}03$

As inequalities are provided in multiple comparisons conducted between groups, medians of these three groups vary from each other and according to the diagnosis EDSS scores become different. Here, the sequence order means belonging to the groups ($\bar{R}_j$) give an idea about whose EDSS scores are bigger according to the diagnosis of the subjects. It could be stated that as the categories belonging to EDSS scores are codified within 1 and 4, the group with a higher sequence number will have higher EDSS scores. For the diagnosis of MS disease and EDSS score, the results we got after applying Kruskal Wallis test, and the Bayesian network we generated from those test results we acquired from conditional probability table, are supporting each other.

In WinMine software we used to generate Bayesian network we learn from the MS data, the estimation accuracy of the model learnt via test set is evaluated by making use of log score, which is a quantitative criteria. In this program log posterior probabilities are calculated for every output variable value ($\log_2 p(x_i|\text{model})$ and the average of log posteriors are reported as log score in all instances about each variable [22]. In order to indicate the number of variables in model n and the number of instances in test set N, log score formula is explained below [23];

$$\text{Log Score}\,(x_1, \ldots, x_N) = \frac{\sum_{i=1}^{N} \log_2 p(x_i|\text{model})}{nN} \qquad (3)$$

The log score of the model that we generated is -0.2693. When we convert this value into probability, the log score is ($2^{\log \text{score}}$) 0.83. With the Bayesian network model that we generated with the MS disease data, in the predictions we made on the test groups, the true prediction point is 0.83. In WinMine program it is possible to see the difference between provided model and marginal model. The difference between log scores of the two models is called lift over marginal [22]. That the Lift over marginal is positive shows that the model we provided in the test set is superior than the marginal model. The lift over marginal of the model we composed is 0.5422. The log score of the marginal model is obtained from the equation (-0.2693) – (marginal model log score) = 0.5422 is -0.8115. When we convert this value into probability, it is calculated as ($2^{(-0.8115)}$) 0.57. This proves that the estimation accuracy of the of the provided model in the test group is (0.83) and it is superior than the marginal model (0.57).

4. CONCLUSION

In our study, the relation between the diagnosis for the patients from Bayesian network which is composed of MS data and EDSS scores and lesion numbers were got probabilistic notice clearly as conditional dependency relations and in test set belonging to our data set, the conditional probability values between Bayesian network generated from our data set with the 0.83 point estimated accuracy rate, and EDSS scores and the MS diagnosis of persons are obtained. These values

are compared the values that shows statistically significant differences, according to MS diagnosis of persons with EDSS scores which is acquired as a result of the multiple comparison by denying the H_0 hypothesis on Kruskal – Wallis test that is another statistical test we applied in out data set. In the end, the analyses consequences in both methods used in MS data showed parallelism.

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REFERENCES

[1] R. Karabudak, N. Işık, A. Siva, Multiple Sklerozda Tanı ve Tedavi Kılavuzu, Bilimsel Tıp Yayınevi, 2009, pp. 5-20.

[2] B. Kaymakamzade, Progresif başlangıçlı Multiple Skleroz hastalarında aksonal hasar belirteçlerinin klinik ve beyin omurilik sıvısı özellikleri temelinde değerlendirilmesi, Yüksel Lisans Tezi, Hacettepe Üniversitesi, 2011.

[3] J. Gilroy, Basic Neurology, 3 rd Edition, The McGraw-Hill Companies, USA, 2000.

[4] R. Karabudak, MS ile Yaşamak, Aşina Kitaplar, Ankara, Türkiye, 2006.

[5] R. Karabudak, A. Siva, A. Altıntaş, D.Y. Kuşcu, Olgularla Multiple Skleroz, Bilimsel Tıp Yayınevi, Ankara, Türkiye, 2011.

[6] M. Gaspari, G. Roveda, C. Scandellari, S. Stecchi, An expert system for the evaluation of EDSS in multiple sclerosis, Technical Report, Bologna University, 2001. Available at http://www.ms-gateway.gen.tr/msi-anlamak/ms-tanx131sx131/edss-nedir 73.htm.

[7] Y. Sun, S. Lv, Y. Tang, Construction and application of Bayesian network in early diagnosis of alzheimer disease's system, in: International Conference on Complex Medical Engineering, 2007, pp. 924-929.

[8] R. Zhang, G. McAllister, B. Scotney, S. McClean, Member, IEEE, G. Houston, Combining Wavelet analysis and Bayesian networks for the classification of auditory brainstem response, IEEE Transactions on Information Technology in Biomedicine 10 (3) (2006) 458-467.

[9] P. Lan, Q. Ji, C.G. Looney, Information fusion with Bayesian networks for monitoring human fatigue, in: Proceedings of The Fifth International Conference on Information Fusion, 2002, pp. 535-542.

[10] A. Meloni, A. Ripoli, V. Positano, Member, IEEE, L. Landini, Mutual information preconditioning improves structure learning of Bayesian networks from medical databases, IEEE Transactions on Information Technology in Biomedicine 13 (6) (2009) 984-989.

[11] F. Liu, D. Xu, C. Yuan, W. Kerwin, Image segmentation based on Bayesıan network-Markov random field model and its application to *in vivo* plaque composition, in: 3rd IEEE International Symposium on Biomedical Imaging, 2006, pp. 141-144.

[12] R. Palacios, J. Goni, I.M. Forero, J. Iranzo, J. Sepulcre, I. Melero, P. Villoslada, A network analysis of the human T-Cell activation gene network identifies jagged1 as a therapeutic target for autoimmune diseases, PLoS ONE 2 (11) (2007).

[13] S. Bozkurt, A. Uyar, K.H. Gülkesen, Comparison of Bayesian network and binary logistic regression methods for prediction of prostate cancer, in: 4th International Conference on Biomedical Engineering and Informatics (BMEI), 2011, pp. 1689-1691.

[14] J.M. De la Fuente, E. Bengoetxea, F. Navarro, J. Bobes, R.D. Alarcon, Interconnection between biological abnormalities in borderline personality disorder: Use of the Bayesian networks model, Psychiatry Research 186 (2-3) (2011) 315-319.

[15] E. Gultepe, H. Nguyen, T. Albertson, I. Tagkopoulos, A Bayesian network for early diagnosis of sepsis patients: a basis for a clinical decision support system, in: IEEE 2nd International Conference on Computational Advances in Bio and medical Sciences, 2012, pp. 1-5.

[16] J. Pearl, Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference, Morgan and Kaufmann, San Francisco, CA, 1988.

[17] D. Heckerman, A Tutorial on Learning Bayesian Networks, Technical Report, Microsoft Research, 1995.

[18] N. Friedman, M. Goldszmidt, Learning Bayesian networks with local structure, Cambridge, MA, 1999, pp. 421-459.

[19] P. Sprent, N.C. Smeeton, Applied Nonparametric Statistical Methods, Champman & Hall, 2001.

[20] Y. Karaca, Multiple Skleroz hastalığının ve alt gruplarının belirlenmesi için optimum bir matematiksel modelin oluşturulması, Doktora Tezi, Marmara Üniversitesi, Fen Bilimleri Enstitüsü, 2012.

[21] Multiple Sclerosis Trust, Expanded Disability Status Scale (EDSS). Available at http://www.mstrust.org.uk/atoz/edss.jsp.

[22] WinMine Toolkit Tutorial. Available at http://research.microsoft.com/en-us/um/people/dmax/WinMine/Tutorial/Tutorial.html.

[23] E.N. Cinicioğlu, P.P. Shenoy, A new heuristic for learning Bayesian networks from limited datasets: a real – time recommendation system application with RFID system in Grocery Stores, Annals of Operations Research, 2012, 1-21.

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ON THE FUZZY CONDITIONAL SEQUENCE LOCAL ENTROPY FUNCTION

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Abstract- *In this work,we first recall some basic properties of the fuzzy conditional sequence entropy function without going into details.After that,we define the fuzzy conditional sequence local entropy function.Lastly,we prove some important results relating to this function.*

Keywords: *Fuzzy dynamical system, fuzzy complete system,conditional entropy function, fuzzy sequence entropy function,fuzzy conditional sequence entropy function,fuzzy local entropy function,fuzzy conditional sequence local entropy function.*

1. INTRODUCTION

Hulse (3) and Zhang (13) first, introduced the concept of conditional sequence entropy function and investigated some properties of this function in the non-fuzzy sense.
The author defined the fuzzy conditional sequence entropy function and stated some important properties of this function in (8).In another its work (10), the author has recently introduced the notion of the fuzzy conditional local entropy function and investigated some important results relating to this function.
It is the purpose of this paper to define the fuzzy conditional sequence local entropy function and show some fundamental results of this function.

2. FUZZY CONDITIONAL SEQUENCE ENTROPY FUNCTION

Let (X,**A**,m,T) be a dynamical system.Where (X,**A**,m) is a Lebesgue space and T : (X,**A**,m) → (X,**A**,m) is an invertible measure-preserving transformation.We shall also refer to (X,T) instead of (X,**A**,m,T) for convenience.For details ,see,(2) and (11).

2.1 Definition.A dynamical system (Y,**B**,m_1,S) is called a factor of the dynamical system (X,**A**,μ,T) if there exists a measure-preserving function φ : X → Y such that for all x∈X, φ(T(x)) = S(φ (x)).Equivalently,we say that (X,**A**,m,T) is an extension of (Y,**B**,m_1,S).

2.2 Definition

Let (Y,S) be a factor of the dynamical system (X,T) and **P** ={p_1,p_2,…,p_n} be a finite measurable partition of (X,T).Then the quantity

$$H_m(P/B)=\sum_{i=1}^{n}\int z(E_m(\chi_{p_i}/B))dm=-\sum_{i=1}^{n}m(p_i/B)\log(m(p_i/B)$$

is called the conditional entropy function of a finite measurable partition **P** with respect to the σ-algebra **B**.Where $E_m(\chi_{p_i}/B)$ is a conditional expectation of the characteristic function χ_{p_i}

defined by $\chi_{p_i}(x)=\begin{cases}1 & if\ x\in p_i\\ 0 & if\ x\notin p_i\end{cases}$ for i = 1,…,n ,m(p_i / B) is conditional measure of p_i with respect to the σ-algebra **B** defined by

$$m(p_i/B)=\frac{m(p_i\cap B)}{m(B)}$$

for i = 1,…,n ,with m(B) > 0 and z : [0,∞) → R defined by

$$z(x)=\begin{cases}-x\log x & if\ \ x>0\\ 0 & if\ \ x=0\end{cases}$$

is a non-negative,continuous and strictly concave function.In this work,all logarithms will be to the natural base ″ e ″.For more properties of the conditional expectation, see,(1) (2) and (11).

2.3 Proposition

Let (Y,S) be a factor of the dynamical system (X,T) and **P** and **Q** be two finite measurable partitions of (X,T) with H_m (**P/B**) < ∞ and H_m (**Q/B**) < ∞ .Then,

(**i**) H_m (**P / B**) ≥ 0.

(**ii**) If **P** ⊂ **B**,then H_m (**P / B**) = 0.

(**iii**) If **B** = { X,ϕ },then H_m (**P/ B**) = H_m(**P**). Where H_m(**P**) is an entropy function of the finite measurable partition **P** defined by

$H_m(P) = \sum_{i=1}^{n} z(m(p_i))$ .For details,see,(1) and (11).

(**ıv**) If **P** ⊂ **Q**,then H_m (**P/ B**) ≤ H_m (**Q/B**).

(**v**) H_m (**P/ B**) ≤ H_m (**P**).

(**vı**) H_m (**P** ∨ **Q/ B**) = H_m (**P/ B**) + H_m (**Q/ P** ∨ **B**).

(**vıı**) H_m(**P** ∨ **Q/ B**) ≤ H_m (**P/ B**) + H_m (**Q/ B**).For measurable partitions with finite conditional entropy equality holds if and only if **P** and **Q** are independent

i.e. m(**P** ∩ **Q**) = m(**P**) . m(**Q**).

(**vıı**) If T is a measure-preserving transformation,then H_m (T^{-1}**P**/T^{-1}**B**) = H_m (**P/ B**).

Proof. See,(1) and (11).

2.4 Definition

Following Zadeh (12),a pair (X,**F**) is called a fuzzy set.Where X is an arbitrary non-empty set and A : X → [0,1] is a membership function.That is,a fuzzy set is characterized by a membership function A from X to the closed unit interval I = [0,1].Thus,

we can identify a fuzzy set with its membership function A.In this connection,A(x) is interpreted as the degree of membership of a point x∈X.The family of all fuzzy sub sets is called a fuzzy class and will be denoted by **F.**This family F is called a fuzzy class**.** For details,see,(5) and (12).

Let **(X,F**,μ) be a fuzzy probability measure space.Where X is a fuzzy set, **F** is a fuzzy σ-algebra **F** defined on the a fuzzy set X and μ is a fuzzy probability measure defined on the fuzzy measurable space **(X,F)**.The elements of **F** are fuzzy measurable events.For more properties of the fuzzy probability measure space **(X,F**,μ) ,see ,(5) and (6).

2.5 Definition

Let **(X,F**,μ) be a fuzzy probability measure space.

(i) The collection **P** = { $A_1,\ldots,A_n$}of fuzzy sub sets is called disjoint,if $(\bigvee_{i=1}^{j} A_i) \wedge A_{j+1} = \phi$ for each j = 1,2,…,n-1.

(**ii**) A collection **P** = { $A_1,\ldots,A_n$ } of disjoint fuzzy sub sets is called a finite fuzzy partition if and only if $X = \bigvee_{i=1}^{n} A_i$.

(**iii**) A collection **P** = { $A_1,\ldots,A_n$ }with A_i ∈ **F** for i = 1,2,…,n-1 is called a complete system of fuzzy events if and only if **P** is a fuzzy partition of X.

(**ıv**) Let **P** and **Q** be two fuzzy complete systems.Then,**P** and **Q** are independent

if and only if μ(**P . Q**) = μ (**P**) . μ (**Q**). Where **P . Q** is a fuzzy product of **P** and **Q** defined by (**P . Q**) (x) = **P**(x) . **Q**(x) for all x ∈ X.For details, see,(5),(6) and (12).

2.6 Definition

Let (X,**F**,μ) be a fuzzy probability measure space.The mapping

T : (X,**F,** μ) → (X,**F,** μ) is called a σ-homomorphism if it satisfies the following properties;

(**i**) $T(\overline{A}) = \overline{T(A)}$ for every A ∈ **F**.

(**ii**) $T(\bigvee_n A_n) = \bigvee_n T(A_n)$ for any fuzzy sequence

$(A_n)_{n\in N} \subset$ **F**.

(**iii**) μ(TA) = μ(A) for each A ∈ **F.**

The quadruple (X,**F**,μ,T) is called a fuzzy dynamical system.One will write briefly (X,T) instead of (X,**F,**μ,T) for convenience.For more properties of the fuzzy dynamical system,see,(4) and (6)

2.7 Theorem

Suppose that the dynamical system (Y,S) is a factor of the dynamical system (X,T).Let **P** be a finite fuzzy complete system of the fuzzy dynamical system (X,T) with H_μ(**P**/ $\mathbf{F}_1$) < ∞ and let

$D = (t_n)_{n\geq 1}$ be a sequence of integers with $t_1 = 0$.Then $\lim_{n\to\infty} \sup \frac{1}{n} H_\mu(\bigvee_{i=1}^{n} T^{t_i} P / F_1)$ exists.

Proof. See ,Theorem 3.4 of (8).

2.8 Definition

Let (Y,S) be a factor of the dynamical system (X,T) and **P** be a finite fuzzy complete system of (X,T) with H_μ (**P**/ $\mathbf{F}_1$) < ∞ and let $D = (t_n)_{n\geq 1}$ be a sequence of integers with $t_1 = 0$.Then the limit function

$$h_{\mu,f,D}(T, P / F_1) = \lim_{n\to\infty} \sup \frac{1}{n} H_\mu(\bigvee_{i=1}^{n} T^{t_i} P / F_1)$$

is called the fuzzy conditional sequence entropy function of finite fuzzy complete system **P** with respect to the fuzzy σ-algebra $\mathbf{F}_1$.

2.9 Proposition

Suppose that the dynamical system (Y,S) is a factor of the dynamical system (X,T).Let **P** , **Q** be two finite fuzzy complete systems of (X,T) with H_μ (**P**/ $\mathbf{F}_1$) < ∞ and H_μ (**Q**/ $\mathbf{F}_1$) < ∞ and $D = (t_n)_{n\geq 1}$ be a sequence of integers with $t_1 = 0$.Then,

(i) $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) ≤ $h_{\mu,f,D}$ (T,**P**).Where $h_{\mu,f,D}(T;P) = \lim_{n\to\infty}\sup \frac{1}{n} H_\mu(\bigvee_{i=1}^{n} T^{t_i} P)$ is called the fuzzy sequence entropy function of T with respect to the finite complete system **P** with H_μ (**P**) < ∞.(For details See,(7)).

(ii) If **P** ⊂ **Q**,then $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) ≤ $h_{\mu,f,D}$ (T,**Q**/ $\mathbf{F}_1$).
(iii) $h_{\mu,f,D}$ (T,**P** ∨ **Q**/ $\mathbf{F}_1$) ≤ $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) + $h_{\mu,f,D}$ (T,**Q**/ $\mathbf{F}_1$).For finite fuzzy complete systems with finite fuzzy conditional entropies equality holds if and only if **P** and **Q** are independent.

Proof. See ,Proposition 3.7 of (8).

2.10 Proposition

Suppose that the fuzzy dynamical system (Y,S) is a factor of the fuzzy dynamical system (X,T).Let **P** be a finite complete system of (X,T) with H_μ (**P**/ $\mathbf{F}_1$) < ∞ and let $D = (t_n)_{n\geq 1}$ be a sequence of integers with $t_1 = 0$.Then,
(i) $h_{\mu,f,D}$ (T,**P** / $\mathbf{F}_1$) ≥ 0.

(ii) If **P** ⊂ $\mathbf{F}_1$,then $h_{\mu,f,D}$ (T,**P** / $\mathbf{F}_1$) = 0.

(iii) If $\mathbf{F}_1$ = { X,ϕ },then $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) = $h_{\mu,f,D}$(T,**P**).

(ıv) If T is a fuzzy probability measure-preserving σ-homomorphism ,then

$h_{\mu,f,D}$ (T,T^{-1}**P**/T^{-1} $\mathbf{F}_1$) = $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$).

Proof . **(i)**,**(ii)** and **(iii)** follow easily from Definition 2.2 and Proposition 2.3 (i),(ii) and (iii). **(ıv)** If T is a fuzzy probability measure-preserving σ-homomorphism, we have from the Proposition 2.3 (vIII)

H_μ (T^{-1}**P**/T^{-1} $\mathbf{F}_1$) = H_μ (**P**/ $\mathbf{F}_1$) (2.1).Therefore, we can also write the following equality;

$$H_\mu(\bigvee_{i=1}^{n} T^{t_i}(T^{-1}P / T^{-1}F_1)) = H_\mu(\bigvee_{i=1}^{n} T^{t_i} P / F_1)$$

(2.2).

Dividing the equality (2.2) by n > 0 and taking the superior limit for n → ∞ , we obtain the result from the Theorem 2.7 and Definition 2.8;

$h_{\mu,f,D}$ (T,T^{-1}**P**/T^{-1} $\mathbf{F}_1$) = $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) (2.3)

2.11 Definition

Let (Y,S) be a factor of fuzzy dynamical system (X,T) and let **P** be a fuzzy finite complete system of (X,T) with H_μ (**P**/ $\mathbf{F}_1$)<∞.We cosider $D = (t_n)_{n\geq 1}$ a sequence of integers with $t_1 = 0$.Then the quantity $h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) = {$h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) : **P** is a finite fuzzy complete system of X with H_μ(**P**/ $\mathbf{F}_1$) < ∞} is called the fuzzy conditional sequence entropy function of the fuzzy dynamical system (X,T).Where the supremum is taken over all finite fuzzy complete systems with the finite fuzzy conditional entropies.

2.12 Proposition

(i) $h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) ≥ 0.

(ii) If **P** is a σ-sub algebra of $\mathbf{F}_1$,then $h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) = 0.

(iii) If $\mathbf{F}_1$ = { X,ϕ },then $h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) = $h_{\mu,f,D}$ (T).

Where $h_{\mu,f,D}$ (T) = { $h_{\mu,f,D}$ (T,**P**) : **P** is a finite fuzzy complete system of X with H_μ (**P**)<∞ }
is a fuzzy sequence entropy function of the fuzzy dynamical system (X,T).For details See, (7)
(ıv) $h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) ≤ $h_{\mu,f,D}$ (T).

Proof . **(i)**,**(ii)** **(iii)** and **(ıv)** follow easily from Proposition 2.9 (i),(ii) , Proposition 2.10 (i),(ii) and (iii) and Definition 2.11.

2.13 Proposition. Let (Y,S) be a factor of the fuzzy dynamical system (X,T) and

D = $(t_n)_{n\geq 1}$ be a sequence of integers with t_1 = 0.Then $h_{\mu_1,f,D}(S/F_1) \leq h_{\mu,f.D}(T/F_1)$.

Proof. Let φ be a fuzzy probability measure

preserving function.If **Q** is finite fuzzy complete system of (Y,S) with $H_{\mu_1}(Q/F_1) < \infty$,then φ^{-1}**Q** is a finite fuzzy complete system of (X,T) with H_μ (φ^{-1}**Q**/ $\mathbf{F}_1$) < ∞.

Then,it is easy to see that

$$\varphi^{-1}(\overset{n}{\underset{i=1}{V}} S^{t_i}Q) = \overset{n}{\underset{i=1}{V}}(\varphi^{t_i}Q) \quad (2.4).$$

Therefore.we can also write the following equality,

$$H_\mu(\varphi^{-1}(\overset{n}{\underset{i=1}{V}} S^{t_i}Q)/F_1) = H_\mu(\overset{n}{\underset{i=1}{V}} T^{t_i}(\varphi^{-1}Q/F_1)$$
(2.5).

Dividing the equality 2.5 by n>0 and taking the superior limit for n → ∞,we obtain the following equalities from the Theorem 2.7 and Definition 2.8;

$h_{\mu,f,D}$ (φ^{-1}S,**Q**/ $\mathbf{F}_1$) = $h_{\mu,f,D}$ (T,φ^{-1}**Q**/ $\mathbf{F}_1$) (2.6) and also

$$h_{\varphi o\mu,f,D}(S,Q/F_1) = h_{\mu_1,f,D}(S,Q/F_1) = h_{\mu,f,D}(T,\varphi^{-1}Q/F_1)$$
(2.7).

Hence,we have from the Definition 2.11,

$$h_{\mu_1,f,D}(S/F_1) = \sup_Q\{h_{\mu_1,f,D}(S,Q/F_1) : Q \text{ is a finite fuzzy complete system of } Y \text{ with } H_{\mu_1}(Q/F_1) < \infty\}$$

by the Equality 2.7

= $\sup_{\varphi^{-1}Q}$ {$h_{\mu,f,D}$ (T,φ^{-1}**Q**/ $\mathbf{F}_1$):φ^{-1}**Q** is a finite fuzzy complete system of X with H_μ (φ^{-1}**Q**/ $\mathbf{F}_1$)<∞}

by the Proposition 2.9 (iii)

≤ $\sup_P$ { $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) : **P** is a finite fuzzy complete system of X with H_μ (**P**/ $\mathbf{F}_1$)<∞ }(2.8) yazılır.

Therefore the result follows from the Definition 2.

$h_{\mu_1,f,D}$ (S/ $\mathbf{F}_1$) ≤ $h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) (2.9).

3. FUZZY CONDITIONAL SEQUENCE LOCAL ENTROPY FUNCTION

3.1 Definition. Let (Y,S) be a factor of the fuzzy dynamical system (X,T) and let **P** be a finite fuzzy complete system of (X,T) with H_μ (**P**/ $\mathbf{F}_1$)<∞ and D = $(t_n)_{n\geq 1}$ be a sequence of integers with t_1 = 0. Then,the quantity $L_{\mu,f,D}$ (T/ $\mathbf{F}_1$) = $h_{\mu,f,D}$(T/ $\mathbf{F}_1$) - $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$)

is called the fuzzy conditional sequence local entropy function.

3.2 Proposition. (**i**) $L_{\mu,f,D}$ (T/ $\mathbf{F}_1$) ≥ 0.

(**ii**) If **P** ⊂ $\mathbf{F}_1$,then $L_{\mu,f,D}$(T/ $\mathbf{F}_1$) = 0.

(**iii**) If $\mathbf{F}_1$ = {X,ϕ},then $L_{\mu,f,D}$ (T/ $\mathbf{F}_1$) = $L_{\mu,f,D}$ (T).Where $L_{\mu,f,D}$ (T) = $h_{\mu,f,D}$ (T) - $h_{\mu,f,D}$ (T,**P**)

is a fuzzy sequence local entropy function.For details,see,(9).

(**ıv**) $L_{\mu,f,D}$ (T/ $\mathbf{F}_1$) ≤ $L_{\mu,f,D}$ (T).

Proof .(**i**) This follows from the Proposition 2.10 (**i**),Proposition 2.12 (**i**) and Definition 3.1.

(**ii**) If **P** ⊂ $\mathbf{F}_1$,then we write the following equalities from the Proposition 2.10(**ii**) Proposition 2.12 (**ii**) and Definition 3.1,

$h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) = 0 (3.1) and $h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) = 0 (3.2).

Hence,we obtain the result from the Defnition 3.1,

$L_{\mu,f,D}$ (T/ $\mathbf{F}_1$) = 0 (3.3).

(**iii**) If $\mathbf{F}_1$ = { X,ϕ },we write the following equalities from the Proposition 2.10 (**iii**) and

Proposition 2.12 (**iii**),

$h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) = $h_{\mu,f,D}$ (T,**P**) (3.4) and $h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) = $h_{\mu,f,D}$(T) (3.5).

Therefore, we can also write the following equality;

$h_{\mu,f,D}$ (T/ $\mathbf{F}_1$) - $h_{\mu,f,D}$ (T,**P**/ $\mathbf{F}_1$) = $h_{\mu,f,D}$ (T) - $h_{\mu,f,D}$ (T,**P**) (3.6).

Hence, the result follows from the Definition 3.1,

$L_{\mu,f,D}$ (T/ **F**$_1$) = $L_{\mu,f,D}$ (T) (3.7).

(**ıv**) Let **P** be a finite fuzzy complete system of (X,T) with H_μ (**P**/ **F**$_1$)<∞ .Then,we have from the Proposition 2.9 (**i**) and Proposition 2.12 (**ıv**),

$h_{\mu,f,D}$ (T,**P**/ **F**$_1$) ≤ $h_{\mu,f,D}$ (T,P) (3.8) and $h_{\mu,f,D}$ (T/ **F**$_1$) ≤ $h_{\mu,f,D}$ (T) (3.9)

Therefore, we write the following equality;

$h_{\mu,f,D}$ (T/ **F**$_1$) - $h_{\mu,f,D}$ (T,**P**/ **F**$_1$) ≤ $h_{\mu,f,D}$ (T) - $h_{\mu,f,D}$ (T,**P**) (3.10).

Hence,we obtain the result from the Defnition 3.1, $L_{\mu,f,D}$ (T/ **F**$_1$) ≤ $L_{\mu,f,D}$ (T) (3.11).

3.3 Proposition. We consider that (Y,S) is a factor of fuzzy dynamical system (X,T).Let **P** be a a finite fuzzy complete system of (X,T) with H_μ(**P**/ **F**$_1$) < ∞ and **Q** be a finite fuzzy complete system of (Y,S) with $H_{\mu_1}(Q/F_1) < \infty$ and D = $(t_n)_{n\geq 1}$ be a sequence of integers with

t_1 = 0.Then,

$$L_{\mu_1,f,D}(S/F_1) \leq L_{\mu,f,D}(T/F_1) + h_{\mu,f,D}(T,P/F_1) - h_{\mu_1,f,D}(S,Q/F_1)$$

Proof. If (Y,S) is a factor of fuzzy dynamical system (X,T),then we have the following inequality from the Proposition 2.13,

$$h_{\mu_1,f,D}(S/F_1) \leq h_{\mu,f,D}(T/F_1) \qquad (3.12)$$

Let **P** be a finite fuzzy complete system of (X,T) with H_μ (**P**/**F**$_1$) < ∞.

Since $h_{\mu,f,D}$(T,**P**/**F**$_1$) ≥ 0,from the Proposition 2.10 (i),we can write the following inequality,

$$h_{\mu_1,f,D}(S/F_1) - h_{\mu,f,D}(T,P/F_1) \leq h_{\mu,f,D}(T/F_1) - h_{\mu,f,D}(T,P/F_1) \qquad (3.13)$$

Therefore,we obtain from the Definition 3.1,

$$h_{\mu_1,f,D}(S/F_1) \leq L_{\mu,f,D}(T/F_1) + h_{\mu,f,D}(T,P/F_1) \qquad (3.14)$$

Let **Q** be a finite fuzzy complete system of (Y,S) with $H_{\mu_1}(Q/F_1) < \infty$.

As $h_{\mu_1,f,D}(S,Q/F_1) \geq 0$,from the Propsition 2.10 (i),we can also write the following inequlity;

$$h_{\mu,f,D_1}(S/F_1) - h_{\mu_1,f,D}(S,Q/F_1) \leq L_{\mu,f,D}(T/F_1) + h_{\mu,f,D}(T,P/F_1) - h_{\mu_1,f,D}(S,Q/F_1) \qquad (3.15)$$

Hence, the result follows from the Definition 3.1,

$$L_{\mu,f,D}(S/F_1) \leq L_{\mu,f,D}(T/F_1) + h_{\mu,f,D}(T,P/F_1) - h_{\mu_1,f,D}(S,Q/F_1) \qquad (3.16)$$

4. REFERENCES

[1]Billingsley P.,Ergodic theory and information,Wiley,New York,1965
[2]CohnD.,L.,Measure theory,Birchauser, Boston, 1980.
[3]Hulse P.,Sequence entropy relative to an invariant σ-algebra,J. London Math.Soc. (2),59-72, 1986.
[4] Kloeden P.,E., Fuzzy dynamical systems,Fuzzy Sets and Systems,7,275-296,1982.
[5] Tok I.,On the fuzzy measure space,E.,U.,J., Sci.,Fac.Series A,VIII,No:1,89-100,1985.
[6] Tok I.,Entropy of fuzzy dynamical systems ,E.,U.,J., Sci.,Fac.Series A,VIII,No:1,101-109,1985.
[7] Tok I.,On the fuzzy sequence entropy function,Conference D.A.D. II,Int.Math.Polish Acad.Sci.,Varsavo,1995.
[8] Tok I., On the fuzzy conditional sequence entropy function,İstanbul Univ. Fac.Sci. J. Math.54,1995.
[9] Tok I., On the fuzzy sequence local entropy function,İstanbul Aydın Üniv.Fen Bil.Derg.,1,2009.
[10] Tok I.,Bulanık koşullu yerel entropi fonksiyonu üzerine,9.Ulusal Mat.Semp.K.T.Ü. Fatih,Eğitim.Fak.,2010.
[11] Walters P.,An introduction to ergodic theory,Springer-Verlag,New York,1982.
[12] Zadeh L.,A.,Fuzzy sets,Inform.Control,8,338-353,1965.
[13] Zhang Q. , Conditional entropy and mild mixing extension,Can. J. Math. 45,No:2,429-448, 1993.

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AN ANALYSIS OF THE FISH POPULATIONS BY USING ANN AND WAVELET TECHNIQUES

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Abstract- *Air – sea climate, environmental and biological conditions show various differences on several spatio-temporal scales. Climate change associated with anthropogenic activity and natural global multi-decadal climate variations effects on air-sea interactions and water surface–atmosphere–biosphere climate system. In the first part of this paper is related with Artificial Neuro Network analyses for prediction of fish stocks in Marmara and Black Sea. The second part of this study is based on wavelet analyses and, the results were compared with former wavelet and harmonic analyses to explain seasonal effects of NAO and ENSO on fish population. The influence of climatic oscillations (based on NAO and ENSO) on monthly catch rates of fish population such as sea bass, Atlantic bonito,blue fish sea (pomatomus population between 1991-2012) in Black Sea and Marmara have been analyzed by discrete wavelet transform (DWT) with Meyer and Daubechie's. Wavelet analysis is an efficient method of time series analysis to study non-stationary data. Wavelet analyses allowed us to quantify both the pattern of variability in the time series and non-stationary associations between fish population and climatic signals. Phase analyses were carried out to investigate dependency between the two signals. We reported strong relations between fish stock and climate series for the 4- and 5-yr periodic modes, i.e. the periodic band of the El Niño Southern Oscillation signal propagation in the Black Sea and Marmara Sea. These associations were non-stationary, evidenced from 1995 to 2012. It is recognized that other factors in small, meso and large scales may modulate fish stocks beginning from 1995 and more clearly from 2005.*

Keywords: *Fish Stocks Management, Climate Signals, ANN, Wavelet Analysis, ENSO, NAO.*

1. INTRODUCTION

In recent years, annual total fish production shows an increasing trend. Climatic effects on fluctuations of fish populations and fisheries have long been recognized and continue to be critical. Understanding these effects is an essential step toward conserving and managing marine resources. The most widely studied climatic forcing impacts on fishes include those at an inter-annual scale, such as El Niño/Southern Oscillation (ENSO), [1-5].

The Japanese eel is a catadromous fish, widely distributed in the western Pacific, from the Philippines in the south, through Taiwan, mainland China, Korea, to Japan in the north. The passive migration from the spawning area to the estuaries of Taiwan takes approximately four to six months [6-11]. While it is speculated that climate variability might have crucial impacts on the Japanese eel recruitment, direct comparisons between the long-

term data for both recruitment and climate are scarce. In this study, they took advantage of the unique long-term (1967–2008) record of glass eels caught in the estuaries of Taiwan [11-13].
The possible influence of particular climate patterns on the annual production may not be stationary, and each climate pattern may affect the recruitment dynamics at a different scale. Therefore used wavelet analyses that require no assumption of stationary and have the ability to determine the dominant modes of variability in frequency and how those modes vary over time. The spectral slope was obtained empirically from the time series data [14-20].
In recent years, increasing ration of fish production causes the important of Artificial neural networks (ANN) analyses [19-27].
The first part of the paper presents some statistical analyses of three regional fish types (levrek: sea bass, lüfer: blue fish and palamut: Atlantic bonite in Marmara and Western Black Sea.

2. DATA AND METHOD

Data for the annual total levrek (sea bass), lüfer (blue fish) and palamut (Atlantic bonite) at Marmara and Western Black Sea have been analyzed by using two different methodologies (Wavelet and Artificial Neuro Network),
To analyze the role of climate changing on the fish-stock related from 1991-2012 were compiled from monthly reports in the Turkish Fisheries Yearbook.

2.1. ANN

Artificial neural networks (ANN) detect patterns too complex to be recognized by humans and can be applied to breast mass malignancy classification when evaluating.
Feed-forward Configuration
Another step in understanding of ANN dynamics was made with introduction and analysis of a perceptron, a simple neural network consisting of input layer, output layer, and possibly one or more intermediate layers of neurons.
Once the input layer neurons are clamped to their values, the evolving starts. And, layer by layer, the neurons determine their output. This ANN configuration is often called *feed-forward* because of this feature. The dependence of output values on input values is quite complex and includes all synaptic weights and thresholds. Usually this dependence does not have a meaningful analytic expression. However, this is not necessary: there are *learning* algorithms that, given the inputs, adjust the weights to produce the required output.
So, simply put, we created a thing which learns how to recognize certain input patterns. There is a training phase when known patterns are presented to the network and its weights are adjusted to produce required outputs. Then, there is a recognition phase when the weights are fixed, the patterns are again presented to the network and it recalls the outputs Figs. 2.1 and 2.2).

2.1. Wavelet

The fundamental idea behind wavelets is to analyze according to scale. Indeed, some researchers in the wavelet field feel that, by using wavelets, one is adopting a whole new mindset or perspective in processing data. It has a very wide spread application from medicine to industry.

3. ANALYSES

Time series analyses of Sea Bass, Blue Fish and Atlantic bonito are presented here in this study. Later on 2002, monthly total Sea Bass population and their variation are presented, (Figs. 3.1-3.4).
Annual variation and linear trends of annual total sea bass population are given as below:

3.2. Analyses of Fish Population by using Wavelet Techniques- Annual Total Sea Bass Production

Low level (high frequency) fluctuations increases beginning from 2005 (approx. data number 160). In the second part of the study period, large, meso and small scale fluctuations are all higher than the values observed in the first term.
The first signal on sea bass population is recorded in 1995. Meso scale fluctuations observed every two year periods (blue, at point 160; in 1995) effect increasing ratio of sea bass population. Large scale effects (60 months, half decadal) and 4 months (seasonal) periodicity, have been observed at the second term of the study period on sea bass population. These factors result in important increasing ratio on fish population.

Important role of large scale fluctuations on blue fish production is more clear on this graph, in the second part of period.

Atlantic Bonito:

Blue fish:

3.3. Analyses of Fish Population by using ANN

This part of the study covers, analyses of ANN based on fish production.

4. Conclusion and discussion

This study is some applications of wavelet and ANN to estimation of fish production in Marmara

and West Black sea region. Large scale evens are associated with increasing of annual fish production in study area. The next study will consider ANN analyses of wavelet outputs.

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References

[1] Aslan,Z, G. Erdemir and A. Tokgozlu, "Analyses of Climate Change Impacts on Wind Speed and Energy Potential by Using ANN", ICIAM, 17-21 July, Vancover, Canada. 2011.

[2] Botsford LW, Castilla JC, Peterson CH The management of fisheries and marine ecosystems. Science 277: 509–515. 1997.

[3] Coifman, R. R. and Donoho, D. L.: Translation-invariant denoising, Wavelets and Statistics, Springer Lecture Notes in Statistics 103, pp. 125-150, Springer-Verlag, 1995.

[4] Coifman, R. R. and Donoho, D. L.: Translation-invariant denoising, Wavelets and Statistics, Springer Lecture Notes in Statistics 103, pp. 125-150, Springer-Verlag, 1995.

[5] Durif CMF, Gjosaeter J, Vollestad LA Influence of oceanic factors on *Anguilla anguilla* (L.) over the twentieth century in coastal habitats of the Skagerrak, southern Norway. Proceedings of the Royal Society B: Biological Sciences 278: 464–473, 2010.

[6] Gutierrez J.C., Silva C., Yaez E., Rodriguez N., Pulido I., Monthly catch forecasting of anchovy engraulis ringens in the north area of Chile: Nonlinear univariate approach, *Fisheries Research*, vol. 86, pages 188-200, 2007.

[7] Hsieh CH, Reiss CS, Hunter JR, Beddington JR, May RM, et al. (2006) Fishing elevates variability in the abundance of exploited species. Nature 443: 859–862.

[8] Jury, Mark R., Physical Oceanographic Influences on Central Benguela Fish Catch , Earth Interact., 16, 1–15.,2012.

[9] Kahramaner,Y.Genç Demiriz,G.Özdemir, Z.Aslan , "Implementation of Wavelets to Detection of Fish Population"The Fifth Symposium on Wavelet Application to the World Problems, 7-8 June 2010, Istanbul,Turkey.

[10] Kahramaner,Y.Genç Demiriz,G.Özdemir, Z.Aslan , "Implementation of Wavelets to Detection of Fish Population" Aydın Üniversitesi Fen Bilimleri Dergisi,Sayı I, (52-659, 2011.

[11] Kahramaner Y., Karaca,Y..,Özdemir,G. Effects of Atmospheric Parameters on Fish Population: Part I, Agriculture and Food Safety within the Context of European Union Directive Semposium,14 - 15 July 2005.

[12] Kuo-Wei Lan and Ming-An Lee Climatic and marine environmental variations associated with fishing conditions of tuna species in the Indian Ocean, Department of Environmental Biology and Fisheries Science, National Taiwan Ocean University International Workshop on Climate and Ocean Fisheries, 2011.

[13] Lehodey P, Alheit J, Barange M, Baumgartner T, Beaugrand G, et al. Climate variability, fish, and fisheries. Journal of Climate 19: 5009–5030. 2006.

[14] Marcogliese LA, Casselman JM Long-term trends in size and abundance of juvenile American eel (*Anguilla rostrata*) in the St. Lawrence River. American Fisheries Society Symposium 58: 197–206, 2009.

[15] Maria Jose Juan-Jorda, John A. Barth, M. E. Clarke, W. W. Wakefield, Ground fish Species Associations With Distinct Oceanographic Habitats in the Northern California Current, Fisheries Oceanography, Volume 18 Issue 1, Pages 1-19, 2 Sept 2008

[16]Menard,F.,Marsac,F.,BellierE.,CAzelles,B.,Climatic oscillations and tuna catch rates in the Indian Ocean: a wavelet approach to time series analysis, Fisheries Oceonography,Volume 16, Issue 1, pages 95–104, January 2007.

[17] Rouyer T, Fromentin JM, Stenseth NC, Cazelles B Analysing multiple time series and extending significance testing in wavelet analysis. Marine Ecology Progress Series 359: 11–23. 2008.

[18] Serre,D., Matrices: Theory and applications.*New York: Springer-Verlag* , 2002

[19] Tokgözlü A., Özdemir,G.,Kahramaner Y. ile birlikte **" ANN Aplication on Sediment Concentration"**.Thirteenth Annual Conference and First International Conference of Gwalior Academy of Mathematical Sciences(GAMS) with Symposium on Mathematical Modelling in Engineering and Biosciences,Anand Engineering College,Agra,India, January 10-13, 2008.

[20] Tsukamoto K, Chow S, Otake T, Kurogi H, Mochioka N, et alOceanic spawning ecology of freshwater eels in the western North Pacific. Nature Communications 2: 179 ,2011.

[21] T. Rouyer, J.-M. Fromentin, B. CazellesComplex interplays among population dynamics, environmental forcing, and exploitation in fisheries**,** 2008.

[22] Tian Y, Kidokoro H, Fujino T Interannual-decadal variability of demersal fish assemblages in the Tsushima Warm Current region of the Japan Sea: Impacts of climate regime shifts and trawl fisheries with implications for ecosystem-based management. Fisheries Research 112: 140–153,2011.

[23] Thomas Brune,R.,Jean Bouche Long-term trends in fish recruitment in the north-east Atlantic related to climate change, Fisheries Oceanography, Vol. 16, No. 4. pp. 336-349, 2007.

[24] Percival, D. and Walden, A.: Wavelet Methods for Time Series Analysis, Cambridge University Press, Cambridge UK, 2000

[25] Pesquet, J.-C., Krim, H. and Carfantan, H.: Time-invariant orthonormal wavelet representations, IEEE Trans. on Signal Processing, vol. 44, no. 8, pp.1964-1970, 1996.

[25] Polanco, J.,Ganzedo, U.,CAballero-Alfonso, A.M., Castro Hernandez, J.J.,Wavelet analysis of correlation among Canary Islands octopus captures per unit effort, sea-surface temperatures and the North Atlantic Oscillation, Fisheries Research, Volume 107, Issues 1–3, January 2011, Pages 177–183.

[26]http://ulcar.uml.edu/~iag/CS/Intro-to-ANN.html (27.9.2012)

[27] Tourre, Y.M., S. E., Lluch-Cotaand W. B. White, (2007): "Global multi-decadal ocean climate and small-pelagic fish population", Environ. Res. Lett. **2** (July-September 2007) 034005, doi:10.1088/1748-9326/2/3/034005

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A DECISION MAKING MODEL FOR SELECTION OF WIND ENERGY PRODUCTION FARMS BASED ON FUZZY ANALYTIC HIERARCHY PROCESS

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Abstract- *The purpose of this paper is to present an evaluation model for the prioritization of wind energy production sites, namely, Mersin, Silifke and Anamur, located in Mediterranean Sea region of Turkey. For this purpose, a fuzzy analytical hierarchy decision making approach based on multi-criteria decision making framework including economic, technical, and environmental criteria was performed. It is found that the results obtained from fuzzy analytical hierarchy process (FAHP) approach, Anamur district is the best area among the alternatives for establishing wind turbines.*

Keywords: *Wind energy, decision making model, fuzzy analytical hierarchy proces*

1. INTRODUCTION

Energy has been recognized as one of the most essential and crucial inputs for social and economic development. Nowadays, the huge demand for energy to facilitate economic growth and social development is largely met with fossil fuels. However, the current energy system is not sustainable due to its significant negative effects on the well-being of humans and ecosystems [1]. Because of the increasing negative effects of fossil fuels on environment, many countries have started to use renewable energy sources. Among the renewable energy sources wind energy being socially, beneficial, economically, competitive and environmentally friendly has become the world's fastest growing and common using renewable energy source for electricity generation. Energy planning using multi-criteria analysis has attracted the attention of decision makers for a long time [2,3]. Analytical hierarchy process, one of the most outstanding multicriteria decision- making (MCDM) approaches, has been used to solve energy problems successfully. In this paper, a hierarchical decision making approach based on multi-criteria decision making framework according to the criteria such as economic, technical, and environmental attributes was presented to prioritize the wind energy production farms. Each criterion was divided into several sub-criteria. The decision making process was applied using an analytical hierarchy process to help decision makers and private investors in determining the most suitable wind production farm in three regions of Turkey, namely Mersin and Anamur located in Mediterranean sea region. In the proposed approach, the opinions of decision makers on the relative importance of the selection criteria were determined by a fuzzy analytic hierarchy process since it is based on pairwise comparisons and allows the utilization of linguistic variables.

2. LITERATURE REVIEW

Large number of wind speed measurements for fuzzy logic system, the dimension of fuzzy rule base is large and it consumes more computational time. Several studies [4-5] have applied using AHP during renewable energy planning. In recent years, some studies [6-7] have concentrated on fuzzy energy planning and fuzzy energy policy making. In references [8-9] a fuzzy model has been suggested for the prediction of wind speed and the produced electrical power at a wind park. Kim and Lee [3] proposed a time-series prediction method using a fuzzy rule-based system. In order to solve the fuzzy logic drawback in non-stationary systems they proposed a method of building fuzzy rules for prediction which utilized the difference of consecutive values in a time series. Damousis et al. [4] presented a new methodological framework of multi-criteria decision making to evaluate renewable energy options in Greece. Zangeneh et al. [5] carried out an assessment and evaluation model for the prioritization of distributed generation technologies, both conventional and renewable energy source. For this aim, a multi-attribute decision making approach was used to assess the alternatives. Cavallaro and Ciraolo [6] proposed a multi-criteria method in order to support the selection and evaluation of one or more of the solutions to make a preliminary assessment regarding the feasibility of installing some wind energy turbines in a site on the island of Salina in Italy. Kaya and Kahraman [7] determined the best renewable energy alternative for Istanbul, Turkey by using an integrated VIKOR-AHP methodology.

3. FUZZY ANALYTIC HIERARCHY PROCESS APPROACH

Strategic planning and management of natural resources has been identified as an important factor in the economic and social development of the countries. The multi-attribute decision making (MADM) approach is one of the most suitable technical aids for strategic planning [3,9]. In this study, the proposed strategy is a hierarchical decision making structure that uses AHP to prioritize preferences for wind production farms according to various criteria. The AHP enables the decision makers to structure a complex problem in the form of a simple hierarchy and to evaluate a large number of quantitative and qualitative factors in a systematic manner under multiple criteria environment in confliction. It is widely used in the literature as one of the major MADM methods for solving a wide variety of problems that involve complex criteria across different levels [7]. Several fuzzy AHP approaches were developed and applied to some industrial problems by researchers [2,4,5].

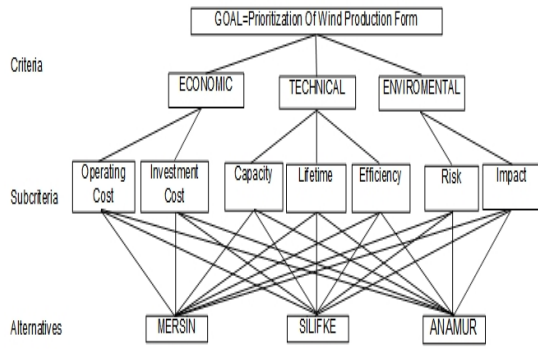

Figure1. The hierarchical structure for the selection of the wind energy production farm

In the present study, the fuzzy AHP was applied to the selection problem for the wind energy production site alternatives in Mediterranean sea region of Turkey. The selection procedure consists of three main steps briefly. Firstly, alternatives and related criteria are determined. Second, alternatives are evaluated by experts in linguistic form. And last, the methodologies are used for the selection procedure by using these evaluations. In our paper,the main and sub-criteria which are obtained by taking into account the above works are given in Figure 1.

Table 1. Fuzzy evaluation scores for the weights

Intensity of relative importance	Definition
1	Equal important
3	Moderately preferred
5	Essentially preferred
7	Very strongly preferred
9	Extremely preferred
2,4,6,8	Intermediate importance between two adjacent judgments

Central to this method is a series of pairwise comparisons, indicating the relative preferences between pairs of decision alternatives in the same hierarchy. The linguistic variables used to make the pairwise comparisons are those associated with the standard 9-unit scale. In this study, all elements have been defined using proposed fuzzy scale as shown in Table 1.

4. SELECTION OF THE MOST APPROPRIATE WIND PRODUCTION FARM USING FAHP

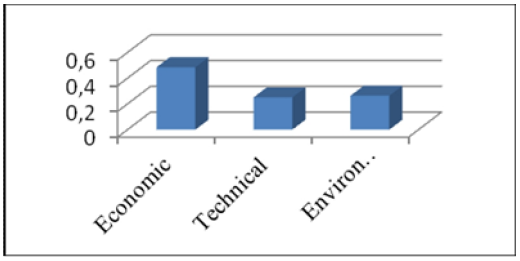

Figure 2. Priority numbers of the main factors for selection the wind production farm

Table 2. The priority numbers of sub- criteria for selection the wind production farm

Main criteria	Sub criteria	Weight
Economic	Investment cost	0,483
	Operating cost	0,517
Environmental	Risk	0,574
	Impact	0,426
Technical	Capacity	0,364
	Lifetime	0,309
	Efficiency	0,327

In this subsection a FAHP approach was applied to determine the most appropriate wind energy production farm for Mediterranean sea region of Turkey. For this aim, a combination of the most frequently used evaluation criteria in the literature were performed. The two level hierarchies composed of 3 main criteria and 7 sub-criteria and 3 alternatives were considered. Main criteria such as economic, technical, and environmental were assigned in first level of the AHP. The importance weights of all criteria were normalized and produced. The comparison of priorities to each criterion was shown in Figure 2.

Among the main criteria, the most important criterion is potential, with a very high benefit priority of 0.485. Nevertheless, the priority number of environmental criteria is almost as high a technical criterion. The priority numbers of sub-criteria were shown in Table 2.
As seen in Table 2, the investment cost and operating cost covered by economic criteria have the highest priority numbers. Sub-factors such as capacity, efficiency and lifetime have the lowest priority number. The comparison of wind energy generation site alternatives to each criterion was shown in Figure 3.
According to the results shown in Figure 3, the best alternative is found to be Anamur. The rank order of the rest is Silifke and Mersin, respectively. In other words, Anamur site must be primary location

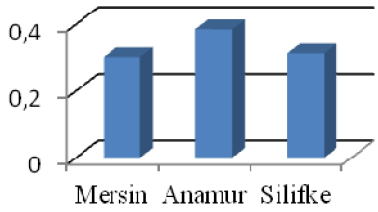

Figure 3. The comparison of wind energy generation

as much as possible for wind energy production in Mediterranean region of Turkey.

5. CONCLUSION

In this study, a hierarchical decision making structure that uses AHP to prioritize preferences for wind production regions according to various criteria named economic, technical, and environmental attributes was suggested. The results of the proposed methodologies show that the best locations for wind generation are Anamur, Silifke and Mersin, respectively. In summary, the proposed FAHP can be used to evaluate various management strategies and thus resources can be effectively deployed to strengthen these aspects of project management. The proposed strategy can also help governments to gain information about the wind energy production regions in the Mediterranean sea of Turkey.

REFERENCES

[1] Jafarian, M. Ranjbar, A.M. (2010). Fuzzy modeling techniques and artificial neural networks to estimate annual energy output of wind turbine. *Renewable Energy* 35, 2008–2014.
[2] Kim, I. Lee, S.H. (1999).A fuzzy time series prediction method based on consecutive values.
In Proceedings of the IEEEinternational fuzzy system conference, Seoul, Korea. 2, 703–707.
[3] Damousis, I.G. Dokopoulos, P. (2001). A fuzzy expert system for the forecasting of wind speed and power generation in wind farms. In: 22nd IEEE Power Engineering Society international conference on power industry computer applications. 63–69.
[4] Damousis, I.G. Alexiadis, M.C. Theocharis, J.B. Dokopoulos, P. (2004). A fuzzy model for wind speed prediction and power generation in wind parks using spatial correlation. *IEEE Transactions on Energy Conversion* 19(2), 352–361.
[5] Zangeneh, A. Jadid, S. Kian, A.R. (2009). A hierarchical decision making model for the prioritization of distributed generation technologies: A case study for Iran, *Energy Policy* 37,752-63.

[6] Cavallaro, F. Ciraolo, L. (2005). A multicriteria approach to evaluate wind energy plants on an Italian island, *Energy Policy* 33, 235–44.
[7] Kaya, T. Kahraman, C. (2010), Multicriteria renewable energy planning using an integrated fuzzy VIKOR & AHP methodology: The case of Istanbul, *Energy* 35, 2517-2527.
[8] Song, Y. D. (2000). A new approach for wind speed prediction, *Wind Engineering* 24(1), 35–47.
[9] Chen, H.H. Kang, Y. Lee, H.I. (2010) Strategic selection of suitable projects or hybrid solar-wind power generation systems, *Renewable and Sustainable Energy Reviews*, 14, 413-421.
[10]. Expert Choice, http://www.expertchoice.com.

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ANALYSIS OF FACTORS IMPACTING LAND USE IN TRANSFORMING ISTANBUL HISTORICAL CITY CENTER

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Abstract- *Istanbul historical city center is going through a provincial transformation by quick population increase, multi-centered city development, developing tourism and trade feature pressures as well as selection of location for housing. Provincial transformation is briefly described as; an action plan integrating with the city and urban people, prepared to increase life quality based on strategic development plan and within the provincial development vision for the non-functional, old and worn provincial pieces unable to fulfill physical, social and economic development dynamics and new requirements. Objective of this study is to find out factors affecting provincial transformation that are observed in research district and positive negative effect ratios based on regression analysis. Research district Sultanahmet and surrounding area located between Divan Yolu Street and Topkapı Palace and Marmara Sea, which is considered among UNESCO Global Heritage Areas, having intensive cultural assets, transforming pursuant to tourism and trade feature pressure, preserving most of its authentic housing texture, worn out as well as observed to be a qualified housing location choice of people with high socio-economic and educational class. It is concluded that the urban transformation resulting from the dynamism in the historical, physical and socioeconomically structure of the space in the research area is weighted with the accommodation and commercial place selections, there are influences of the culture asset structure, some part of the functions being in the place selection and the positive and negative reflections of the quantitative and qualitative characteristics of the focal points on the transformation which is followed on the area and also the land-plot unit price value directs the selections in part.*

Keywords: *Transformation; İstanbul old CBD; land use; regression analysis.*

1. INTRODUCTION

Istanbul having the population of 12 million (TÜİK, 2008) is the biggest city of Turkey as well as the most important socio-economic and cultural center of the country. As a result of multi-directional changes in country's economy and industry in 1950's, a fast rural immigration movement and multi-centered provincial structure as well as a reduction in the population of historical city center and outdating is observed in Istanbul which has become the center of industrialization. İstanbul historical city center is going through a provincial transformation with the developing tourism, trade function pressure and selection of location for housing. Objective of this study is; to identify factors affecting provincial transformation observed in the research area, interrelation of subject factors (field usage structure, cultural asset structure, distances to focus points and land-field unit m^2 prices), determination of positive and negative affect ratios using regression analysis (Figure 1).

Academic and occupational literature is full of provincial renovation/transformation definitions that race with each other. Reason for that are the objectives and scope of provincial transformation has differed under changing political, economic and social conditions in time and among the countries. Therefore, provincial transformation is a dynamic concept [1]. In the context of planning and architecture, "Provincial Transformation" is approached as intervention methods for improvement of existing urban area problems rather than planning and development of new urban areas. In that extent, provincial transformation can be defined as provincial intervention methods planned and implemented for improvement of urban areas that are going through economic, social, physical and environmental breakdown [2].

Just like in the other metropolitan areas around the world, suburbanization, continuous enlargement of the city due to rural immigration after 1950's [3,4,5], Bosporus Bridge and construction of linear roads as well as economic development after

Figure 1: Research area panoramic view of the general

1980's caused partial breakdown of historical city center [6].

Throughout the historical process, most of the medium and high income groups working and living downtown earlier moved to new business centers and residential districts [7] and the changes in their life styles may also affect their choice of housing [8]. In the meantime, old city center started to lose employment and population due to deforming provincial structure. Thus, housing and trade demand and income ratio decreased. Restoration projects supported individually or by government are being implemented in order to stimulate degenerated districts [9]. Main theme of these studies was; to reorganize urban relations according to natural structure and history of the city and to meet the needs by creating employment [10].

The first few studies in terms of provincial transformation examined the effects of reactivation process using different indicators. The common outcomes of these studies were that repair, restoration or reconstruction of worn out buildings increased house possession, changed physical structure and increased real asset prices [11,12,13]. Changes in physical structure as well as reclamation planning and gentrification process resulted in important social structure changes [14,15,16,17]. Zukin [18] defines gentrification as transformation of socially marginal and labor class areas of downtowns to housing of middle class and identifies gentrification as investment capital of private businesses in the business and trade districts of large city centers. Later on; it was observed that new retail sales sector played an important role in bourgeoisification of New York [19].

Sometimes, preserving and reclamation planning results in different effects in terms of social structure and location of a district. Groves and Niner [20] states that reclamation planning without side effects of price inflation and gentrification influence on improving life standards and keeping the market alive for district occupants. Furthermore, Listokin and others [21] claims that preserving has great impacts on housing and economic development. Structural activities such as reclamation planning and reactivation projects supports local economy by creating employment, local sales, tax incomes and a strengthened tax foundation. Additionally, identification of historical areas is now often used as a tool to stop breakdown, wearing out of or reactivate districts located in downtown. In a study conducted by Leichenko and others [22,23] and as verified by Clark [24], regulations in the historical areas increase real estate values.

In addition to all of the above, increasing use of preserving history, redevelopment of districts and reactivation of city centers for cultural heritage tourism plays an important role in provincial economic improvement and society development [25]. In an article published by Chang and others [26], a uniting approach is recommended in terms of "up to down" point of view emphasizing role of global elements and "down to up" point of view

focusing on local impacts. An examination conducted on Montreal and Singapour cities proves that similar macro scale processes lead both cities to recognize cultural heritage tourism as a provincial re-development strategy.

Actual development of the city occurred pursuant to rural immigration after 1950's and increase of İstanbul population rate from 5,5 % to 18,2 % of Turkey's population between 1950 and 2011. As a result of enormous provincial growth and globalization, provincial structure and socio-economic characteristics are continuously evolving. Just like in most metropolitan areas in other countries, old CBD also started deteriorating after 1980's. Various renovation projects were accelerating after late 1990's and the need to increase competitive superiority in the new global order and to create new world city has been the focus of provincial administrations [10].

This study identifies the relation between factors of land use, land unit price, cultural asset infrastructure and distance to focal locations for the provincial transformation observed at historical neighbourhood within the research area; and positive and negative impact ratios by regression analysis. Historical process of provincial transformation in Istanbul is identified in the second part of the article; regression analysis conducted in research is provided in the third section; and evaluations of conducted analysis as well as opinions for the future studies are provided in the last section.

2. PROVINCIAL TRANSFORMATION IN İSTANBUL CBD

As a result of the multi-directional changes occurring in country's economy and industry in 1950's, a fast rural immigration movement started in İstanbul which has become the center of industrialization. Fast population increase in the city negatively impacted historical life quality. Infrastructure and social facilities did not have a parallel development with such speed of growth, and housing production grew without plan and control, and shaped in disorganized pile form. The fast growth of the city, forming of new sub-centers, construction of bridges and highways on Bosphorus, development of some housing areas according to modern planning rules increased life quality difference in different districts of the city which led to great differences between the houses in various districts [6].

Process of industrial spread started in 1960's from city center throughout the highways to surrounding area and the great population increase in Istanbul created difficult problems such as housing, infrastructure and transportation, and there has been differentiating in housing area locations according to income groups. Low income groups preferred to be close to business areas whereas higher income groups preferred to be near cultural center, away from the industry, and reside in prestigious districts. In that period, population increase was directed to outer skirts of city, and the highest population increases observed to be occurring in those areas [27].

Rural immigration and fast urbanization, development of new settlement areas, movement of trade and higher income groups to new residential areas as well as the cultural changes have caused to a loss of interest to old city center Suriçi and particularly Beyoğlu district, even resulting in transformation of some districts into areas of breakdown. Beyoğlu, a reflection of western culture started meeting the cheap housing needs of rural population immigrating to Istanbul, and important changes in both social and location structure have been observed [28].

In the Historical Peninsula where functional and intensity differentiation occurred and housing population decreased in time during 1965 to 1970, no protective resolutions were made agains changes although the old texture diminished quickly. Decrease of population in Eminönü where majority of Historical Peninsula population is accommodated occurred due to spread of urban residents and business areas from center to surrounding area [27].

Spatial spread caused by automobiles in 1970's was also observed in Istanbul; achievement of some companies to international scales increased need for modern office buildings. Factors such as planning restrictions caused by lack of free spaces in historical city center, historical texture characteristics and small parceled structure, historic narrow streets unsuitable for heavy traffic load brought by wheeled vehicles, lack of car parking could not meet developing office needs. Old structures with low standard in old city center could not meet those requirements and thus, city center lost its attraction in the historical development process and an outward expansion from center has been inevitable [6].

In this period, as the residential areas around the center transform to workplaces, historical and cultural continuity, ecological and symbolic characteristics of this area has been ignored, and inconvenient functions loaded on structures with high cultural assets, accelerating wear out. There has been a high rate of abandoned structures in the area due to changes in structure and environmental standards [29].

Historical city center became unable to meet transportation, communication, location, space, etc. needs due to historical texture characteristics and structural wear out, and tendency to abandon has been observed. In addition to the structural characteristics, increase in accessibility around the city by highways, opportunity to provide cheap and

large lands around city, development of communication technologies also played a role in loss of old central business district (CBD) characteristics of historical city structure. Istanbul fully gained function of being a multi-centered metropolitan with the new central business areas and sub-centers [30].

A social and spatial gentrification process occurred in Beyoğlu, constituting part of the historical center pursuant to strengthening of Turkey's international relations and economical development as well as recent formation of a young, professional population of an important size in Istanbul due to the changes around the world and globalization process started in 1980's [7,31]. On the other hand, although there is a great potential of unused structure around historical city center in Eminonu which constitutes the other part of the historical center, no such development has been observed. Reasons for that are accumulation of business and entertainment center outside Historical Peninsula as well as use of residential areas in the close neighborhood of center at Suriçi as bypass for transition to the other areas of city still continues [27]. Some changes have been observed particularly in recent years in Historical Peninsula which has become an important center by trade and administration functions in early 20th century. One of the most important changes was planned removal of industry and small production shops as well as other functions disturbing the area located on Marmara coast line of Ordu and Divanyolu Streets to outer rampart by local administration. Residential use in Sultanahmet, the most touristic area of İstanbul, and the surrounding area is transformed to touristic use by the impacts of those changes as well as change of user by such transform is observed in the area [32].

In the recent years, Istanbul historical city center is going through a provincial transform by the developing tourism and pressure of trade function as well as choice of residential locations. Social and spatial renovation (gentrification) phenomenon is increasing in research area of Sultanahmet and surrounding neighbourhood (Figure 2). In the area, old and authentic works of art are observed to be transforming into accommodation and trade functions (Figure 3,4). In addition to the provincial transform and gentrification observed in the research area, there has been an increase in the non-facilitated buildings and wear out process (Figure 4, 5).

Figure 2: Views of gentrification examples in research area

Figure 3: Views of transformers housing to hotel examples

Figure 4: Views of transformers housing to trade examples

Figure 5: Views of empty building examples

Figure 6: Views of dilapidation examples

3. REGRESSION ANALYSIS

In the scope of study, Sultanahmet centered area is selected in Suriçi (Historical Peninsula of Istanbul), where there is intensive presence of cultural assets require protection, transforming under the pressure of tourism and trade but partially maintaining its authentic housing textures along with such transformation and where people with high education and socio-economic level are observed to be choosing as qualified residential location. Physical marks used as analysis area borders are Divanyolu Street and main pedestrian artery and tramcar road in the North, Marmara Sea and Kennedy Street in the South, Topkapı Palace and Sur-u Sultani in the east and Piyerloti Street in the west are general restrictive lines. The selected area administration covers complete Sultanahmet and Küçük Ayasofya Neighbourhood, the area of Cankuraran Neighbourhood outside Sur-u Sultani and Topkapı Palace and palace functions, however complete Cankurtaran Neighbourhood is evaluated completely as the functions subject to structural examination covers the complete area. 95% of Binbirdirek Neighbourhood is included in the study. 35% of Eminsinan Neighbourhood and 18% of Şehsuvarbey Neighbourhood is within the physical borders, they are evaluated within general land use in the previous section and included in general analysis in regression analysis studies, however they are excluded from detailed neighbourhood analysis due to lack of samples.

In addition to the area based analysis performed in study area, neighbourhood based analysis are also performed as socio-economical structures, physical features differ by location development characteristics of the neighbourhood and such differences impact function preferences. When the provincial transformation in the area is assessed only for physical usage differences other than socio-economic and demographic characteristics, provided that there are more than one variable, each variable is analyzed as dependent variable. In the research area, years 2005-2010-2012 are considered as basis; relations among residential, trade features to include retail business and touristic sales-dining-entertainment locations, selection of location for accommodation facility purposes and land unit m^2 prices dependent variables as well as other independent variables (land utilization structure, cultural asset characteristics, distances to focus locations and land-field unit m^2 prices) are examined individually.

Performed analysis model specifications are evaluated using Durbin-Watson statistics, t, F and Anova tests, and the analysis considered to be meaningful for all functions and areas except for indefinable transformation in selection of business locations in Sultanahmet.

Year 2005 land usage structure developed based on the evaluations conducted in research area is provided in figure 7, year 2010 land usage structure is provided in figure 8 and year 2012 land usage structure is provided in figure 9. Cultural assets having great importance within the scope of research are provided in Figure 10.

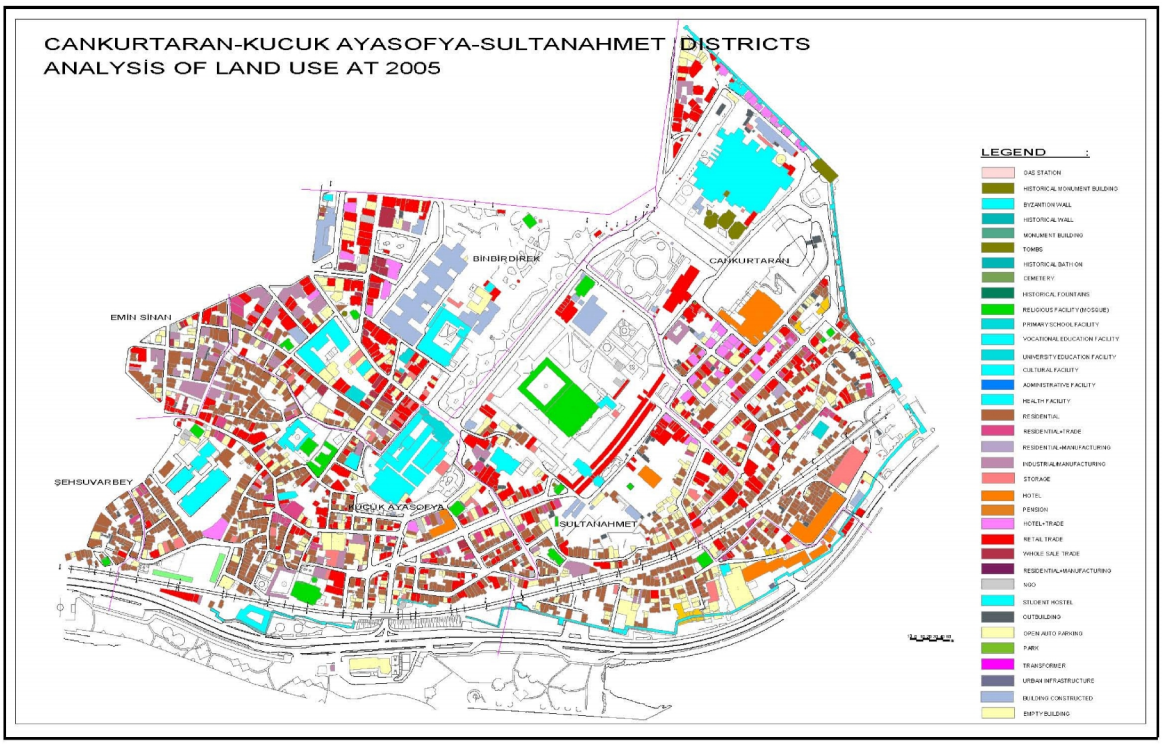

Figure 7: Land use of research area, 2005

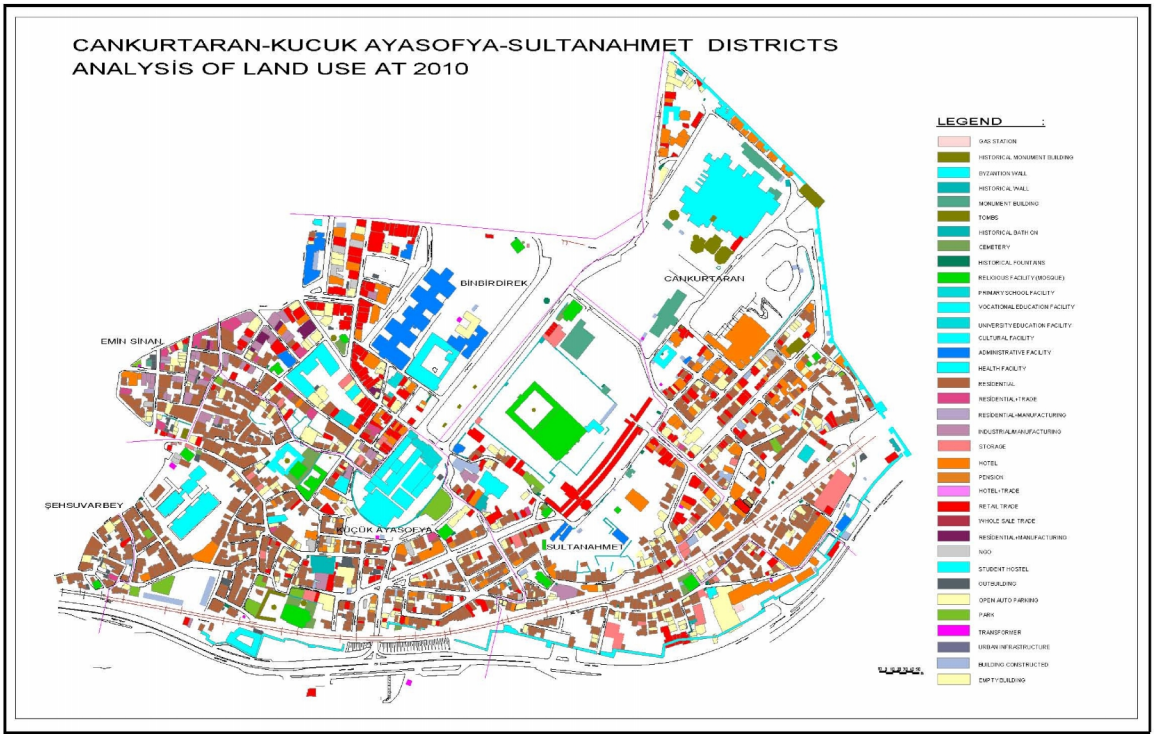

Figure 8: Land use of research area, 2010

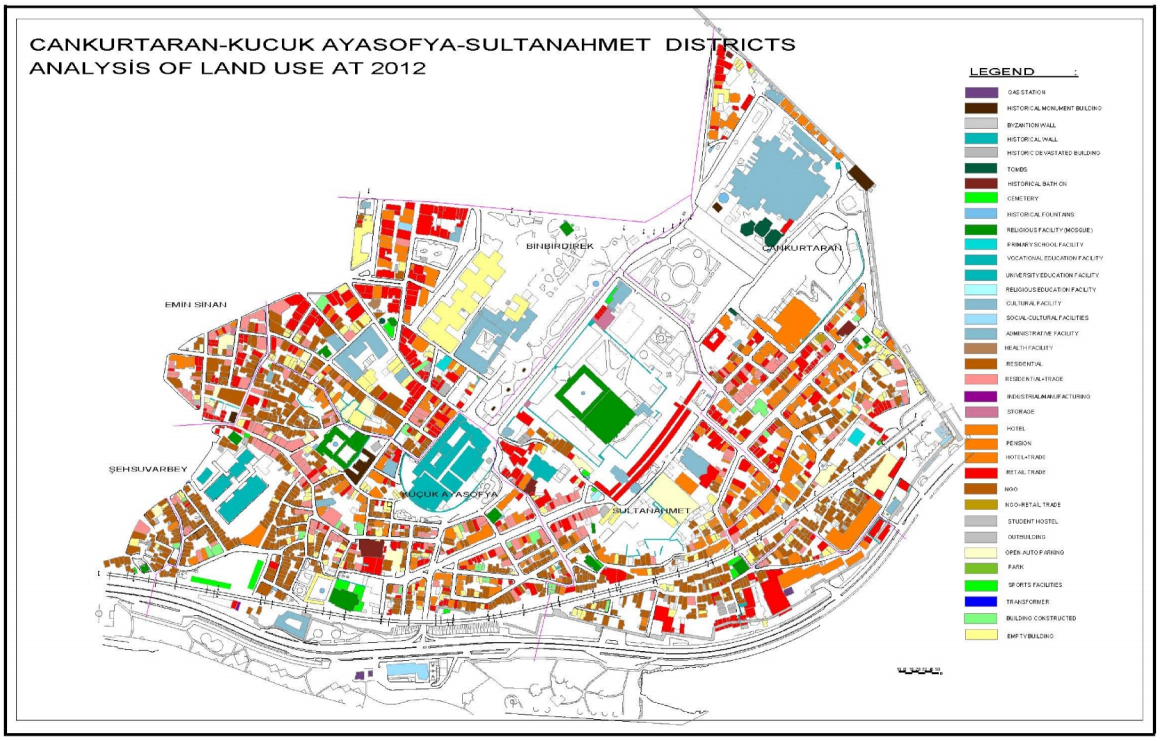

Figure 9: Land use of research area, 2012

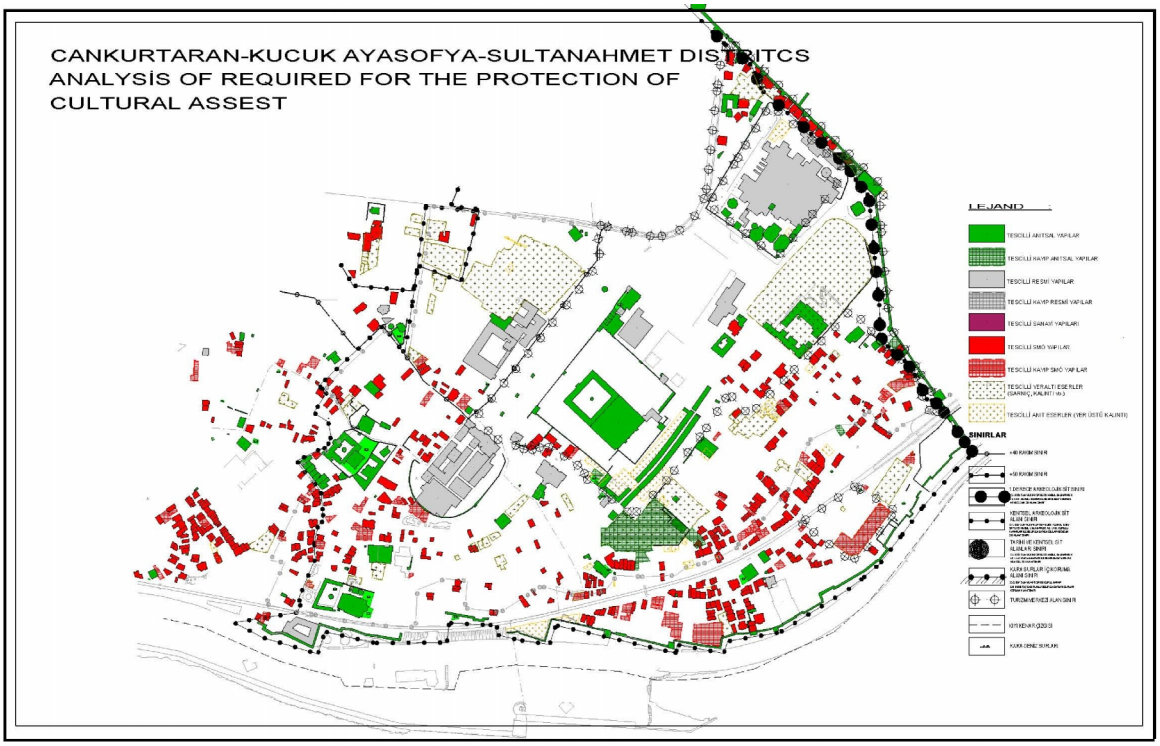

Figure 10: Inventory of cultural property in research area

3.1 Regression analysis for residential location selection

The most effective positive impact variable in the overall area analysis for provincial land usage transformation, residential location selection dependent variables are; the increase in distance of streets to Gülhane Square, civil architecture samples on the streets and presence of buildings under construction, and variables with negative impact are the increase in distance of streets to Hagias Sophia, presence of monumental official structures, hotels and retail business (Table 1). In the detailed neighbourhood analysis;

- Positive impact variable in Binbirdirek Neighbourhood is presence of residences + trade structure on the streets, negative impact variable is land-field unit price value on the streets.
- The most effective positive impact variables in Cankurtaran Neighbourhood are the presence of civil architecture presence on the streets and increase in distance of streets to Topkapı Square, and the negative impact variables are increase in distance of streets to Cankurtaran Square and presence of hotels on the streets.
- Positive impact variable in Küçük Ayasofya Neighbourhood is presence of civil architecture samples and buildings under construction and there is no negative impact variable.
- The most effective positive impact variable in Sultanahmet Neighbourhood is the presence of civil architecture on the streets and there is no negative impact variable (Table 1).

Table 2: Regression coefficients in accommodation (hotel) location selection

	RESEARCH AREA[1]		BİNBİRDİREK NEIGHBORHOOD[2]		CANKURTARAN NEIGHBORHOOD[3]		KÜÇÜK AYASOFYA NEIGHBORHOOD[4]		SULTANAHMET NEIGHBORHOOD[5]	
	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean(sig)
Hotel	-0,147	0,006			-0,339	0,004				
Trade	-0,108	0,035								
TL/m^2			-0,276	0,029						
House+ trade			0,424	0,005						
Construction	0,191	0,000					0,295	0,003		
Cankurtaran Sq..					-0,441	0,000				
Topkapı P.					0,397	0,007				
Ayasofya Sq.	-0,805	0,015								
Gülhane	0,709	0,009								
Civil Architecture	0,431	0,000			0,410	0,000	0,436	0,000	0,759	0,000
Monuments										
Official Monuments	-0,154	0,039								
Lost Civil Architecture									0,178	0,036

([1] Research Area R= 0,667 R^2= 0,445 Adj R=0,413 sig=0,000 F=13,929 Durbin Watson= 2,152)
([2] Binbirdirek R= 0,615 R^2= 0,378 Adj R=0,320 sig=0,000 F=6,528 Durbin Watson= 1,514)
([3] Cankurtaran R= 0,774 R^2= 0,600 Adj R=0,549 sig=0,000 F=11,824 Durbin Watson= 1,954)

([4] Kücük Ayasofya R= 0,592 R^2= 0,351 Adj R=0,317 sig=0,000 F=10,450 Durbin Watson= 2,409)
([5] Sultanahmet R= 0,825 R^2= 0,681 Adj R=0,638 sig=0,000 F=15,878 Durbin Watson= 1,728

3.2 Regression analysis for accommodation (hotel) location selection

In the dependent variable for accommodation location selection within the research area, the most effective positive impact variables are presence of civil architecture samples on the streets, land-field unit price value on the streets and presence of structures under construction, and there is no negative impact variable (Table 2). In the detailed neighbourhood analysis;

- The most effective positive impact variable in Binbirdirek Neighbourhood is presence of outhouses and non-utilized structures, and there is no negative impact variable.
- The most effective positive impact variables in Cankurtaran Neighbourhood are the lost civil architecture samples on the streets, presence of monumental works and land-field unit price on the streets, and there is no negative impact variable.
- The most effective positive impact variables in Küçük Ayasofya Neighbourhood are the structures under construction on the streets, retail sale structure and land-field unit price, and there is no negative impact variable.
- The positive impact variable in Sultanahmet Neighbourhood is the land-field unit price and the negative impact variable is the distance value of streets to Kennedy Street-Coast Road connection (Table 2).

Table 2: Regression coefficients in accommodation (hotel) location selection

	RESEARCH AREA[1]		BİNBİRDİREK NEIGHBORHOOD[2]		CANKURTARAN NEIGHBORHOOD[3]		KÜÇÜK AYASOFYA NEIGHBORHOOD[4]		SULTANAHMET NEIGHBORHOOD[5]	
	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)
Trade							0,222	0,008		
TL/m^2	0,212	0,001			0,188	0,035	0,174	0,018	0,372	0,010
Outbuilding			0,419	0,009						
İnşaat	0,151	0,008					0,524	0,000		
Empty			0,385	0,002						
Coastal road connection									-0,436	0,047
Monuments					0,471	0,000				
Lost Civil Architecture	0,266	0,000			0,532	0,000				

([1] Research Area R= 0,469 R^2= 0,220 Adj R=0,190 sig=0,000 F=7,268 Durbin Watson= 1,794)
([2] Binbirdirek R= 0,606 R^2= 0,367 Adj R=0,324 sig=0,000 F=8,507 Durbin Watson= 1,127)
([3] Cankurtaran R= 0,716 R^2= 0,512 Adj R=0,486 sig=0,000 F=19,935 Durbin Watson= 1,867)
([4] Küçük Ayasofya R= 0,709 R^2= 0,502 Adj R=0,467 sig=0,000 F=14,383 Durbin Watson= 1,898)
([5] Sultanahmet R= 0,669 R^2= 0,447 Adj R=0,385 sig=0,000 F=7,144 Durbin Watson= 1,564

3.3 Regression analysis for retail trade location selection

In the depedent variable for retail business location selection within the research area, the most effective positive impact variables are presence of civil architecture samples and land-field unit price, and negative impact variable is the distance value of streets to At Meydanı (Horse Square) (Table 3). In the detailed neighbourhood analysis, findings are;

- The most effective positive impact variables in Binbirdirek neighbourhood are the presence of outhouses on the streets, lost civil architecture sample presence and land-field unit price, and there is no negative impact variable.
- Positive impact variables in Cankurtaran Neighbourhood are residential + business and civil architecture sample structures, and there is no negative impact variable.
- The most effective positive impact variable in Küçük Ayasofya Neighbourhood is presence of non-utilized building, hotel, pension and resident + trade presence, there is no negative impact variable.
- Effective variables for Sultanahmet Neighbourhood are not identified, and retail business transformation cannot be explained by land usage structure and land-field unit price value, cultural asset structure and distances to certain focus points (Table 3).

Table 3: Regression coefficients in reatil trade location selection

	RESEARCH AREA[1]		BİNBİRDİREK NEIGHBORHOOD[2]		CANKURTARAN NEIGHBORHOOD[3]		KÜÇÜK AYASOFYA NEIGHBORHOOD[4]		SULTANAHMET NEIGHBORHOOD[5]	
	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)
Hotel							0,285	0	meaningless	meaningless
TL/m^2	0,196	0,004	0,283	0,010					meaningless	meaningless
House+ trade					0,275	0,013	0,155	0,048	meaningless	meaningless
Pension							0,224	0,003	meaningless	meaningless
Outbuilding			0,531	0,000					meaningless	meaningless
Empty							0,342	0,000	meaningless	meaningless
At Meydanı Sq.	-0,419	0,055							meaningless	meaningless
Civil Architecture	0,206	0,002			0,235	0,032			meaningless	meaningless
Lost Civil Architecture			0,383	0,043					meaningless	meaningless

([1] Research Area R= 0,466 R^2= 0,217 Adj R=0,184 sig=0,000 F=6,510 Durbin Watson= 1,740)
([2] Binbirdirek R= 0,756 R^2= 0,572 Adj R=0,521 sig=0,000 F=11,225 Durbin Watson= 2,048)
([3] Cankurtaran R= 0,410 R^2= 0,168 Adj R=0,147 sig=0,000 F=7,887 Durbin Watson= 1,459)
([4] Küçük Ayasofya R= 0,687 R^2= 0,471 Adj R=0,440 sig=0,000 F=15,008 Durbin Watson= 1,987)
([5] Sultanahmet R= 0,381 R^2= 0,145 Adj R=0,083 sig=0,067 F=2,333 Durbin Watson= 2,287)

3.4 Regression analysis for land-field price

In the dependent variable for land-field unit price value within the research area, our findings are; the most effective positive impact variables are distance value of streets to Kadırga Square, At Meydanı (Horse Square) and presence of monumental works, structures under construction, hotel and retail business, and the negative impact variable is the increase in distance value of streets to Sultanahmet Tramcar Station and residential structure on the streets (Table 4). In the detailed neighbourhood analysis, findings are;

- The most effective positive impact variable in Binbirdirek Neighbourhood is the monumental works and retail business structure on the streets, and the most effective negative impact variables are the large bulk monumental official structure and residential structure.
- The most effective positive impact variable in Cankurtaran Neighbourhood is the presence of monumental works and structures under construction on the streets, negative impact variables are the increase in distance of streets to Kennedy Street-Coast Road connection and housings on the streets.
- The most effective positive impact variable in Küçük Ayasofya Neighbourhood is presence of hotels; negative impact variables are the increase in distance of streets to Kennedy Street-Coast Road connection and housings on the streets.
- The most effective positive impact variable in Sultanahmet Neighbourhood is presence of hotels and monumental works on the streets, and there is no negative impact variable (Table 4).

Table 4: Land-field price (TL/m^2) regression coefficients

	RESEARCH AREA[1]		BİNBİRDİREK NEIGHBORHOOD[2]		CANKURTARAN NEIGHBORHOOD[3]		KÜÇÜK AYASOFYA NEIGHBORHOOD[4]		SULTANAHMET NEIGHBORHOOD[5]	
	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)	Beta	Mean (sig)
House	-0,135	0,014	-0,321	0,010	-0,209	0,030				
Hotel	0,145	0,006					0,242	0,025	0,496	0,000
Trade	0,121	0,022	0,307	0,010						
Construction	0,196	0,000			0,339	0,000				
At Meydanı Sq.	0,435	0,020								
Sultanahmet Railway	-0,998	0,000								
Kadırga Sq..	0,809	0,000								
Coastal road connection					-0,398	0,000	-0,345	0,005		
Monuments	0,328	0,000	5,319	0,001	0,361	0,001			0,404	0,008
Official monuments			-4,967	0,002						

([1] Research Area R= 0,607 R^2= 0,369 Adj R=0,342 sig=0,000 F=13,723 Durbin Watson= 1,456)
([2] Binbirdirek R= 0,688 R^2= 0,473 Adj R=0,424 sig=0,000 F=9,660 Durbin Watson= 1,054)
([3] Cankurtaran R= 0,656 R^2= 0,430 Adj R=0,392 sig=0,000 F=11,333 Durbin Watson= 1,599)
([4] Küçük Ayasofya R= 0,464 R^2= 0,216 Adj R=0,189 sig=0,000 F=8,115 Durbin Watson= 1,551)
([5] Sultanahmet R= 0,731 R^2= 0,534 Adj R=0,471 sig=0,000 F=8,517 Durbin Watson= 1,126)

3.5 Regression analysis assesment

Our findings are; provincial transformation occurring due to location's historic, physical and socio-economic dynamism of the research area are mostly residential and business location selection based, there are positive and negative reflection impacts of qualitative and quantitative features of certain focus points as well as presence of cultural assets requiring protection and housings in the area, and land-field unit price value also manipulate selections to a certain extent.

In the examination of regression analysis conducted according to the full method where housing location selection dependent variable is selected, it is identified that; presence of civil architecture work is the most effective positive impact variable in overall area and in detail for all districts except for Binbirdirek Neighbourhood, lost civil architecture sample is the effective independent variable only for Sultanahmet Neighbourhood. Increase in land-field unit price value does not have negative impact for residential location selection other than Binbirdirek Neighbourhood. Presence of hotel, increase in trade functions does not have negative impact corresponding to the studies performed on the subject.

Another finding is that use of retail trade has low negative impact on residential location selection in overall area whereas its not effective in detailed district analysis, spread of trade business on ground floors is not effective in overall area whereas it has positive impact in Binbirdirek Neighbourhood, and increase in construction functions has impact in overall area and Küçük Ayasofya Neighbourhood having a low physical quality. Variables gaining importance in the increase of distance to certain focus points are not important on district basis whereas it becomes significant in positive and negative impacts for changing focus preferences.

In the examination of regression analysis conducted according to the full method where accommodation location selection dependent variable is selected, it is identified that; presence of lost civil architecture is the most effective independent variable in overall area, and in cankurtaran District along with the presence of monumental works. It is identified that land-field unit price value increase is effective for accommodation location selection in overall area as well as Cankurtaran, Küçük Ayasofya and Sultanahmet Neighbourhoods where accommodation transformation occurs rapidly. Increase in construction functions has low impact in overall area whereas it has a high impact in Küçük Ayasofya Neighbourhood having a low physical quality parallel with residential location selection, outhouse and non-utilized structure presence in Binbirdirek Neighbourhood where physical development is limited is another finding expected to be significant. Increase in distances to certain focus points does not have significance in the research area whereas it is remarkable that distance to coast road connection in terms of accessibility becomes significant in important negative effects.

In the examination of regression analysis conducted according to the full method where retail trade location selection dependent variable is selected, it is identified that; presence of civil architecture work is positive impact independent variable in overall area and only in Cankurtaran Neighbourhood in detail. Land-field unit price value increase is identified to be important for trade location selection in overall area and only in Binbirdirek Neighbourhood in detail together with the outhouses gaining great importance pursuant to restriction in physical development. Increase in distance to At Meydanı (Horse Square) gained importance as focus point in the research area and significant in trade and pedestrian circulation does not have importance in district detail and is remarkable.

In the examination of regression analysis conducted according to the full method where land-field unit price value dependent variable is selected, it is identified that; increase in number of houses has negative impact corresponding to the studies on the matter, and presence of hotel and trade has positive impact. Remarkably, only presence of monumental works in cultural asset structure has significant importance as they have marketable trade elements. Variables gaining importance in positive and negative impacts by increase in distance to certain focus points in research area are not important on district basis; however it is remarkable that distance to coast road in terms of accessibility becomes significant on district basis in negative impact.

Following summarized explanations are made in respect to factors effective in provincial transformation observed in the area in this research;

- In the conducted analysis, area's World Heritage Area characteristics, presence of cultural assets, architectural and traditional street form that constitutes the diversity of area and possibility of detached structures as well as most of them having gardens usable for trade feature, sheltering and accommodation, renovated old artwork structures having higher investment value and preference of authentic work structures in boutique commercial and accommodation units can be effective in user and guest selection as well as allow transformation into housing in the future are effective under

present circumstances. Civil architecture sample works in the area become significant as gentrification example in residential areas; accommodation use for retail boutique trading and dining facility functions on trade arteries, and restoration as hotel in the developing areas. Administrative permits and other obstructions in existing old artwork applications and projects as well as rather less and easier monitoring of timing process in old artwork applications are effective in addition to the aforementioned issues in the significance of lost architectural example presence.

- Monumental cultural assets that play important role in the area being a World Heritage Area by the increasing and accomplished recent restoration studies became effective on touristic attraction and visits, and it also has impact on familiarity with the area as well as increase in tradable elements and on land-field price in certain districts. However, in addition to the pedestrian and traffic intensity arising from the presence of large scale monumental official structures, there is also a potential of residential populating moving out of the area pursuant to expectations for use of subject structures for transformation and tourism purposes.
- There are negative effects such as noise arising from retail trade functions serving mostly for tourism purposes of dining and souvenir business bringing the potential of alienating and movement of residing population out of area as well as being an often observed factor of pressure for spreading to residential areas, and there are also positive effects such as development in accommodation function and dining-drinking facilities to feed the accommodation, touristic marketing units and economical returns of those facilities. On the contrary to impact on housing + retail trade functions, pure trade fields and in consideration to non-utilized structure stocks not being offered for residential use, structures maintaining housing functions on the normal floors has positive impact on house selection as well as retail trade development.
- Outhouse structures; have great importance in the area's commercial functions of dining-drinking and tourism pursuant to structuring being accomplished both horizontally in parcel use and vertically, restriction of additional structuring, magnitude of area use on ground floors in the research area.
- Presence of houses has negative impact on accommodation and land-field unit price.
- Presence of accommodation structures impact moving out for residential location selection in general as well as trade functions and investments with its attraction potential and economical return of hotel investments, and has positive impact in some districts in terms of land-field unit price and development of retail trade.
- As for presence of structures under construction, structures renovated to eliminate wear out by construction works increase physical and visual quality as well as economical value.
- Presence of non-utilized structures has impact on retail trade location selection in the neighbor districts where trade development and land-field unit prices are high. Furthermore, it has an impact increasing the transformation in the districts where tourism and retail business trade transformation is observed.
- Suriçi being an important focus point in touristic use and in terms of familiarity have impact on house selection regardless of the pedestrian and vehicle traffic created by Hagias Sophia Square.
- Although distance to Gülhane Square has been significant with the increasing use of Suriçi for cultural events recently, moving away from the square due to intense pedestrian circulation and vehicle traffic has impact on increase in housing. Distance to At Meydanı (Horse Square) has relation with the intense touristic visits and pedestrian accessibility in the area. Attraction of the crowds with high shopping potential by providing shopping preferences on the main walking axis and intensity of dining-drinking-entertainment business as well as increasing use of Suriçi for cultural events recently have great contribution to selection of trade location whereas having contrary impact on land-field unit price.
- Although Kadırga Square is an important focus point as transportation distribution from Aksaray and Yenikapı areas for vehicle and pedestrian accessibility, intense traffic and the disconnection caused by existing educational structures make the area effective.
- The food-beverage-entertainment purposed workplaces which carry out activities surrounding Cankurtaran Square, having influence with the vehicle traffic weight of the spatial dimension of the square and in spite of its lack of pedestrian solutions, suburban train usage in the mass transportation in the residential purposed usages and with the recreational areas transportation at the coastline.
- Shopping preference of Sultanahmet Tramcar Station users on the walking axis and pedestrian accessibility as well as public transportation have positive contribution.
- Topkapı Square has negative impact on accommodation selection in the adjacent districts due to intense pedestrian and vehicle traffic although it is an important focus point for use of Suriçi in touristic utilization.
- Coast Road-Kennedy Street has impact on accommodation selection and land-field unit price as it is an important focus point in transfer and transportation of touristic users.

- Land-field unit value impacts investors' preferences with the concern of being economically profitable. Investor's commercial concerns and high profit expectations as well as parallel behavior of residential users unable to benefit from economical returns of the area are economically acceptable behaviors for the positive impact of land-field price increase in spatial selection for trade and accommodation.

4. CONCLUSIONS

Istanbul historical city center is going through provincial transformation pursuant to developing tourism and trade function pressures as well as residential location selection. Provincial transformation briefly is described as; an action plan integrating with the city and urban people, prepared to increase life quality based on strategic development plan and within the provincial development vision for the non-functional, old and worn provincial pieces unable to fulfill physical, social and economical development dynamics and new requirements. In the research subject, "identification of factors impacting provincial transformation in historical city centers" matter which was found to be missing in literature was analyzed together with different variable groups, and implemented for Sultanahmet-Cankurtaran Neighbourhood and nearby areas which have been significant in Historical Peninsula having great importance for Istanbul metropolitan area. This study aims to guide users and investors in the area as well as central and local administrations by presenting factors impacting provincial transformation in the research area and the degree of such impact using regression analysis.

It has also been possible to statistically describe provincial transformation by the performed analysis within the description of provincial transformation in the area identified as examination area. Conducted analysis support the idea that land-field unit price change, socio-economic, historical and physical structure as well as user and visitor preferences, positive and negative impacts of the existing functions on one another in the area are effective on provincial transformation observed in the area.

Furthermore, results support that the places with different characteristics in the area as well as changes in the monitored land utility structure transformation require individual assessment of multiple dependent variables both in overall area and in detail and have great importance in presenting provincial transformation observed in the research area.

The results which are obtained throughout the research shall provide data for the purpose of enabling urban transformation in Surici and in the research area by the central and local administrations in general and in the testing of the decisions in the frame of the strategic analysis of transformation and forming base for the renovation projects which are developed in the coverage of the laws newly enacted recently and its application and development of new strategies.

It will also be able to bring a new perspective to the actors playing role in zone planning, research and project studies pursuant to analysis of applications in archeological site in coordination with area management. Particularly the data, analysis and results obtained in area experiencing wear out, gentrification and provincial transformation together with its own internal dynamism at Suriçi under accommodation and trade pressures other than the renovation projects conducted recently shall be able to establish data for other scientific studies in respect to transformations observed in historical city centers. With the results obtained, the clues which belong to the spatial problems from which the functions in the place selection are negatively influenced in the research area shall make contribution to the socio-economical development of the traders and users, living in the area as much as the environmental quality increase by means of finding solutions for the problems. The results which are obtained in the research will be effective in defining the development which is followed on the research area in narrower framework and evaluation of the statistical analyses and shedding light to the studies in the projections to be made in the continuance of the data and to be beneficial in the expectations in unit price as well as the functional change in addition to the renewal and restoration of the structures for the landowners, in the immovable property evaluation, marketing and construction sectors, in the investment decisions in the tourism and commerce sectors at first.

Furthermore, it will also provide data for public awareness to be created by interest groups and civil public organizations on the provincial transformation observed in the area, marketing, policy development. In the next step of the study and in the light of obtained data, it would be useful to evaluate optimum planning decisions, minimum land price values and establish standards to be used in provincial transformation and renovation studies by central and local administrations. Repetition of similar analysis both in other districts of Suriçi requiring protection having different socio-economical and physical characteristics where a structural and functional transformation process is experienced, conduct spatial, structural and location comparisons will enable study achieve general and national level results. Forming a model for assessment of multiple factors effective in provincial transformation will provide an aspect to guide new researches in planning, statistics and real estate issues of a brand new study in literature.

5. REFERENCES

[1] Kocabas, A., 2006. Kentsel Dönüşüm (/Yenileş(tir)me): İngiltere Deneyimi ve Türkiye'deki Beklentiler. 2-10.
[2] Akkar, Z. M., 2006. Kentsel Dönüşüm Üzerine Batı'daki Kavramlar, Tanımlar, Süreçler ve Türkiye, Planlama 36, 29-37.
[3] Galantay, E.Y., 1975. New Towns: Antiquity to the Present, New York: G. Braziller.
[4] Taylor, B. , R.Y.-W. Kwok, 1989. From export center to world city: Planning for the transformation of Hong Kong, *Journal of the American Planning Association* 55, 3, 309-322.
[5] Fujita, K., 1991. A world city and flexible specialization: Restructuring of the Tokyo Metropolis, *International Journal of Urban and Regional Planning* 15, 2, 269-284.
[6] Dokmeci, V., Berkoz, L., 1994. Transformation of Istanbul from a monocentric to a polycentric city, *European Planning Studies*, 2, 2, 193-205.
[7] Ergun, N., 2004. Gentrification of Istanbul, *Cities*, 21, 5, 391-405.
[8] Dökmeci, V. and Berkoz, L., 2000. Residential-location preferences according to demographic characteristics in Istanbul, *Landscape and Urban Planning* 48, 1-2, 45-55.
[9] Carmon, N., 1997. Neighborhood regeneration: The state of the art, *Journal of Planning Education and Research* 17, 2, 131-144.
[10] Gunay, Z., Dokmeci, V., 2012. Cultural-led regeneration of Istanbul waterfront: Golden Horn Cultural Valley Project, *Cities* 29, 4, 213-232.
[11] Criekingen, M.V., Decroly, J.M., 2003. Revisiting the diversity of gentrification: Neighborhood renewal processes in Brussels and Montreal, *Urban Studies* 40, 12, 2451-2468.
[12] Fang, K., Zhang, Y., 2003. Plan and market mismatch: Urban redevelopment in Beijing during a period of transition, *Asia Pacific Viewpoint*, 44, 2, 149-162.
13] Ozus, E., Dokmeci, V., 2005. Effects of revitalization in historical city center of Istanbul, *International Real Estate Review* 8, 1, 144-159.
[14] Atkinson, R., 2000. Measuring gentrification and displacement in Greater London, *Urban Studies*, 37, 1, 149-165.
[15] Milanovich, N.P., 2001. Urban Housing Markets in Central and Eastern Europe: convergence, Divergence or Policy "Collapse", *European Journal of Housing Policy*, 1, 2, 145-187.
[16] Uzun, C.N., 2003. Gentrification on in İstanbul: a diagnostic study, University of Utrecth, Utrecth.
[17] Levine, M.A., 2004. Government policy, the state, and gentrification: The case of Prenzlauer Berg Berlin, Germany, *Journal of Urban Affairs*, 26, 1, 89-108.
[18] Zukin, S., 1987. Gentrification: Culture and capital in the urban core, *Annual Review of Sociology* 13, 129-47.
[19] Zukin, S., Trujillo, V., Frase, P., Jackson, D., Recuber, T., Walker, A., 2009. New retail capital and neighborhood change: Boutiques and gentrification in New York City, *City and Community*, 8, 1, 47-64.
[20] Groves, R., Niner P., 1998. The impact of urban renewal on an owner-occupied inner city housing market, The Policy Press, UK.
[21] Listokin, D., Listokin, B., Lahr, B., 1998. The Contributions of Historic Preservation to Housing and Economic Development, *Housing Policy Debate*, 9, 3, 431-218.
[22] Leichenko, R.M., Coulson, N.E., Listokin, D., 2001. Historic preservation and residential property values, *Urban Studies* 38, 11, 1973-1987.
[23] Coulson, N.E., Leichenko, R.M., 2004. Historic preservation and neighborhood change, *Urban Studies*, 41, 8, 1587-1600.
[24] Clark, D., 1997. Historic preservation districts and home sale prices: Evidence from the Sacramento Housing Markets, *Review of Regional Studies* 27, 1.
[25] Sohmer, R., Lang R.E., 1998. Beyond this old house: Historic preservation in community development, *Housing Policy Debate*, 9, 3, 425-430.
[26] Chang, T.C., Fallon, D., Pohlmann, C., 1996. Urban heritage tourism: The global-local nexus, *Annals of Tourism Research* 23, 2, 284-305.
[27] Ergün, N., 2010. İstanbul Kent Merkezi Yakın Çevresindeki Konut Alanlarında Kullanım ve Kullanıcı Farklılaşması, *İTÜ Dergisi/a mimarlık, planlama, tasarım*, C:9 s:1, 167-180.
[28] Dökmeci, V., Çıracı, H., 1990. Tarihsel Gelişim Sürecinde Beyoğlu, 9-59, Türkiye Turing ve Otomobil Kurumu Yayınları, İstanbul.
[29] Giritlioglu, C., Bölen, F., Erkut, G., Ergun, N. ,Yirmibesoglu, F., 1993. Metropoliten şehir merkezlerinde değişen işlevsel ve mekânsal ilişkiler-İstanbul Metropolü şehir eski merkezinin yeniden organizasyonu, *Planlama Dergisi*, İstanbul Özel Sayısı, 1-4, 18-25.
[30] Tekeli, İ., 1998. Türkiye'de Cumhuriyet Döneminde Kentsel Gelişim ve Kent Planlaması, *75 Yılda Değişen Kent ve Mimarlık*, I-24, Tarih Vakfı Yayınları İstanbul.
[31] Kocabas, A., 2006. Türkiye'de Ortaya Çıkmakta Olan Kentsel Yenileştirme Uygulamaları: 1999-2006, Kentsel Dönüşüm (/Yenileş(tir)me): İngiltere Deneyimi ve Türkiye'deki Beklentiler. 2-100-107.
[32] Ergun, N., Dundar B., 2004 Functional Change as an İndicator of Transformation Near the Old City Centre of İstanbul, *European Planning Studies*, Carfax Publishing, 12, 5, 723-738.

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[1] Özsu M., T, Valduriez, P., *Principles of Distributed Database Systems*, Prentice Hall, New Jersey, 128-136,1991.

Referencing papers:

[2] G. Altay, O. N., Ucan, "Heuristic Construction of High-Rate Linear Block Codes," *International Journal of Electronics and Communications (AEU),* vol. 60, pp.663-666, 2006.

Page number is to be placed at the top left corner of each page with pencil.

Length of the Manuscript should not exceed 20 pages excluding Figures and Tables.

INSTRUCTIONS ABOUT THE ACCEPTED MANUSCRIPTS:

Page Design: Text body area is (195mm x 275mm). 30 mm margin from top, 20 mm from down and 25 mm margins should be left on right/left sides.

Title should be in 16 pt. bold, capital letters with Times New Roman font in Microsoft Word format. Authors' names, affiliations, e-mail addresses should follow the title after double line spacing with authors' names in lower case and surnames in capital letter in 14 pt. the rest in 10 pt. in the same format.

Abstract should not exceed 200 words with the word "Abstract" in 12 pt. italic, bold, abstract text in 9 pt. italic, all in Times New Roman font in Microsoft Word format.

Key Words not exceeding 5 should be in 9 pt. bold.

Document Character: Subtitles should be in 10 pt. bold, capital letters and text body 10 pt. both with Times New Roman font in Microsoft Word format. **The manuscripts should be written on two columns, be single spaced with single line spacing between paragraphs**. The subtitle of the first section should start after a single space following the keywords, the other subtitles also with a single line space following the text, there should also be single line spacing between the previous text and the subtitle.

SECTIONS: Formulas should be numbered sequentially. Referring to formulas should be as Eqn (.). Figures and Tables should be placed into the text body and captions for both should be 10 pt. Table numbers and captions should be placed before the Table. If necessary, both columns may be used for large Figures and Tables.

CONCLUSION section should have a title written in 12 pt. bold, capital letters and the text in 10 pt. all in Times New Roman font in Microsoft Word format. Conclusion should not be a version of the Abstract.

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SHORT BIOGRAPHY of the authors should follow references after a single line space, names in 9 pt. surnames in 9 pt. and the text in 9 pt. The text should not exceed 100 words.

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