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Review Article

Evaluation of Hazardous Wastes in Terms of Occupational Health and Safety, and Environmental Ethics

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Abstract

Considering the two concepts of environment and human from a historical point of view, they are two interconnected formations that cannot be separated from each other, and which have influenced each other throughout history. The purpose of the article is to evaluate the concept of "environment" in which many living beings and non-living objects can affect each other endlessly, and humans who have an organic connection with the environment since its existence, develop biologically and socially due to this bond, and who used the environment throughout its development and dragged this "environment" to extinction with the destruction it has created. It will also be narrowed these concepts and try to evaluate the sub-headings of occupational safety in terms of people in business life, and hazardous waste management, which is not very ecocentric in terms of the environment and companies. Furthermore, the results were tried to evaluate in the example of a factory producing hazardous waste in the scope of environmental ethics, which has almost no impact on working life conditions.

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Çevresel Eğilimler ve Ekolojik Perspektif Açısından; Toprak Yönetimi ve Pestisit Kullanımı ile Gübre Talebi ve Ekosistem Çeşitliliği Analizleri

Özet

Çevre ve insan kavramlarına tarihsel açıdan bakıldığında, tarih boyunca birbirini etkilemiş, birbirinden ayrılamayan, birbirine bağlı iki oluşumdur. Makalenin amacı, birçok canlı ve cansız varlığın birbirini sonsuzca etkileyebileceği ve var olduğu günden itibaren çevre ile organik bir bağı olan insanın, biyolojik ve bu bağı, gelişimi boyunca çevreyi kullanan ve yarattığı tahribatla bu "çevreyi" yok olmaya sürükleyen kimdir? Ayrıca bu kavramlar daraltılarak iş hayatındaki insanlar açısından iş güvenliği, çevre ve şirketler açısından çok ekosentrik olmayan tehlikeli atık yönetimi alt başlıkları değerlendirilmeye çalışılacaktır. Ayrıca çalışma hayatı koşullarına neredeyse hiç etkisi olmayan çevre etiği kapsamında sonuçlar tehlikeli atık üreten bir fabrika örneğinde değerlendirilmeye çalışılmıştır.

Anahtar Kelimeler
Toprak Yönetimi
Gübre Talebi
Pestisit Kullanımı
Ekosistem Çeşitliliği
Çevresel Etki Analizi

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INTRODUCTION

Having started to experience the golden age of production with the industrial revolution, people began to exploit both the environment and the humans, with the acceleration in production and the greed for profit. The growth and expansion of production, the change in production, and the exponential expansion of the commodity concept accelerated the commoditization of both the environment and humans [1]. Although the increase in industrialization, especially in cities, is one of the causes of environmental pollution, one of the main sectors of occupational accidents and occupational diseases are again industries. Although there have been positive developments in both fields in the last two centuries, it is a matter of debate where and how effective the legislative developments, management practices, standards and policies applied in the industrial enterprise that we will examine are. What makes this controversial is how much value positive practices are given when we evaluate them in terms of environmental ethics. In particular, the fact that the damage to the environment is now irreversible, while the continuity of human labor and the reproduction of humans as cheap labor has been placed in the first place as a more urgent issue by the "policymakers" who make up the world's environmental policies [2]. With the impact of industrialization, the increase in production, and, as a natural consequence, the increase in waste has also brought about, and waste has become a serious problem for both the environment, nature, and humanity. Both in social and business life, people have faced many wastes, and the dangerous parts of these wastes have seriously endangered their health.

Since the related law in our country is carried out by different laws and regulations, ministries, and inspectors, the risks arising under the scope of hazardous waste are evaluated in different ways in terms of environment and human health. But with the integration of internationally applied standards, which also have many examples and applications in Turkey, these processes have provided ease of implementation as a whole. Combining the ISO 14001 Environmental Management System and the ISO 45001 Occupational Health and Safety Management System within integrated management systems, and the elimination of risks that may arise in terms of both environmental health and occupational health, and safety within these management systems based on a voluntary basis of companies have been evaluated without separating them. However, environmental, and occupational health and safety practices in Turkey are not of the same standard and quality in every company. In this article, it is aimed to contribute to the purpose of re-evaluating occupational safety and hazardous

waste management practices used in working life by taking into account neglected environmental ethics principles and creating a new method.

Occupational Health and Safety / Concepts Involved in Hazardous Waste Management

Occupational Health and Safety: According to the International Labor Organization (ILO), It is defined as "to maximize the physical, mental and social well-being of employees in all occupations, to maintain them at this level, to prevent the deterioration of health of employees due to working conditions, to protect workers from dangers caused by unhealthy factors during employment, placing the employees in the most suitable occupational environment for their physiological and psychological conditions. "On the national scale, occupational safety is defined as scientific and systematic studies conducted to protect workplaces from situations that will harm health for various reasons during the performance of work.

Hazardous Waste: The concept of waste is defined in our legislation as any substance or material that is disposed of or left in the environment by a natural or legal entity who is its manufacturer or actual owner, or must be disposed of, while it can be defined as "an object that has no direct use, is permanently disposed of and can move. ‘’ by another short definition. [3] As for hazardous waste, in the Basel Convention; it is defined as ‘waste that is harmful to all living organisms or potentially harmful to them or new waste structures that may be formed as a result of the combination of waste that may be formed.’ [4] Wastes that contain many factors that will harm the environment and human health can be defined as “Hazardous waste”.

Risk Assessment: It refers to the studies that need to be carried out in order to identify the hazards that exist in the workplace or hazards that may come from the outside, the factors that cause these hazards to turn into risks, and the analysis and grading of the risks arising from the hazards, and to decide on control measures [5]. Environmental risk analysis or environmental risk assessment and its applications were also included in our working life with the environmental management system. The methods used when conducting an environmental risk assessment are almost identical to the methods used in occupational health and safety. The objective of the environmental risk assessment is to evaluate how the environment and the elements that make up the environment (living and non-living) will be affected as a result of an accident that will occur in the company at the production stage (pre-production and post-production are included in this phase), to evaluate how severe these effects will be, and

to determine the measures to be taken to prevent these accidents and how the considered risks will be eliminated. No matter which method is used when conducting risk assessments, the most important element is that they should have a proactive approach.

Hazardous Waste Management: Waste Management in Waste Management Regulations refers to, the 'prevention of the formation of waste, waste source reduction, articulation, collection, temporary storage, transport, handling, interim storage, recycling, recovery including energy recovery, removal, and disposal operations after the monitoring, control, and audit activities '' [6]

The first thing to do in successful hazardous waste management is to classify the waste correctly. When classifying, there are different waste classification methods in two centers such as the USA and the EU. The first of these methods is the properties approach. This approach is the testing of certain characteristics and the classification made according to the hazard characteristics as a result. Another approach, called the lists approach, is the classification of wastes using a source list or catalog where the formation process is certain.

Table 1. Hazardous waste classification in EU directives

H1	Explosive
H2	Oxidizer
H3A	Highly Flammable
H3B	Flammable
H4	Irritant
H5	Harmful
H6	Toxic
H7	Carcinogenicity
H8	Corrosive
H9	Infectious
H10	Harmful to the Reproductive System
H11	Mutagenic
H12	Releases Toxic Gas in Contact with Water, Air or Acid

H13	Sensitizer
H14	Ecotoxic
H15	Which Reveals a Hazardous Substance After Its Disposal

In Turkey, the situation is carried out according to the Waste Management Regulation prepared on the basis of EU directives (see Table 1). Fifteen hazard characteristics found in the regulation have been determined and according to the same regulation, 839 waste codes have been determined in the total of twenty main headings and sub-headings below these headings. The designated waste codes consist of six-digit numbers. The first two digits of these six digits give the sector, the middle two digits give the sub-sector, and the last two digits give the code of the waste. If the six-digit waste codes consist of a '*' sign after the last digit, these wastes are designated as hazardous waste. In the list, wastes with the letter 'A' in the description section are classified as definite hazardous waste, wastes with the letter 'M' in the description section are classified as probable hazardous waste; wastes with the letter 'N' are classified as probable non-hazardous waste, and wastes without any letter in the description section are classified as non-hazardous waste [7]. The measures to be applied in the waste management hierarchy are as follows in order of importance.

- Prevention
- Reduction
- Re-Use
- Recycle
- Energy Recovery
- Disposal

Environmental Ethics: It has been revealed by environmentalist thinkers who believe in the importance of the environment and ecological balance, that humans are the only ones responsible for activities on natural balance [8].

Human Centrist (Anthropocentric) Ethics: The anthropocentric ethical approach puts humans at the center and brings to the forefront that the environment should be protected for humans. Measures and action plan to be taken in order to establish policies to protect the environment based on anthropocentric ethical principles, that is, to prevent environmental

disasters; requires that the benefits that a person can obtain from the environment, or their vital activities are in danger [9].

Biocentric Ethical: Puts the concept of "alive" in its center, which is different from the human-centered ethical approach. These are ethical approaches that describe human beings as only a part of the whole of nature-dependent creatures and as a result, argue that other living things apart from the human species can have rights as valuable as humans and even like humans [10].

Environmental Centrist (Ecocentric) Ethics: It is the concept that focuses on the ecosystem and creates a living and non-living unity. The ecocentric approach argues that all forms of life (plants, animals, and other ecosystem members) have equal rights. In this context, humans do not have any priority or disparity. This basic perspective of ecocentrism is an ideological opposition to the understanding that sees nature as a potential source [11].

MATERIAL AND METHOD

Material

This study, which includes the subject of Evaluating Occupational Health and Safety in Hazardous Waste Management within the framework of Environmental Ethics, continues with a re-evaluation of the ‘reality and environmental ethics of these data, which are used by numerical data on the identified nonconformities in the field.

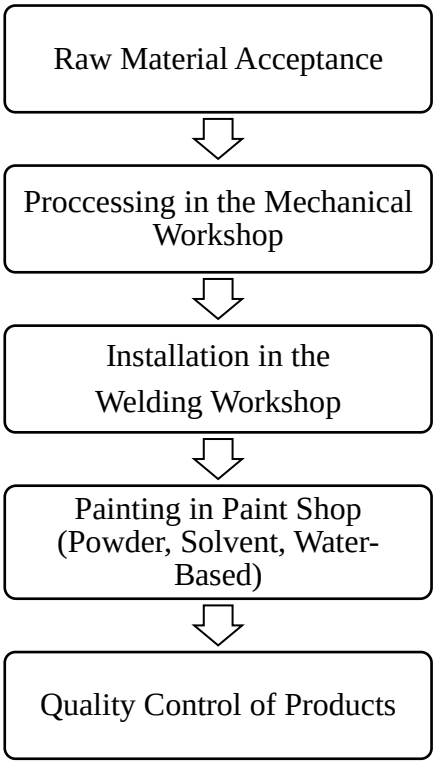

Figure 1. Process Flow Chart in Manufacturing

The process flow chart for the company is given in Figure 1. The paint and metal processing departments of the company operating in Ankara, where wastes are mixed without being separated at the construction site and landfill without applying hazardous waste management, were re-established by considering the environmental ethics of hazardous waste management.

Table 2. Hazardous waste code and definitions

Waste Code	**Waste Code Definition**	**Explanation**
08 01 11*	Waste paints and varnishes containing organic solvents or other hazardous substances.	M
12 01 09*	Halogen-free processing emulsions and solutions	M
12 01 20*	Grinding parts and substances containing hazardous substances	M
15 01 10*	Packaging containing hazardous material residues or contaminated with hazardous materials.	A

In the pilot company, a risk assessment of hazardous waste, given in Table 2, has been carried out to determine the risks that will affect both environmental and human health.

Method

Risk Assessment Methodology: The methods used when conducting a risk assessment are divided into three main headings: quantitative, qualitative, and mixed methods.

When conducting a quantitative risk analysis, numerical data are used in the calculations. These numerical data can become subjective depending on the conditions such as the expert's experience and knowledge, so the importance of working as a team in quantitative risk analysis is a lot.

When conducting a qualitative risk analysis, expressions are used and a verbal assessment is made. When qualitative risk analyses are used before quantitative risk analyses, performed risk analysis becomes more effective. Many methodologies are used when evaluating risk, and these methodologies have yielded more successful results depending on the nature of the work done. The methods used as an example are given below.

- The Fine-Kinney Method
- L-type matrix
- Failure mode and effects analysis (FMEA)
- Hazard and Operability Analysis (HAZOP)
- X-type matrix
- Event tree analysis
- Preliminary hazard analysis, etc.

The Fine-Kinney Method: The Fine-Kinney method was introduced by Fine in 1971 and was developed and finalized by Kinney and Würth in 1976. In order to reach the risk score in the Kinney method risk assessment, three headings are multiplied by each other.[12]

Risk: Probability x Frequency x Severity

The definitions of the values that make up the risk score are important for the reason that the emerging quantitative data without knowing the exact definitions, will be wrong. Three values in our methodology have separate scales, these are presented in Table 3, 4 and 5.

Table 3. Probability: the probability of an accident or damage when the danger is revealed.

Probability	Value
Expected, Certain	**10**
Quite Possible	**6**
Rare But Possible	**3**
It's Unlikely, But Possible	**1**
Very Low Probability, Not Expected	**0.5**
Practically Impossible	**0.2**
Almost Impossible	**0.1**

Table 4. Frequency: the frequency of occurrence of danger

Frequency	Value
Perpetual	**10**
Frequent (Once A Day)	**6**
Occasionally	**3**
Not Often (Once A Month)	**2**
Rare (Several Times A Year)	**1**
Very Rarely (Once A Year Or Less Often)	**0.5**

Table 5. Severity: The severity of the consequences that occur in the event of an accident.

Severity	Value
A Disaster And An Environmental Disaster In Which There Were Many Deaths	**100**
Multiple Fatal Accidents And Severe Environmental Impact	**40**
Very Serious Injury And Environmental Impact That Will Result In Death	**15**
Serious Injury (Limb Loss, Permanent Health Problems), Mild Environmental Impact	**7**
Significant Injury	**3**
Minor Injury, First Aid	**1**

Table 6. The risk assessment scale

Risk	The Result Of Risk Assessment
R>400	Very Serious Risk: Work Should Be Stopped And Necessary Measures Be Taken Immediately.
200≤R≤400	Serious Risk: Precautions Should Be Taken Immediately.
70≤R≤200	Important Risk: Precautions Should Be Taken.
20 ≤ R ≤ 70	Possible Risk: The Process Should Be Kept Under Observation.

R ≤ 20	Insignificant Risk: The Measure Is Not A Priority.

Risk Score: The risk score, which is calculated by multiplying the three above-mentioned titles with each other, is used in order to rank the measures to be taken, while the scale given in Table 6 is used to layer the steps of prevention [13]. The risk assessment of the company is given in Table 7.

Table 7. The risk assessment of the company

EVALUATION TABLE					RATING TABLE								PRECAUTIONS SECTION				LAST SITUATION								
					RISK ASSESSMENT			RISK RATING									RISK ASSESSMENT			RISK RATING					
					F	O	S	O	O	3	O	3					F	O	S	1	7	O	O	O	
NO	EPISODE	DANGER OR SOURCE OF DANGER	RISK	AREA OF IMPACT	FREQUENCY	PROBABILITY	SEVERITY	5	4	3	2	1	PLANNED MEASURES / ACTIONS	RESPONSIBLE	TERMIN	DATE OF REMEDY OF CONFORMITY	FREQUENCY	POSSIBILITY	SEVERITY	5	4	3	2	1	
1	PRODUCTION	Lack of Chemicals Msds	Injury due to Not Knowing the Intervention in Case of Chemical Exposure, Improper Storage	Environment and Human	6	6	7				252		Obtaining MSDS of Chemicals from Supplier and Posting of MSDS Summaries in Work Areas	Employer/Employer's Attorney	Now	-	6	0,5	7		21				
2		Insufficient Warehouse Ventilation	Reaching Flash-Explosion Point of Chemical Gas-Vapors, Inhalation, Fire	Environment and Human	6	6	15					540	Ensuring Adequate Ventilation of the Chemical Storage in order not to Cause Fire and Poisoning	Employer/Employer's Attorney	Now		6	0,5	15		45				
4		No Ex-Proff of Electrical Installation	Flash-Explosion-Fire	Environment and Human	6	6	15					540	Ensuring Ex-Proff of Electrical Installation in Flammable Explosive Environments	Employer/Employer's Attorney	Now		6	0,5	15		45				
6		Side-by-side Storage of Interacting Chemicals	Chemicals React	Environment and Human	6	3	7				126		Ensuring that the substances that can react according to the properties of the chemicals are stored in separate sections under the conditions specified in their Msds	Employer/Employer's Attorney	Now		6	0,5	7		21				
8		Undefined Section with Chemicals	Unsafe Behaviors Due to Not Knowing the Danger in Emergency Situations	Environment and Human	6	6	7				252		Providing Identification of the Department with Chemicals	Employer/Employer's Attorney	Now		6	0,5	7		21				
9		Leaving Chemicals Agape	Evaporation, Overturning of Chemical	Environment and Human	3	6	7				126		Keeping Your Mouth Closed When Not Using Chemicals	Employer/Employer's Attorney	Now		6	0,5	7		21				
10		Absence of Warning Signs	Flash-Explosion-Fire	Environment and Human	10	6	7					420	Ensuring the Hanging of Warning Signs such as 'Do Not Approach with Open Flame', 'No Smoking', 'Danger'	Employer/Employer's Attorney	Now		10	0,5	7		35				
11		The Floor of the Chemical Warehouse is Not Easy to Clean	Exposure to Chemicals, Fire	Environment and Human	3	6	7				126		Ensuring that the warehouse floor is easy to clean in order not to be exposed to chemicals in cases of chemical spills etc.	Employer/Employer's Attorney	Now		3	0,5	7	11					

The gas measurement and the measurement of volatile organic compounds carried out within the scope of occupational hygiene measurements carried out in our company were performed once a year and concluded as follows;

Table 8. The gas and volatile organic compounds measurement of the company

No	Measurement Location/ Work and Person	Device Location	Temperature (C^o)	Moisture (%RH)	Pressure (hPa)	Altitude (m)	Chemicals detected in the location	Measurement Value	Limits	Limits Under/ Above
1	Dye House Section,	Respiratory level	14,6	38,6	993	893	Butanol	<LOD	150	Under
							Acetone	<LOD	1210	Under

	Painting Person						Benzene	<LOD	10	Under
							Chloroform	<LOD	308	Under
							Dichloromethane	<LOD	1900	Under
							Dietileter	<LOD	1400	Under
							Ethanol	<LOD	-	Under
							Ethylacetate	<LOD	2085	Under
							Isooctane	<LOD	15	Under
							N-Heptane	<LOD	435	Under
							Pridin	<LOD	190	Under
							P-xylene	<LOD	150	Under
							Toluene	<LOD	450	Under

Table 9. The gas and volatile organic compounds measurement of the company

No	Measurement Location/ Work and Person	Device Location	Temperature (C°)	Moisture (%RH)	Pressure (hPa)	Altitude (m)	Chemicals detected in the location	Measurement Value	Limits	Limits Under/ Above
1	Weld House, Welding Person	Respiratory level	17,1	41,3	1002	893	Butanol	<LOD	150	Under
							Acetone	<LOD	1210	Under
							Benzene	<LOD	10	Under
							Chloroform	<LOD	308	Under
							Dichloromethane	<LOD	1900	Under
							Dietileter	<LOD	1400	Under
							Ethanol	<LOD	-	Under
							Ethylacetate	0,403	2085	Under
							Isooctane	<LOD	15	Under
							N-Heptane	<LOD	435	Under
							Pridin	<LOD	190	Under
							P-xylene	<LOD	150	Under
							Toluene	<LOD	450	Under

As a result of measurements made in the dyeing department, it was found that volatile organic compounds appeared below the limit values, and it was found that the company did not encounter any results in the working environment that was not appropriate for environmental health and occupational health in accordance with this report.

RESULTS and DISCUSSION

In the measurement made in our company, which is an example as a pilot, it is seen in the Table 8 and 9 that the organic chemicals, which are dangerous, are below the limit values in the air. It has been determined that the products and working hours in mass production in a closed environment are greatly exceeded, and the production of eight hours a day continues without interruption in the enterprise, where the concept of overtime is normalized. It has been observed that the dyehouse is not separated from production, the source area is intertwined with other products; chemicals such as welding gases, powder paint, solvent paints, thinner primers, etc. are not filtered out of the environment through any ventilation, there is no hazardous waste management, and the wastes remain for days without being separated by the chemicals used in the production area. As seen Table 7, the results of these study revealed that the "ethical concept" should be the key point in terms of both the environment and occupational safety, based on the emerging normal results in the intensive production environment and pollution in the soil due to the overlooked hazardous waste formations (cooling liquids used in CNC benches which are given directly to the sewer system or poured into the ground in pieces or flowing into the working environment while being transported from the IBC panels where the cooling liquids are stored to the workbenches).

The measurements to be made (occupational hygiene or environmental measurements) are the results of the risk assessment studies to be carried out by the risk assessment team, where there are no mandatory periods in the regulations. The measurements are made at the request of the inspector within the scope of the recommendation of the occupational safety expert working in the company or under the supervision of the inspector. Since the risk assessment and the recommendation of the expert do not constitute a direct sanction authority, these measurements, which are generally requested, are delayed as much as possible by the company managers. The reports prepared at the request of the labor inspectors coming to the companies are made in the additional period given by the inspectors to close the deficiencies that emerged after the first inspection; companies carry out measurements by making an

appointment with authorized laboratories for measurement. It is also possible that the owner of the company that made the measurement pressures the laboratories to create changes in the resulting reports, by reducing the production or stopping the production, since it is known that the results of the measurements will go to the labor inspector since the measurements are done planned and informed. The results of the study show that human health is partially brought to the fore, the results and parameters are evaluated according to human health, and the damage done to the environment is ignored. Policies and practices that have been created considering practices that are actually harmful to the environment will not affect human health indirectly or directly are one of the main situations that we often encounter in small and medium enterprises. In small businesses where waste management is not implemented, it is observed that the presence of hazardous wastes poisons the working areas where the employees live and produce, and these poisonings are shown unproblematic in reporting. While varnish, primer, coolant resulting from machining, powder paint particles, solvents and vapors, and hazardous waste packaging[15], which are classified as hazardous waste, pollute not only people, but also living and non-living soil, air, and the water they mix with, evaluating the results of the report in terms of occupational health and safety as if human health will not be affected by the environment in which they live, actually casts a shadow on the sincerity of the studies.

The fact that the results of the report belong only to the moment of measurement and the production during the year is not calculated, it is not taken into account that the hazardous wastes are increasing gradually without a disposal method. As long as employees are in this environment, the damage they will see will obviously increase continuously without any disposal method. Since the pressure of the legislation to be applied for the renewal of the reports is not enough and will create a certain cost, it is unlikely that it will be repeated during the year. Measurements made only once during the year show that the company does not constitute impropriety in terms of its regulatory obligations.

In the field where quality management systems are kept only as documents, it has been seen that there are no areas of application of management systems standards in our pilot company. There are no waste management practices in our company, which has environmental and occupational safety quality management standard certificates. Although the company that does not make a waste declaration has taken occupational health and safety training within the scope of the company, training such as basic environmental training and zero waste practices were not provided.[16] This situation had a negative impact on environmental awareness and environmental culture that should be created in the employees,

and as a result, the practices applied by the employees who did not receive any environmental training were formed without caring about environmental health. The fact that the employees of the company do not know about the policy created by a company with an environmental management system is that the EMS exists only as a document and its task is used to enter into tenders.

CONCLUSION AND RECCOMENDATION

As can be seen from the example of the pilot company, the risks identified in the company within the scope of the risk assessment conducted are the risks posed by both production and wastes generated as a result of production as a whole. The company, which was chosen as an example, is just one of the many companies that are non-corporate, focused on production and profit, and characterized as a small business. Although the level of environmental impact is not much on its own, the number of companies working in this way in industrial centers is quite large, and it is obvious that the measurements and results made on paper do not correspond in the field, and the applications made without the priority of environmental ethics will be insufficient.

In the audits, the desired measurement results should be spread over the entire production year and inappropriate processes found based on these measurement results should be determined, approaches to the appropriate process should be increased. The number of measurements should be increased and all elements of the production area should be measured in the reports, the integration of occupational health and safety management and environmental management should be increased, and the evaluations should not be separated from each other in terms such as environmental health and human health, but should be evaluated as a whole and they should not be separated with sharp boundaries not only at the level of companies but also within the scope of ministries and inspectors. The principles and ethical aspects of the above-mentioned practices in production are practices in which people are centered and evaluated.

These approaches need to be put into practice by calculating the damage not only to humans but also to the ecosystem. The environment and humans should be evaluated as a whole and the organic link between them should not be forgotten. While determining the environmental and occupational safety policies, it should be considered that the focus of the ethical approach is shifted away from people and focused on the ecosystem, and the environmental awareness that will be created will be more inclusive. With the development

of such perspectives that focus on parts from the whole, applications will emerge that will positively affect not only humans but also all parts of the ecosystem, whether living or non-living.

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