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The Cost of Work Accidents and Occupational Diseases to the Country's Economy in the Forest Products Industry Sector in Turkey

Ali Ağar[1], Fatih Demir[2], Erhan Daştan[3]

Abstract

The aim of this study is to calculate the visible and invisible costs of work accidents and occupational diseases in the Forest Products Industry Sector that occurred in Turkey between 2011 and 2020 and to reveal the factors affecting the costs statistically. The data of the study were obtained from the website of the Ministry of Labor and Social Security. In order to calculate the cost of work accidents and occupational diseases in the forest products industry sector to the country's economy, the method of multiplying the incapacity times by the average daily worker earnings was used. According to the results obtained, a total of 3309 occupational accidents occurred in this sector between 2011 and 2020, and a total of 73 workers lost their lives due to these accidents. Again in the same period, only 1 employee got an occupational disease, and this did not result in death. As a result of the calculations, the apparent cost of work accidents and occupational diseases in the forest products industry sector to the country's economy has reached a total of 147.014.518.5 TL. As a result of the regression analysis, Number of Permanent Incapacity for Work made the biggest impact on this cost, while the second place was the deaths resulting from work accidents. The variable that has the least effect on the cost is Temporary Incapacity Duration (Days) (Ambulatory) - Days in the Hospital (Inpatient). The data were analyzed with the SPSS package program.

Keywords: Work accident, occupational disease, apperent cost, hidden cost, forest products industry.
Jel Codes: J81, D24, L73

Türkiye'deki Orman Ürünleri Sanayi Sektöründeki İş Kazaları ve Meslek Hastalıklarının Ülke Ekonomisine Maliyeti

Özet

Bu çalışmanın amacı Türkiye'de 2011 – 2020 yılları arasında meydana gelen Orman Ürünleri Sanayi Sektöründeki iş kazalarının ve meslek hastalıklarının görünür ve görünmeyen maliyetlerinin hesaplanması ve maliyetleri etkileyen faktörlerin istatistiksel olarak ortaya konmasıdır. Çalışmaya ait veriler Çalışma ve Sosyal Güvenlik Bakanlığı'nın internet sitesinden elde edilmiştir. Orman ürünleri sanayi sektöründeki iş kazaları ve meslek hastalıklarının ülke ekonomisine maliyeti hesaplamak için iş göremezlik süreleri ile ortalama günlük işçi kazancının çarpılması yöntemi kullanılmıştır. Elde edilen sonuçlara göre bu sektörde 2011–2020 yılları arasında toplam 3309 iş kazası meydana gelmiş olup, bu kazalardan dolayı toplam 73 işçi hayatını kaybetmiştir. Yine aynı dönemde sadece 1 çalışan meslek hastalığına yakalanmış ve bu ölümle sonuçlanmamıştır. Yapılan hesaplamalar sonucunda Orman ürünleri sanayi sektöründeki iş kazaları ve meslek hastalıklarının ülke ekonomisine görünür maliyeti toplam 147.014.518.5 TL'ye ulaşmıştır. Yapılan regresyon analizi sonucu bu maliyete en büyük etkiyi Sürekli İş Görmezlik Sayısı yaparken, ikinci sırada ise İş kazası sonucunda meydana gelen ölümler etkilemiştir. Maliyete en az etkisi olan değişken ise Geçici İş göremezlik Süresi (Gün) (Ayaktan) - Hastanede Geçen Günler (Yatarak) dir. Veriler SPSS paket programıyla analiz edilmiştir.

Anahtar Kelimeler: İş kazası, meslek hastalığı, görünür maliyet, görünmeyen maliyet, orman ürünleri sanayi
Jel Kodları: J81, D24, L73

Araştırma ve Yayın Etiği Beyanı	Etik kurul kararı gerektirmemektedir.
Yazarların Makaleye Olan Katkıları	A.A., F.D. ve E.D. araştırmanın tasarımına ve uygulanmasına, sonuçların analizine ve metnin yazılmasına eşit düzeyde katkıda bulunmuştur.
Çıkar Beyanı	Yazarlar ya da üçüncü taraflar açısından çalışmada çıkar ilişkisi/çatışması bulunmamaktadır.

[1] Öğr. Gör., Artvin Çoruh Üni., Yaşlı Bakımı, Artvin/Türkiye, aliagar@artvin.edu.tr, ORCID ID: https://orcid.org/ 0000-0003-2771-9587

[2] Öğr. Gör., Artvin Çoruh Üni., Sosyal Güvenlik, Artvin/Türkiye, fatih@artvin.edu.tr, ORCID ID: https://orcid.org/0000-0001-7551-0302

[3] Öğr. Gör., Artvin Çoruh Üni., Sağlık Kurumları İşl., Artvin/Türkiye, erhan@artvin.edu.tr, ORCID ID: https://orcid.org/0000-0001-7498-8910

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1. Introduction

Humans have to work and produce in order to continue their life, and therefore, a large part of our life is spent in the working environment. The forestry sector is one of the sectors where we spend most of our working life in terms of production.

The Forest Products industry sector is constantly developing with its wide sub-sector groups and produces world-class production with the latest technology. Recently, significant investments and capacity increases have been observed in facilities that process forest products, which clearly reveals the dynamic structure and potential of the sector. The forest products industry sector, which has the ability to produce many different products, is in an active position in the manufacturing industry. The forest products industry mostly deals with timber, paper, furniture and wood. Today, the timber industry is a very popular forest product. About 70% of the timber produced in Turkey is used in construction, 20% in furniture, 10% in packaging and other sectors. Lumber consumption per person is between 0.075-0.085 m^3 (Ankara Chamber of Industry, 2017).

The forest products industry sector is a sector that processes primary and secondary products obtained from forests and turns them into semi-products or final products. It is in a location where thousands of large and small businesses have a scattered layout. According to TUIK (Turkish Statistical Institute) data, it has an important share in the manufacturing industry with 46,341 workplaces and an annual average of 231.378 employees. The fact that the forest products industry enterprises are mostly small and medium-sized enterprises and they could not fully adapt to technological innovations prevented the formation of occupational health and safety awareness and created a situation that increased the danger and risk potential of the forest products industry (Yıldırım vd. 2018).

The forestry sector is one of the sectors with the most dangerous working environment in all production areas. For this reason, the importance of the forestry sector on employees is its impact on the safety and health of the workforce (Tsioras et al. 2014).

We are exposed to various risk factors related to the business lines we work in and we get work accidents and occupational diseases related to these risks. Work accidents and occupational diseases cause financial and moral losses for employees. In addition, it hinders the welfare of the country financially and morally rather than personal losses.

Today, since many countries give more importance to welfare, they spend more and more especially on health systems, so employee health and safety seems to be an important issue for countries (Di Noia et al. 2020).

With the spread of the industry-oriented society, the negative effects of work accidents and occupational diseases on the society have increased considerably. There are many initiatives related to occupational health and safety in our country recently. For example, a new Occupational Health and Safety Law and Law No. 6331 have entered into force for the risk assessment (Demir et al. 2020).

Occupational accidents in industrial enterprises can be divided into two categories as unsafe working conditions and unsafe behavior. It is clear that occupational accidents and injuries can be prevented by eliminating unsafe behaviors and conditions. With the growth of the forest products sector in the last 5 years, there has been an increase in the number of occupational accidents and deaths in the industrial enterprises sector. This clearly demonstrates the need to eliminate unsafe working conditions and unsafe human behavior. Sector managers should try to recognize their employees' risk-taking behaviors in order to eliminate occupational accident risk factors (Cil and Gedik 2021).

Looking at the literature, it is seen that there are many occupational accidents in the forest products sector. The presence of dangerous trees, difficult terrain conditions, working with heavy-duty equipment such as chainsaws and harsh weather conditions have shown that they play an important role in

occupational accidents (Nikooy et al. 2019; Gumus et al. 2020; Tsioras et al. 2014). In addition, since the working area in the forestry sector is narrow or many activities are carried out at the same time and in the same place, the risks of encountering head injuries are high (Ovacilli and Öymez 2020).

Of all industrial sectors in Japan, the highest rate of fatal accidents occurs in forestry, with chainsaw cutting accidents each year representing 41 to 69% of all fatal accidents between 2000 and 2014 (Tobita et al. 2019).). In our country, there are no studies on occupational accident and cost analysis in the forestry industry sector.

Another danger in the forest products sector is occupational diseases. Especially since the forestry sector requires working outdoors, they are more exposed to tick-borne diseases from occupational infectious diseases. In addition, occupational infectious diseases such as tularemia, Lyme disease, rabies and plaque, as another occupational infectious diseases, are among the occupational diseases encountered in forest workers (Basaran and Ünal 2020; Diagnosis Guide for Occupational Errors and Work-Related Diseases).

Evidence has been found that long-term and increased repetitive flexion or extension of the wrist, especially due to musculoskeletal disorders in forestry workers, increases the risk of carpal tunnel syndrome, especially with a strong grip (Çetintepe et al. 2020). In addition, white finger (Raynaud's Phenomenon) disease is also common in forest workers, who are associated with the use of chainsaws and working in cold environments (Bilir 2019). As respiratory system diseases, occupational asthma due to wood dust is the diseases seen among forest workers (Kurt and Demir 2018).
Occupational accidents and occupational diseases seen in employees constitute a great economic burden to countries. The economic loss caused by a work accident or occupational disease is incomparably higher than the expenditures made to prevent this accident. In this study, the statistics of occupational accidents and occupational diseases in the forest products sector were examined and the losses caused in the economy were revealed, and the necessity and importance of taking precautions in this regard was tried to be emphasized. In addition, when we look at the literature, it will fill the deficiency in the literature because there is no study on the cost of work accidents and occupational diseases in the forest industry sector in our country.

2. Materıal and Method

The aim of this study is to calculate the apparent and hidden costs of work accidents and occupational diseases in the Forest Products Industry Sector that occurred in Turkey between 2011 and 2020 and to reveal the factors affecting the costs statistically.

When calculating the cost of work accidents and occupational diseases to the national economy, the total period of incapacity is taken into account. Total period of incapacity for work consists of the sum of temporary incapacity for work due to work accident or occupational disease, work days lost due to death as a result of work accident or occupational disease, and work days lost due to permanent incapacity for work. Labor statisticians use an average of 7500-8000 working days to calculate the number of working days lost as a result of permanent incapacity for work and death. In this study, 8000 was used as the number of days lost while making the calculations (Bekar et al. 2017).

In the research, the following terms were used to calculate the cost of work accidents and occupational diseases to the country's economy.

Temporary incapacity for work (A): “Work days lost due to inpatient and outpatient treatment as a result of work accident or occupational disease”

Duration of permanent incapacity for work (B): “It is obtained by multiplying the number of people who have lost more than 40% as a result of work accident or occupational disease and the number of 8000 days”.

Number of days lost as a result of death (C): "It is obtained by multiplying the number of people who died as a result of work accident or occupational disease and 8000 days".

Total duration of incapacity = A+B+C

Apparent economic loss: "calculated by multiplying the total number of years of incapacity for work lost by the average daily earnings of workers".

Hidden economic loss = Apparent Economic Loss X 8

The sum of the apparent and hidden economic loss constitutes the economic burden of work accidents and occupational diseases on the country's economy.

Occupational Accident Frequency Rate: "It shows how many accidents occur among every 100 people working full-time".

Occupational accident frequency rate = "NWA /(TMPAD *8)*225.000"

NWA = "Number of work accidents"

TMPAD= "Total number of premium accrued days, TMPAD, It is multiplied by 8 hours of full work for each day to find the total working hours of all insured persons in a year"
In the study, the costs of work accidents and occupational diseases in the forest products industry sector in Turkey to the country's economy were calculated. Apparent Economic Loss was used as a cost indicator. In calculating the costs, the period of incapacity of the worker is multiplied by the average daily earnings of a worker.

Data Collection and Analysis

The factors affecting the national economy of work accidents and occupational diseases in our country between the years 2011-2020 were analyzed statistically. Forestry working life statistics between 2011 and 2020 were used in the study. These data were obtained from the Ministry of Labor and Social Security.
While the dependent variable of the study is the apparent economic loss (AEL), the independent variables are Death Due to Work Accidents (DWA), Number of Permanent Incapacity for Work (NPIW) and Period of Temporary Incapacity (Days) (Ambulatory) - Days in the Hospital (Inpatient) (PTIDY). forms. In the study, the factors affecting the Apparent Economic Loss (AEL) were examined by regression analysis

3. Findings and Discussion

Forestry working life statistics in Turkey between 2011 and 2020 are shown in the table below, and it is striking that the numbers have increased in recent years. Although there is an increase in the Number of Workplaces, Number of Employees, Occupational Accidents, Occupational Accident Deaths and Permanent Incapacity, there is no death due to Occupational Disease and Occupational Disease. In this sector, only one employee was diagnosed with an occupational disease in 2020.

When Table 1 is examined, it is striking that there is no linear relationship between the number of workplaces and the number of employees. However, there is a linear relationship between the number of workplaces and occupational accidents. It can be seen more clearly from the correlation coefficients whether these relationships exist or if they are statistically significant. When the correlation table (Table 2) is examined, it is seen that the occupational accidents are high when the number of workplaces is high. Therefore, there is a positive and high correlation between the number of workplaces and occupational

accidents (r= .87; p < .05). However, no significant relationship was found between the number of workplaces and the number of employees, and between the number of employees and occupational accidents (r= .209; p > 0.05 r= .162; p > 0.05).

Table 1: Forestry Working Life Statistics Between 2011-2020

Years	Number of Workplace	Number of Employees	Occupational Accidents	Occupational Accident Deaths	Occupational disease	Occupational disease death	Number of Permanent Incapacity for Work
2011	2384	34233	98	6	0	0	2
2012	2581	36506	85	2	0	0	4
2013	2378	33696	192	7	0	0	2
2014	2769	37646	202	5	0	0	1
2015	3458	97820	434	7	0	0	4
2016	2994	34666	345	7	0	0	14
2017	3362	39705	447	8	0	0	13
2018	3238	34620	487	9	0	0	10
2019	3367	27025	510	9	0	0	18
2020	4255	34579	509	13	1	0	5

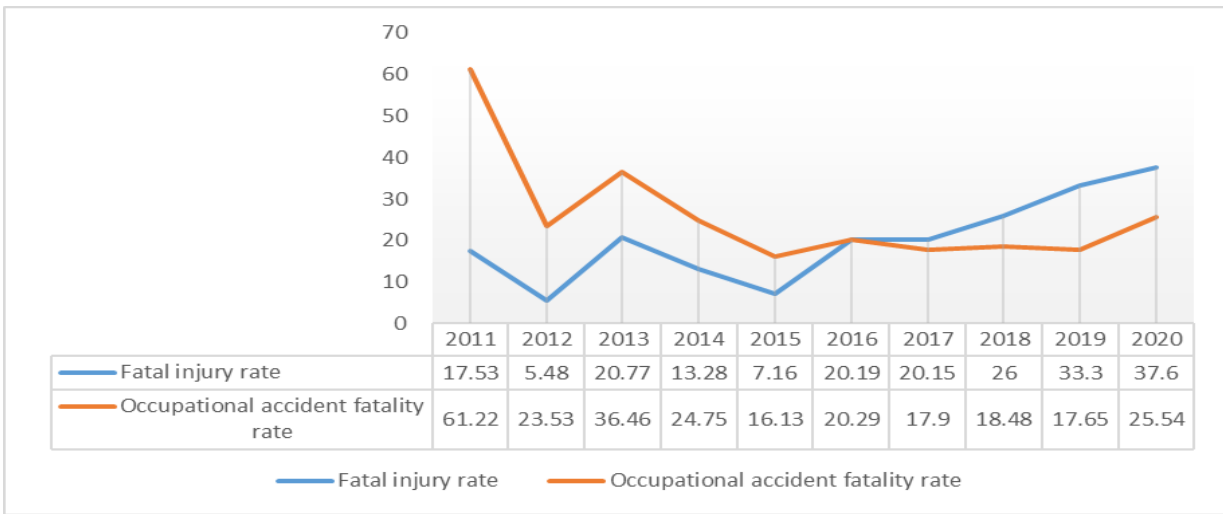
Table 2: Correlation Table Between Number of Workplaces, Number of Employees and Occupational Accidents

Correlations						
	Number of Workplaces		Number of Employees		Occupational Accidents	
	r	p	r	p	r	P
Number of Workplaces	1		.20	.562	.87	.001
Number of Employees	.20	.562	1		.162	.656
Occupational Accidents	.87	.001	.162	.656	1	

As can be seen from Figure 1, although the occupational accident frequency rate decreased slightly from 2011 to 2012, it increased again from 2012 to 2013. The main increase was between 2015-2019 and reached its peak in 2019. The reasons underlying this increase can be considered as a separate study.

Figure 1: Forestry Working Life Occupational Accident Frequency Statistics Between 2011-2020.

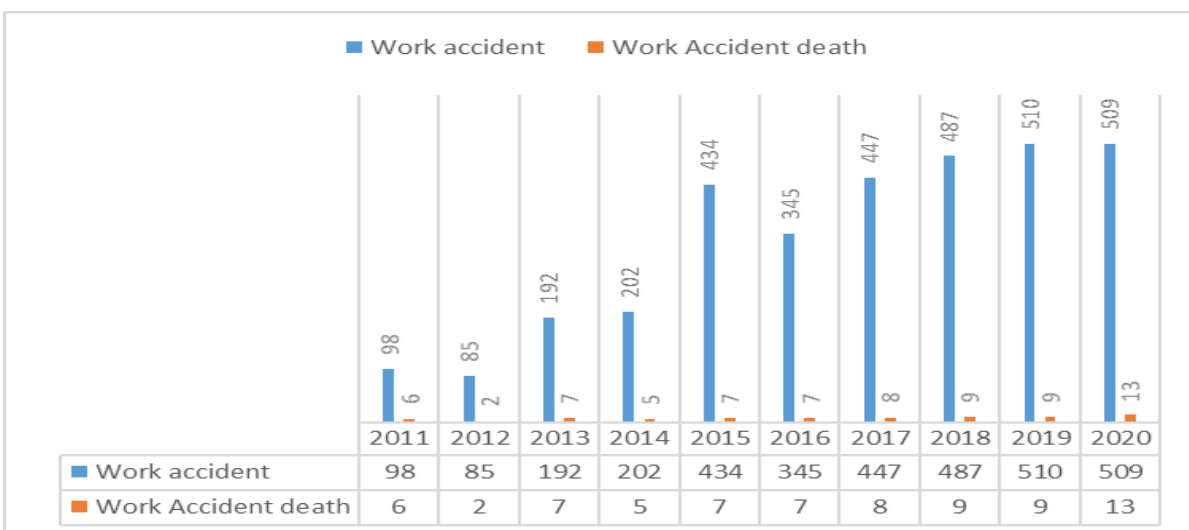
Considering the years in which the study was implemented, although the Occupational Accident Fatality rate was quite high in 2011, it decreased on average in the following years. But the same is not true for the fatal injury rate. Looking at Graph 2, the fatal injury rate followed a fluctuating course until 2016 and increased after this date. The rate of increase, which was 17.53 in 2011, reached 37.6 by 2020. This is more than 100%.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fatal injury rate	17.53	5.48	20.77	13.28	7.16	20.19	20.15	26	33.3	37.6
Occupational accident fatality rate	61.22	23.53	36.46	24.75	16.13	20.29	17.9	18.48	17.65	25.54

Figure 2: Forestry Working Life Occupational Accident Fatality and Fatal Injury Rates for 2011-2020.

Considering the number of occupational accidents and deaths as a result of occupational accidents in the forest products industry sector, it is seen that occupational accidents have increased remarkably in recent years. Occupational accidents, which were 98 in 2011, caused 6 deaths in the same year. By 2020, 509 work accidents occurred and these work accidents caused 13 deaths. The number of deaths as a result of work accidents has followed a horizontal course, but has reached its peak with 13 deaths in 2020. The lowest work accident and death as a result of work accident occurred in 2012.

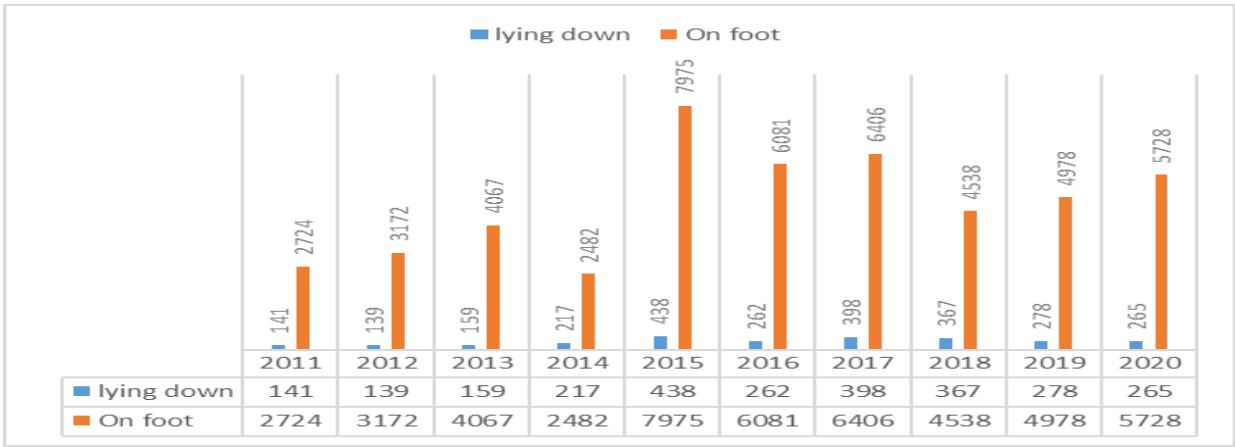


	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Work accident	98	85	192	202	434	345	447	487	510	509
Work Accident death	6	2	7	5	7	7	8	9	9	13

Figure 3: Number of Occupational Accidents and Deaths as a result of Occupational Accidents in Forestry Working Life Between 2011-2020.

When the number of days of temporary disability as a result of work accidents in the forest products industry sector is examined, it is seen that there are serious fluctuations in the number of outpatient

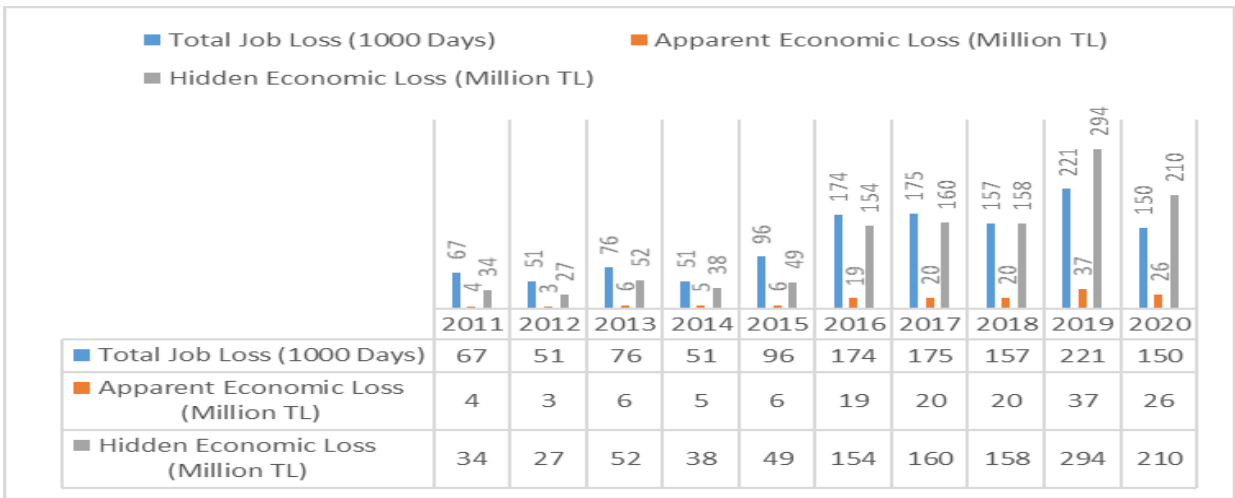
treatments. However, there is a more horizontal course in the number of days of incapacity spent in bed. The number of days spent standing and lying on disability peaked in 2015. It is seen in detail in graph 4 that there are 438 days lying down and 7975 days standing. Although the lowest number of days of incapacity for standing work was in 2014 with 2482, the lowest number of days of incapacity for work was in 2012 with 139.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
lying down	141	139	159	217	438	262	398	367	278	265
On foot	2724	3172	4067	2482	7975	6081	6406	4538	4978	5728

Figure 4: Number of Days of Temporary Incapacity for Work as a result of Forestry Working Life Work Accident Between 2011-2020.

The graphic above shows the economic loss as a result of work accidents and occupational diseases between 2011 and 2020. In the study, the economic loss represents the Apparent Economic Loss. According to the data obtained as a result of the calculations, the economic loss resulting from work accidents and occupational diseases has increased significantly in recent years. The economic loss, which was 4 million TL in 2011, reached 6 million TL in 2015. However, in 2016, the economic loss jumped to 19 million TL. It reached its peak point in 2019, reaching 37 Million TL. In order to see which of the factors, which are Occupational Accident Death, Number of Permanent Incapacity for Work, Temporary Incapacity for Work (Days) (Ambulatory) - Days in Hospital (Inpatient), affecting the calculated Apparent Economic Loss affects more, a regression analysis is performed and the coefficients table is given below.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Job Loss (1000 Days)	67	51	76	51	96	174	175	157	221	150
Apparent Economic Loss (Million TL)	4	3	6	5	6	19	20	20	37	26
Hidden Economic Loss (Million TL)	34	27	52	38	49	154	160	158	294	210

Figure 5: Economic Loss as a result of Occupational Accident and Occupational Disease in the forestry sector between 2011-2020.

As seen in Table 3, the constant term was found to be -5787090.782.. This means that if DWA, NPIW and TIWTH are zero, the total loss decreases by 5787090.782 units. The parameter value of the LFPR was found to be 2335180.095, which means that a one-unit increase in LFPR increases the total apparent economic loss by 2335180.095 units. Likewise, a one-unit increase in NPIW increases AEL by 1375156,620 units, and a one-unit increase in TIWTH decreases AEL by 1298,222 units.

Beta under the heading Standardized Coefficients shows the order of importance of the independent variables. The sign of the beta is ignored. The variable with the highest Beta value is the variable that most affects the most important or dependent variable. Accordingly, NPIW is the most important independent variable, followed by OIC and TIWTH.

Table 3: Coefficients Tablosu

	Unstandardized Coefficients		**Standardized Coefficients**		
Model	**B**	**Std. Error**	**Beta**	**t**	**Sig.**
(Constant)	-5787090.782	3389423.238		-1.707	.139
OIC	2335180.095	423623.462	.588	5.512	.001
NPIW	1375156.620	198172.125	.721	6.939	.000
TIWDH	-1298.222	683.859	-.211	-1.898	.106

4. Results

Occupational health and safety is an extremely important issue not only for employees but also for employers and society. Occupational accidents can occur due to different reasons. Some of these reasons are that the employee does not comply with the rules, acts undisciplined, avoids using personal protective equipment, does not have sufficient safety awareness even if he has received occupational health and safety training. Occupational accidents and occupational diseases cause both material and moral damages to both the person affected and the state. In this study, the apperent and hidden costs of work accidents and occupational diseases in the Forest Products Industry Sector that occurred in Turkey between 2011 and 2020 were calculated and the factors affecting the costs were statistically revealed. In calculating the costs, the duration of the worker's incapacity for work is multiplied by the average daily earnings of a worker. At the same time, the factors affecting these costs were analyzed statistically. Forestry working life statistics between 2011 and 2020 were used in the study. These data were obtained from the Ministry of Labor and Social Security.

Total incapacity period consists of the sum of temporary incapacity for work due to work accident or occupational disease, work days lost due to death as a result of work accident or occupational disease, and work days lost due to permanent incapacity for work. Labor statisticians use an average of 7500-8000 working days to calculate the number of working days lost as a result of permanent incapacity and death. In this study, 8000 was used as the number of days lost while making the calculations.

According to the results obtained, a total of 3309 occupational accidents occurred in this sector between 2011 and 2020, and a total of 73 workers lost their lives due to these accidents. Again in the same period, only 1 employee got an occupational disease, and this did not result in death. As a result of the calculations, the apparent cost of work accidents and occupational diseases in the forest products industry sector to the country's economy has reached a total of 147,014,518.5 TL. As a result of the regression analysis, Number of Permanent Incapacity for Work made the biggest impact on this cost, while the second place was the deaths resulting from work accidents. The variable that has the least effect on the cost is Temporary Incapacity Duration (Days) (Ambulatory) - Days in the Hospital (Inpatient). It is

thought that this study will contribute to the literature since it is the first study to examine the cost of work accidents and occupational diseases in the forestry industry sector in our country.

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