Journal of Scientific Research & Reports
5(4): 265-274, 2015; Article no.JSRR.2015.094
ISSN: 2320-0227

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The Relationship between Privatization and Occupational Safety in Coal Industryin Turkey; A Statistical Review of Coal Mine Accidents

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/JSRR/2015/15125
Editor(s):
(1) Masum A Patwary, Department of Geography and Environmental Science, Begum Rokeya University, Bangladesh.
Reviewers:
(1) Ajeet Jaiswal, Department of Anthropology, Pondicherry University, India.
(2) MN Bagde, CSIR-Central Institute of Mining and Fuel Research, India.
Complete Peer review History: http://www.sciencedomain.org/review-history.php?iid=750&id=22&aid=7519

Review Article

Received 7th November 2014
Accepted 16th December 2014
Published 27th December 2014

ABSTRACT

Aims: The purpose of the article is to examine the causes of the increase in work-related accidents in the coal mining industry in Turkey. Furthermore, the article aims to investigate the impact of private sector employment and privatization process to occupational health and safety conditions in coal mining industry in Turkey
Study Design: The data used in the study are prepared by using the official occupational accident statistics taken from Turkish Social Security Institution and the tables that present the sectoral contribution of the insured workers. The number of recorded official occupational accidents, number of insured workers and number of workers who work for private and public sector are used to make comments on the data. Occupational accident rates per sector are calculated on the basis of years.
Methodology: In this study, occupational accidents, accident rates, standardized occupational accidents rates and changes of insured workers of private and public sector were investigated in the coal mining industry. Outsourcing, privatization and growth rates of private sector employment in coal mining sector were compared with the increase of standardized occupational accident rates, and its impact on accidents in coal mining was investigated.
Results: The rate of the employees of private sector in coal mining increased from 31% to 75% in

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the period of last 12 years. On the other hand, occupational accidents increased rapidly in coal mining sector since 2004 in comparison with the other sectors. Since 1992, 11 of 12 great accidents occurred in the coal mines that are operated by private sector enterprises and 937 workers died due to firedamp explosions and fires. Most of the coal mines are operated by lessee private sector enterprises, however, coal production is made without taking adequate measures in the basins. This poor conditions leads to great industrial accidents that resulting death of the workers.

Conclusion: Occupational accidents in coal mines cannot decrease unless making new regulations. Turkey needs a new mining sector strategy from the point of need for the sector and economic losses caused by occupational accidents. Thus, Turkey must sign the "Safety and Health in Mines Convention" (No. 176) of ILO firstly and an action plan, that defines the existing conditions and measures, must be developed and applied as in the USA and China. Occupational accidents and deaths is related with using modern systems and technologies used in the mines. Performing risk analysis showing the existing conditions in coal mines is very important. According the results of risk analysis, the mine pits with the poor conditions must be closed or must be taken necessary preventive measures.

Keywords: Coal mines; mine accidents; safety; privatization; subcontracting.

1. INTRODUCTION

The need for energy is increasing continuously due to the increasing population, industrial production and domestic use. Coal still maintains its importance as a traditional energy source in developing countries. While the proved reserves of natural gas and oil are estimated as 40-60 years, it is estimated that coal reserves can be used for 200 years. The rate of the coal in worldwide electricity production is considerably high as 30% [1,2].

Coal mining has high accident risks due to its production processes, labor-intensive characteristics and negative conditions such as underground production. Thus, occupational accident rates are 5-6 times more in comparison with the other sectors [3,4,5]. These accidents, which cause death and serious injuries, also cause a great amount of financial loss [6,7,8,9,10]. Risk factors that cause the occupational accidents in mining sector are investigated in many previous studies [9,11,12, 13,14,15,16,17].

Removing of these risks and preventing the accidents are generally possible nowadays. Making technological investments play an essential role in order to prevent occupational accidents by practicing modern production tools and methods in mines. Preventive engineering control methods, personal protective measures, risk-based management approach, design of the workplace environment and worker education are very effective to prevent the accidents. It is also indicated that the mine owner employers are the primary responsible in order to take measurements [6,18,19,20,21].

Turkey has approximately 2% of world coal reserves and coal takes an important place in energy production. More than 50,000 workers are currently employed in coal mining sector. However, working conditions and protective measures against occupational accidents are still at a very low level.

After the Soma Disaster, which occurred in 13th of May 2014 and resulted with the death of 301 workers, "occupational safety in mining sector" has became most important issue in Turkey. While great mine accidents occurred frequently in 1980's, any great accident didn't occur during the period between 1995-2003 and besides, occupational accident rates decreased. After the beginning of the millennium, legal arrangements that encourage the subcontractor system have important effects on mining sector. Comprehensive changes have been made on Mine Act in 2004 and 2010 and some public coal fields' operating rights were assigned to the private sector by "mining lease agreements". Thus, subcontractor system became widespread in coal mines. Labor Act and Occupational Health and Safety Act, which entered into force in 2003 and 2012, respectively, make easy to use subcontractor system. After these legal arrangements, the rate of private sector exceeded 70% in mines and a great increase is observed in occupational accidents during the same period.

In some recent studies, some findings, which explain the negative effects of privatization, subcontractor system and other outsourcing practices on occupational health and safety, are obtained [22,23,24,25,26]. The aim of this study is to investigate the occupational safety conditions in coal mines and the relationship between increasing occupational accidents and privatization and subcontractor system in coal mining in Turkey by using statistical data.

2. MATERIALS AND METHODS

The data that are used in the study are prepared by using the official occupational accident statistics taken from Turkish Social Security Institution and the tables that present the sectoral contribution of the insured workers. The number of recorded official occupational accidents, number of insured workers and number of workers who work for private and public sector are used to make comments on the data. Occupational accident rates per sector are calculated on the basis of years.

Standardized occupational accident rates are calculated and published by Turkish Social Security Institution annually. Standardized occupational accident rate (SOAR) is the rate of the frequency speed that is calculated according to the number of insured workers and the number of occupational accidents to the rate of increase according to expected occupational accident frequency speed. Because of standardized occupational accident rate defines the rate of increase of occupational accidents of a sector according to other sectors, it provides an opportunity to evaluate the progress of occupational accidents, objectively. Standardized occupational accident rate is calculated as below:

*GOAS = TNOA / TNIE
ENOA = GOAS x NIEBA
SOAR (%) = NOABA x 100 / ENOA

*GOAS: General occupational accident speed
TNOA: Total number of occupational accidents
TNIE: Total number of insured employee
ENOA: Expected number of occupational accident
NIEBA: Number of insured employees in the branch of activities
SOAR: Standardized occupational accident rates (%)
NOABA: Number of occupational accidents in the branch of activities

The number of occupational accidents, accident frequency speed and standardized occupational accident rates of coal mining sector are compared with the rates of Metal Products Manufacturing, Construction, Transportation/ Shipping and Textile sectors which have the highest occupational accident numbers. The relationship between the rates of occupational accidents and the numbers and changes of insured workers of private and public sector is evaluated for the period of last 12 years.

In this study, occupational accidents, accident rates, standardized occupational accidents rates and changes of insured workers of private and public sector were investigated in the coal mining industry. Outsourcing, privatization and growth rates of private sector employment in coal mining sector were compared with the increase of standardized occupational accident rates, and its impact on accidents in coal mining was investigated. Structural problems that cause great accidents in recent years in coal mines, and the impact of legislation were evaluated. The legal, administrative, technological and other preventive measures were presented.

3. RESULTS AND DISCUSSION

3.1 Characteristics of Occupational Accidents in Coal Mines in Turkey

According to Turkish Social Security Institution data, 65-80 thousand occupational accidents occur in Turkey every year and as a result of these accidents, 700-1700 workers dies and approximately 2000 workers become permanently incapable. Occupational accidents cause approximately $ 3 billion income loss in social security system. Majority of occupational accidents are not recorded and because 99% of occupational diseases are not identified, they are not considered in statistics. Estimations of Turkish Statistical Institute and Turkish Social Security Institution indicate that the expected number of occupational accidents and diseases can be 4 times more than the recorded data.

According to the International Labour Office, Eurostat and Turkish Social Security Institution data, the average "fatal accident frequency rate" (number of deaths for 100,000 worker in a year) is “2.1” in 15 EU countries. However, this rate is “9.8” in Turkey. Fatal accident frequency rates

are;“0.7” in the UK, “1.7” in Finland, “2.2” in Germany, “3.4” in France, “4” in the United States, “3.8” in Spain and “10” in Mexico, respectively. According to these values, Turkey is better than countries such as India and Russia in terms of frequency rates of fatal accidents. However, much worse than countries such as Finland, France, England, Germany and other EU countries. These frequency rates reveals that more intense efforts should be exerted on sectors such as mining and construction sector in Turkey [27].

Table 1 presents the 5 sector at which accidents involving death are seen most for the last decade in Turkey. According the last decade’s data, coal mining sector, which was in the third place after metal product manufacturing and construction sectors in terms of occupational accidents until 2009, has risen to the first place after 2009.

30% of the deaths as a result of occupational accidents occur in construction sector every year. 30-40% of accidents involving death occur as “falling down from height” in construction sector. Transportation/Shipping sector at which many of the fatal accidents occur as a result of vehicle accidents, takes the second place after construction sector in terms of accidents involving death. However, deaths increase in coal sector during the years in which great mine accidents occur. For instance, during the year of 2010 in which 30 workers died in Zonguldak-Karadon accident, 92 workers died in coal mining sector. Thus, after the Soma mine accident at which 301 worker died, coal mining is expected to be the most fatality sector with approximately 400 death in 2014 statistics.

China, the USA, India and Australia are the greatest coal producer countries. Turkey has the 0.03% of anthracite coal and 2% of lignite world reserves and it is in the fourth place among 35 countries and 44. Place among 50 countries in terms of lignite and anthracite coal production, respectively. However, Turkey is in a very poor position among other countries in terms of occupational accidents and fatality rates. While the death per million tones rates is 1.27 and 0.2 for China and the USA, which are the biggest coal producer countries, this rate is 5-7 times more than these countries. According to International Labor Organization (ILO) data, mine worker fatality rate of Turkey is approximately 4.5 times more than Europe [7,28,29,30,31].

Some legal arrangements entered into force related with occupational health and safety in the USA since 1940’s and new technologies are developed and become widespread for the problems of mine pits and for the conditions that jeopardize occupational safety. As a result of these developments, it can be seen that fatality rates in the USA decrease rapidly especially since 1970’s. After the rapid increase in accidents and deaths in mines, China took decision to renew the mine pits and reorganization is planned in 2004. Thus, fatality rates have been decreasing since 2004 in China. Furthermore, small, inefficient and non-beneficial mine pits are closed within the scope of the reorganization. Similarly, leader countries in coal production such as Australia, Canada and Germany, developed planned studies including occupational safety measures and thus, accident rates decrease [6,28,32,33,34].

Mining sector is one of the dangerous sectors in which occupational accidents and diseases occurred much in Turkey. 70270 occupational accidents occurred and 450 workers died from 2003 to 2012 (see also Table 1). Besides these several accidents, a great number of workers died in great accidents which occur frequently. 937 workers died in 18 great mine accidents, including the last Soma accident, since Zonguldak-Armutcuk accident in which 103 workers died in 1983. 17 of these accidents occurred in coal mines. One of the accidents occurred as landslide, two of them occurred as fire and the rest of them occurred as firedamp explosion. Since 1992, 11 of 12 great accidents occurred in the coal mines that are operated by private sector enterprises.

Many studies indicated that there are serious occupational safety deficiencies which restrict a safe production progress in coal mines in Turkey. According to the inspection results of Ministry of Labor and Social Security (2012), it is indicated that 7%, 23% and 83% of the mines don’t have technical supervisor, explosives magazine and operation permit document, respectively, 43% of the mines don’t measure gases regularly, 26%, 32% and 21% of the mines don’t have occupational physician, occupational safety specialist and occupational health and safety committee, respectively. In the same report, it is also indicated that coal mines don’t have appropriate and adequate fortification, adequate ventilating system and escape routes. Expect big ones; mines generally don’t have gas monitoring and distant signal systems and circuit breakers. In only 7 of 64 workplaces that are inspected don’t have any deficiencies [1,35,36,37].

3.2 Privatization Process in Coal Mining and Occupational Accidents

As it can be seen in Table 2. number of workers in coal mining sector increased 16% during the last 12 years. While number of employees of public sector decreases continuously; number of employees of private sector increase 3 times in the same period (see also Fig.1). While the rate of the workers of private sector or subcontractor companies that provide worker to the public sector is 31% in 2001, this rate exceeds 75% in 2012. Althoug h2013 and 2014 statistics haven't been published yet, it is estimated that private sector rate exceeds 80%.

Number of occupational accidents has been increasing since 2004. While 5481 occupational accidents occurred in 2004, the number of the accidents increased 38% until 2012. Occupational accidents rate, which defines the rate of the number of occupational accidents to number of workers, was also increased. Occupational accident rate increased 3% compared with the year of 2004.

In order to provide an objective evaluation of occupational accidents in the sector, the standardized occupational accident rates are compared with 4 sectors in which occupational accidents occur most and the greatest number of workers is employed according to the Turkish Social Security Institution statistics. The results show that the situation of coal mining worsened after 2004. Metal Products Manufacturing, Construction, Transportation/ Shipping and Textile sectors' standardized accident rates follow an unstable progress in 12 years period and although the number of accidents increased

Table 1. Annual number of occupational accidents and death in the sectors that most occupational accidents occur in Turkey

Years	Coal mining		Metal products		Construction		Transportation/ shipping		Textile	
	Accident	Death	Accident	Death	Accident	Death	Accident	Death	Accident	Death
2003	5647	54	9682	23	8198	274	3762	88	7382	21
2004	5481	38	11584	37	8106	263	4098	109	6839	14
2005	6011	82	10283	25	6480	290	3928	163	5869	29
2006	6722	35	11039	31	7143	397	4478	165	5155	26
2007	6293	38	11224	45	7615	359	4483	146	5639	20
2008	5728	30	6971	34	4518	231	1974	111	3641	9
2009	8193	3	7314	11	3497	128	2329	36	3771	12
2010	8150	92	6918	43	3056	264	2206	133	3474	16
2011	9217	58	7268	72	3836	304	2363	194	3239	22
2012	8828	20	7045	25	4511	127	2549	73	5127	18
Total	**70270**	**450**	**89328**	**346**	**56960**	**2637**	**32170**	**1218**	**50136**	**187**

Source: Turkish social security institute statistical yearbooks

Table 2. Annual number of workers and occupational accidents rates in the coal mining sector in Turkey

Years	Number of workers	Public sector	Private sector	Private sector employment rate	Number of occupational accidents	Occupational accident rate
2001	42857	29613	13244	%31	7104	%16,5
2002	42541	24.999	17542	%41	6587	%15,4
2003	38053	20203	17850	%46	5647	%14,8
2004	38492	18248	20244	%53	5481	%14,2
2005	40390	16857	23533	%58	6011	%14,8
2006	43585	16470	27115	%62	6722	%15,4
2007	43389	15170	28219	%65	6293	%14,5
2008	49487	15051	34436	%69	5728	%11,6
2009	51975	14634	37341	%71	8193	%15,7
2010	50143	13.757	36.386	%72	8150	%16,2
2011	51662	13.401	38.261	%74	9217	%17,8
2012	50949	12.750	38.199	%75	8828	%17,3

Source: Turkish social security institute statistical yearbooks

and decreased in different years, the changes are small between years. On the other hand, standardized occupational accident rate in coal mining sector increased 246% from 2001 to 2012 (see Table 3). Besides, while the rate tended to decrease from 2001 to 2004, it began to increase again and rapidly after 2004. The rate of increase reaches 263% from 2004 to 2012. After the regulations in Mine Act in 2004, it is observed that the number of occupational accidents increased related with the increasing of private sector rate and privatizations via mining lease agreements (see also Figs. 1 and 2).

Turkish Republic aimed to increase the coal production which was begun in "Eregli Basin" in 1850's. Thus, mining laws included the first legislations about occupational health and safety. After the great mine accidents occurred in the beginning of 1980's, technological investments were made for occupational safety in public mines and some partial measures were developed in order to increase the workplace safety level. Privatization and subcontractor system practices, which was begun in order to increase the production in 1990's, increased with the new regulations in 2004, rapidly. A great number of companies began to be active in mine basins that have single-handed management and financial support. Many related reasons such as small-scale mine enterprises, mine pits that don't have adequate technical equipment for their production aims, old-fashioned mechanization systems, insufficient number of expert technical personnel, negative attitude of enterprises about occupational safety, insufficient inspections in mine pits, may increase the number of great and deathly accidents [38,39,40,41].

Although there are regulations in 1985 Mine Act for privatization of mines, because legal basis is not completely finished, privatization process could not accelerate. The legal obstacles for assignment of mines to the private sector were removed in 2004 regulations in the Act with the help of mining lease agreements. General Directorate of Turkish Coal (TKI) and General Directorate of Turkish Anthracite (TTKI) encourage the private sector instead of establish new mine pits, thus, the share of private sector and employment increased after 2004. Nevertheless, tens of illegal mine pits are established due to the deficiency of inspection of the government. Registration process is made easier for establishing mine pits and thus, hundreds of workers died and injured in these mines due to insufficient technological investments and measures on occupational safety [37,39,40,41].

A purpose of mining lease agreements is to prevent illegal coal mining. However, illegal coal production could not be removed but continue in different ways. The lessee companies legalize the illegal mine companies.

The companies that prepare mining lease agreements give the mine field to subcontractor after renting or it allows other companies to establish other mine pits in the field. Tools, which are not flameproof, are used in the fields that are given to the subcontractor company by lessee companies and the fortification and ventilation are not at an adequate safety level.

Table 3. standardized occupational accident rates in sectors that most occupational accidents occur in Turkey

Years	Coal mining	Metal products manufacturing	Construction	Transportation/ shipping	Textile
2001	1.119,40	395,5	83,8	87,4	150,2
2002	1.117,90	373	81	82	155,5
2003	1.086,90	377	88	80	148,7
2004	1.049,90	395,3	79,5	76,2	134,1
2005	1.392,90	398,6	65	80,4	146,9
2006	1.525,90	396,9	59,6	85,2	137,1
2007	1.530,50	384,6	64,4	83,1	159
2008	1.396,49	237,41	214,84	62,38	130,6
2009	2.213,23	316,21	89,64	80,74	159,75
2010	2.591,96	340,85	59,51	70,82	155,4
2011	2.842,96	232,72	65,35	72,35	131,48
2012	2.763,14	313,96	70,08	66,52	190,05

Source: Turkish social security institute statistical yearbooks

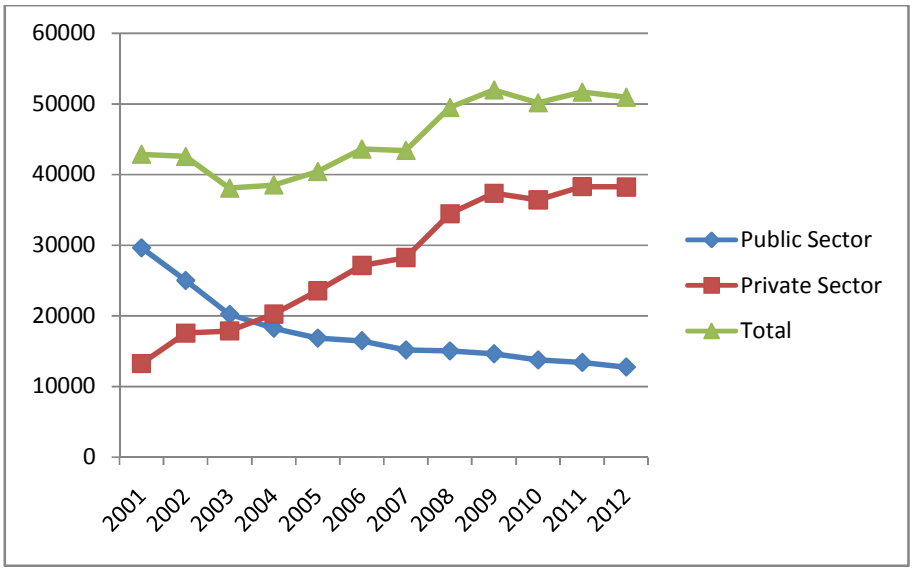

Fig. 1. Development of private sector employment in coal mine sector in Turkey

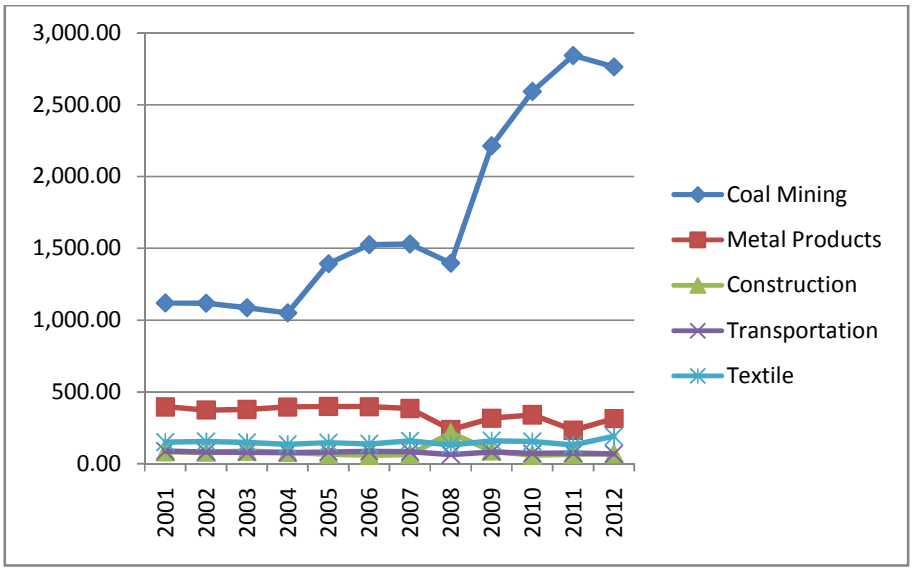

Fig. 2. Annual changes of standardized occupational accident rates in most occupational accidents occur in Turkey

The necessary equipment is bought among unexploited and scrapped equipment of public coal mines. Old wooden bonds are reused for fortifications in mine pits. Because of ventilation system requires an additional investment, lessee companies don't prefer to open long drifts. Thus, the working conditions are not sufficient for workers' health and safety. Uninsured employees are employed in illegal mine pits, commonly. The wages are very low and working hours are long. Besides, the workers are not unionized. The coals in the region generally tend to burn and explode due to their chemical characteristics. Although strict inspections are needed on measures for working conditions, illegal production cannot be inspected in an adequate level [37,40,41,42,43].

4. CONCLUSION

Coal mining is the most difficult and risky sector in Turkey. Deficiencies in Turkish mining sector

such as knowledge, experience, expertise and inspection cause serious and great accidents especially in underground coal mining.

The rate of the employment of private sector in coal mining increased from 31% to 75% in the period of last 12 years. On the other hand, occupational accidents increased rapidly in coal mining sector since 2004 in comparison with the other sectors. Since 1992, 11 of 12 great accidents occurred in the coal mines that are operated by private sector enterprises and 937 workers died due to firedamp explosions and fires. A great increase have occurred in occupational accident rates in coal mining industry in Turkey due to the increase in private sector employment rates. Most of the coal mines are operated by lessee private sector enterprises, however, coal production is made without taking adequate measures in the basins. This poor conditions leads to great industrial accidents that resulting death of the workers.

Comprehensive changes have been made on Mine Act in 2004 and 2010 and some public coal fields' operating rights were assigned to the private sector by "mining lease agreements". Thus, subcontractor system became widespread in coal mines. The main reason of unsafe working conditions in the mines is assignment of the mine pits to the private sector via mining lease agreements without the necessary investments for establishing safe working areas and using modern production techniques. Mining productions are assigned to the companies that are incapable of experience and expertise, thus, not only the mine sources are wasted by inappropriate production methods but also the number of occupational accidents increases.

Turkey needs a new mining sector strategy from the point of need for the sector and economic losses caused by occupational accidents. Thus, Turkey must sign the "Safety and Health in Mines Convention" (No. 176) of ILO firstly and an action plan, that defines the existing conditions and measures, must be developed and applied as in the USA and China.

It is observed that the number of occupational accidents and deaths is related with using modern systems and technologies used in the mines. In a study in which a modern and a traditional mine are compared, it is proved that new technologies increase the efficiency and decrease the number of accidents. Systematic education programs are also considered extensively in order to develop occupational safety.

Infrastructural and technological problems such as problems in ventilation systems, inadequacy of escape routes and personal protective equipments, deficiencies in applications of modern production methods and production plan and project are the main reasons of accidents and deaths. However, it is possible to prevent work-related accidents and deaths occurring in coal industry in Turkey.

There are some uncertainties in the legislation of occupational health and safety in mines. Thus, there are some differences in safety applications and due to the competition in the sector, the private sector enterprises are deaf to the occupational safety measures. For instance, it is ascertained that although the fire had been continuing for a long time in Soma accident, no measurements are had been taken. Legislations on mines must be revised and detailed and all of the technical and organizational details must be determined strictly.

Increasing the production in current conditions causes great and fatal accidents in coal mining sector. Coal mines are strictly controlled and basin planning should be initiated. Performing risk analysis showing the existing conditions in coal mines is very important. According the results of risk analysis, the mine pits with the poor conditions must be closed or must be taken necessary preventive measures. Safety-related conditions must be provided before licensing of coal mining. Costs related to occupational safety should not be considered as a "cost". Technical supervisors and safety experts should be employed in mines. Mine workers should be trained regularly.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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