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A Case Study on Istanbul Electronic Waste Firms: ISO 14000 Environmental Management

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Abstract

Due to the limited natural resources and increasing needs, the activities carried out have negative effects on the environment. This situation has revealed the necessity for controlling environmental effects with legal practices. Consumers now expect businesses operating in the market to meet their increasing needs at the highest level and to respect the environment. The environmental management system has emerged in order to keep the environmental impacts of businesses under control in order to exist in the global market and to ensure the continuity of their existence. With the environmental management system, it aims to reduce the harmful effects of the enterprises to the environment by systematic stages and to eliminate these effects. In this study, a survey was conducted in order to reveal and evaluate the relationship between the factors affecting the transition to the ISO 14000 environmental management system and the improvements achieved. It has been determined that the companies are not obliged to obtain the documents because the audit is not sufficient in obtaining the ISO 14000 certificates, which are required by the laws of the electronic waste recycling companies.

Keywords: ISO 14000 Environmental Management System Standards, E-Waste, Electronic Waste Firms, Occupational Health and Safety, Recycling

1. INTRODUCTION

Electronic equipment waste is increasing day by day due to the rapid population growth, increasing consumption practices. Electrical and electronic devices, such as televisions, mobile phones, refrigerators, computers, video recorders, coffee machines and devices used in the health field, that provide convenience and comfort to modern life, have become an indispensable part of modern life. However, they are turned into waste at the end of their useful life due to reasons such as rapidly changing technology, short lifespan and limited repair options (Montalvo et al., 2016; Ahirwar et al., 2021). It has been observed that the use of mobile phones and the internet has

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increased significantly in the last decade. According to the Digital 2020 report; as of July 2020, there are 5.15 billion mobile phone users and 4.57 billion internet users globally and about 60% of the world's population used mobile phones and the Internet. In line with the data obtained from the report, it is seen that mobile phone and internet users increased by 2.4% and 8%, respectively, compared to the previous year's data (Kemp, 2020).

Electronic waste consists of many different equipment that is disposed of by connecting to electric current, including household appliances, communication technology devices or transportation products that contain different toxic chemicals. (URL1, URL2, URL3). Persistent toxic substances such as Polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), polybrominated biphenyls and polycyclic aromatic hydrocarbons (PAHs), have been detected widely in electronic waste (Kaifie et al., 2020; Liu et al., 2020; Li et al., 2022). In addition to, electronic waste consists of various materials and contains many harmful elements such as CFC, arsenic, barium, cadmium, cobalt, copper, lead, lithium, mercury, nickel, polychlorinated biphenyls, selenium, silver, zinc and more. Recovery materials such as iron, aluminum, gold and copper can be recovered from electronic waste (Forti et al., 2020; Hsu et al., 2021). It is aimed to make electronic wastes reusable with legal regulations and it is stated that the environmental impact can be reduced by gradually reducing the waste generation rate (Risco et al., 2021).

It is stated that the annual production of electronic waste produced globally is growing by 5-10% per year, while the recovery rate is only around 10% (Forti et al., 2020). According to the European Plastics Manufacturing Association, the material composition of EEE is 38% iron, 28% non-ferrous, 19% plastic, 4% glass, 1% wood and 10% others. Modern electronics can contain up to 57% different elements; many are valuable, some are dangerous, and some are both valuable and dangerous. (Kaya, M., 2018). Electronic wastes become hazardous wastes with arsenic, heavy metals, asbestos, chlorofluorocarbon, halogenated compounds, chlorinated biphenyls (PCB), brominated flame retardants and polyvinylchloride (PVC). Volumetric production of electronic waste, hazardous metals (Lead (Pb), Mercury (Hg), Cadmium (Cd), Tin (Sn), Antimony (Sb), Arsenic (As), Asbestos (As), Barium (Ba), Beryllium (Be), Chromium (Cr-vi), Nickel (Ni) etc.), it poses a threat to waste treatment institutions because it contains inorganic and organic compounds. While the hazardous materials used in electronic waste are not released during regular use, they can pose a risk during waste processing and disposal. Therefore, special attention should be paid to the proper treatment of electronic waste. (Ylä-Mella et al., 2019). It is known that heavy metals such as chromium and cadmium contained in electronic wastes leak from the soil and mix with groundwater and drinking water to form pollution. If it is disposed of by incineration, fly ash and chrome mix with the atmosphere and cause air pollution.

It is known that electronic waste contains many components such as beryllium, hexavalent chrome lead, mercury, cadmium, brominated flame retardants, phosphorus and barium, which are harmful to health. Considering that the electronic waste produced is increasing day by day, it is thought that the risks that may occur on health may also increase. Especially these harmful components are known to have serious effects on the thyroid, lungs, nervous system and fertility (Grant et al., 2013). Therefore, proper e-waste management is a major concern. It is known that electronic waste recovery and management consists of stages such as collection, transportation, storage, final disposal of electronic waste (Yılmaz et al., 2006).

Electronic waste is recycled and reused, most of the substances it contains are recovered and are specified as a source of secondary raw materials. If they are not recycled, they are classified as toxic substances due to the components they contain (Çelik et al., 2007). The recycling process includes the stages of separation at source, separate collection of recyclable wastes, classification and bringing the new product into the economy.
The need for raw materials is reduced by reusing the materials consumed by the recycling process as raw materials, and the damage to nature is reduced. It has been seen that the lack of awareness

about environmental pollution has made informal processing dominant in electronic waste management and recycling practices in the developing world (Borthakur et al., 2015). With the developments in the world, specific legislation has been enacted in order to control electronic waste. In developed countries, environmental laws for recycling, recovery and disposal are very strict, and the cost of processing waste electrical and electronic equipment is very high compared to the recovery of waste electrical and electronic equipment materials. This high rate causes waste electrical and electronic equipment flow from developed countries to developing countries. This increases the amount of waste electrical and electronic equipment in developing countries and encourages informal disposal. To stop this practice, the international Basel convention was adopted in 1989 and entered into force in 1992 (Baxter et al,2016). Developing countries, on the other hand, use primitive methods such as open burning of waste electrical and electronic equipment, taking into account the lack of infrastructure or financing, in order to cope with these wastes (Ravindra, P., 2016).

This paper aims to reveal and evaluate the relationship between the factors that are effective in the transition to the ISO 14000 environmental management system, which electronic waste recycling companies have to take, and the improvements achieved. In this study, it was aimed to reveal the degree of improvement achieved in the processes and general performance of environmental management activities with the implementation of ISO 14000 standards. A survey was conducted with e-waste recycling companies in Istanbul, which volunteered to participate in the study, and the data were evaluated statistically.

2. MATERIALS AND METHODS

In this research, a poll was made for determining the importance of effective facts for passing to the environmental management system, practicing of ISO14000standards regarding the duration of environmental management activities, presenting and assessing improvements regarding general performance. The survey was carried out with volunteer electronic waste companies which are placed in Istanbul and data were evaluated statistically.

There are three main parts in poll form. The first part is about the importance of effective facts for practicing ISO 14000 environment management system. The second part is a perception about provided improvements which are obtained after practicing ISO 14000 environment management system. Third part consists of a questionnaire about specifications about company's structural and environmental activities and in every part, These questions are multiple choice with 5 Likert scales. The universe of the research is all electronic waste recycling companies in Istanbul. 4 companies with ISO 14000 certificates in Istanbul and 2 companies with no ISO 14000 certificates were selected and research are conducted.

3. RESULTS

A total number of participants which are on research is 6 due to the scope of research including Istanbul and attending to research is based on being a volunteer. It is indicated that four of them have ISO 14000 certificate and two of them haven't a certificate. In table, 1982, 2007,2013 and 2014 establish dated companies have ISO 14000 certificate. In the same table, 1990 and 2016 establish dated companies haven't got it. According to the Table 1, there is 102 employees in companies which have ISO 14000 environment management standards. There are 19 employees in small companies which haven't got a certificate. A total number of participants including employees is 121 people.

Table 1. Information about companies such as establish years, total number of employee, and about ISO 14000 environment management certificate.

Establish Year	Number of Employees	ISO 14000 Certificate	Issue Date of ISO 14000
1982	55	Available	2004
1990	8	Absent	-
2007	12	Available	Renew Every Year
2013	5	Available	2018
2014	30	Available	2015
2016	11	Absent	-

Table 1 shown the establish dates and issued date of certificates that 4 companies have ISO 1400 environment management system standards. The company which was established in 2007 and has 12 employees renews ISO 14000 certificates every year. The company which was established in 2014 and has 30 employees issued required ISO 14000 certificate after one year from its established date. The company established in 1982 was established before then all others and has 55 employees issued ISO 14000 certificate in 2004. The company which was established in 2013 has 5 employees issued ISO 14000 certificate in 2018.

In Table 2, 75% of the questions about the importance of the factors related to the attitudes and improvement expectations of the companies with ISO 14000 certificate in the internal processes related to the environment were asked as one of the most important reasons, while 25% of them considered it as one of the most important reasons. The question that is about recycling activities was answered by 75% as one of the most important reason and 25% of participants answered as it is a reason. The question that is about using our sources efficiently was answered by 25% as undecided and 75% answered as one of the most important reason. In that direction, the question that always provides improvements in processes was answered by 50% as it is a reason and the rest of 50% answered it as one of the most important reason.

One of the questions to activate waste management which is from importance of facts that attitude and expectation for improvements in duration environment activities of companies which haven't got ISO 14000 certificate was answered by 100% as one of the most important reason in table 3. The question that is about recycling activities was answered by an absolute 100% as one of the most important reason. The question that is about using our sources efficiently was answered by 50% as it is a reason and the remaining 50% answered as one of the most important reason. In that direction, the question that always provides improvements in processes was answered by 50% as it is a reason and the rest of 50% answered it as one of the most important reason.

Table 2. Importance of facts that attitude and to expectation for improvements in duration environment activities of companies which have ISO 14000 certificate.

Condition Assessment		Absolutely not a reason	Not counting as a reason	Undecided	It is a reason	One of the most important reason	Total
Activate waste management	**Frequency**	0	0	0	1	3	**4**
	Percent (%)	0	0	0	25.0	75.0	**100**
About recycling activities	**Frequency**	0	0	0	1	3	**4**
	Percent (%)	0	0	0	25.0	75.0	**100**
Using our sources efficiently	**Frequency**	0	0	1	0	3	**4**
	Percent (%)	0	0	25.0	0	75.0	**100**
Always provide improvements in processes	**Frequency**	0	0	0	2	2	**4**
	Percent (%)	0	0	0	50.0	50.0	**100**

Table 3. Importance of facts that attitude and to expectation for improvements in duration environment activities of companies which haven't got ISO 14000 certificate

Condition Assessment		Absolutely not a reason	Not counting as a reason	Undecided	It is a reason	One of the most important reason	Total
Activate waste management	**Frequency**	0	0	0	0	2	**2**
	Percent (%)	0	0	0	0	100	**100**
About recycling activities	**Frequency**	0	0	0	0	2	**2**
	Percent (%)	0	0	0	0	100	**100**
Using our sources efficiently	**Frequency**	0	0	0	1	1	**2**
	Percent (%)	0	0	0	50.0	50.0	**100**
Always provide improvements in processes	**Frequency**	0	0	0	1	1	**2**
	Percent (%)	0	0	0	50.0	50.0	**100**

In Table 4, one of the questions arising from the perceptions of companies with ISO 14000 certificate regarding the improvement of the processes related to environmental management activities was answered as 25% undecided, 75% as undecided, and 75% as the reason. The question that is about a great contribution has been made to the updating and effective implementation of our environmental management system was answered by 50% as undecided and other 25% answered as it is a reason. Remaining 25% answered as one of the most important

reason. The question that is about reductions in the amount of waste and pollution that may occur at the end of the processes was answered by 75% as it is a reason and other 25% answered as one of the most important reason. The question that is about improvements in social and environmental risk have been achieved by identifying the limits of responsibilities was answered by 75% answered as ıt is a reason and other 25% answered as not counting as a reason. The question that is about the expectations and criteria of the investor was fulfilled and thus the capital inflows were improved was answered by 25% as undecided, other 50% answered as it is a reason and remaining 25% answered as one of the most important reason.

Table 4. Perceptions about the improvement of processes related to environmental management activities of companies which have ISO 14000 certificate.

Condition Assessment		Absolutely not a reason	Not counting as a reason	Undecided	It is a reason	One of the most important reason	**Total**
There are improvements in recovery activities by reusing waste or reusing non-harmful waste	**Frequency**	0	0	1	3	0	**4**
	Percent (%)	0	0	25.0	75.0	0	**100**
A great contribution has been made to the updating and effective implementation of our environmental management system	**Frequency**	0	0	2	1	1	**4**
	Percent (%)	0	0	50.0	25.0	25.0	**100**
Reductions in the amount of waste and pollution that may occur at the end of the processes	**Frequency**	0	0	0	3	1	**4**
	Percent (%)	0	0	0	75.0	25.0	**100**
Improvements in social and environmental risk have been achieved by identifying the limits of responsibilities	**Frequency**	0	1	0	3	0	**4**
	Percent (%)	0	25.0	0	75.0	0	**100**
The expectations and criteria of the investor were fulfilled and thus the capital inflows were improved	**Frequency**	0	0	1	2	1	**4**
	Percent (%)	0	0	25.0	50.0	25.0	**100**

The most important reason was answered as the most important reason at the rate of 100% to the question that there are improvements in recycling activities through reuse of wastes or reuse of harmless wastes arising from the perceptions of companies that do not have ISO 14000 certificate to improve their processes related to environmental management activities. The question that is about a great contribution has been made to the updating and effective implementation of our environmental management system was answered by 100% as it is a reason. The question that is about reductions in the amount of waste and pollution that may occur at the end of the processes was answered by 50% as it is a reason and other 50% answered as one of the most important reason. The question that is about improvements in social and

environmental risk has been achieved by identifying the limits of responsibilities was answered by 100% as it is a reason. The question that is about the expectations and criteria of the investor was fulfilled and thus the capital inflows were improved was answered by 100% as it is a reason in table 5.

Table 5. Perceptions about the improvement of processes related to environmental management activities of companies which haven't got ISO 14000 certificate.

Condition Assessment		Absolutely not a reason	Not counting as a reason	Undecided	It is a reason	One of the most important reason	**Total**
There are improvements in recovery activities by reusing waste or reusing non-harmful waste	**Frequency**	0	0	0	0	2	**2**
	Percent (%)	0	0	0	0	100	**100**
A great contribution has been made to the updating and effective implementation of our environmental management system	**Frequency**	0	0	0	2	0	**2**
	Percent (%)	0	0	0	100	0	**100**
Reductions in the amount of waste and pollution that may occur at the end of the processes	**Frequency**	0	0	0	1	1	**2**
	Percent (%)	0	0	0	50.0	50.0	**100**
Improvements in social and environmental risk have been achieved by identifying the limits of responsibilities	**Frequency**	0	0	0	2	0	**2**
	Percent (%)	0	0	0	100	0	**100**
The expectations and criteria of the investor were fulfilled and thus the capital inflows were improved	**Frequency**	0	0	0	2	0	**2**
	Percent (%)	0	0	0	100	0	**100**

4. DISCUSSION

Since the study covers the province of Istanbul and the criteria for participation in the study is voluntary, it was stated that 66.67% of the companies participating in the research did not have ISO 14000 certificates and 33.33% did not have ISO 14000 certificates. In Table 1, there are ISO 14000 certificates of the companies with the establishment date of 1982, 2007, 2013 and 2014. According to Table 1, companies with ISO 14000 Environmental management standards have a total of 102 employees. On the other hand, companies that do not have ISO 14000 certificates are small-scale companies with a total of 19 employees. When we look at the dates of obtaining ISO 14000 certificates of companies with ISO 14000 certificate in Table 1, the company with the oldest establishment year among the companies participating in the study, received the ISO certificate from 1982 exactly 22 years after its establishment. The company with the previous establishment is the company dated 2007. This company declares that it renews ISO 14000 certificates every year. It has been observed that the company established in 2013, which is younger than these

companies, received the ISO 14000 certificate 5 years after its establishment, while the company established in 2014 received the ISO 14000 certificate one year after its establishment, namely in 2015.

While 75% of the companies with ISO 14000 certificate see it as one of the most important reasons, 25% of them see it as a reason and 100% cause the expectation of "activating waste management", one of the factors related to the attitude and improvement expectations in the internal processes related to the environment. The question that is about activating recycling activities was answered by 75% as one of the most important reason and 25% of participants answered as it is a reason so it is indicated that it's a reason 100%. The question that is about using our sources efficiently was answered by 25% as undecided and 75% answered as one of the most important reason. In that direction, the question that always provides improvements in processes was answered by 50% as it is a reason and the rest of 50% answered it as one of the most important reason.

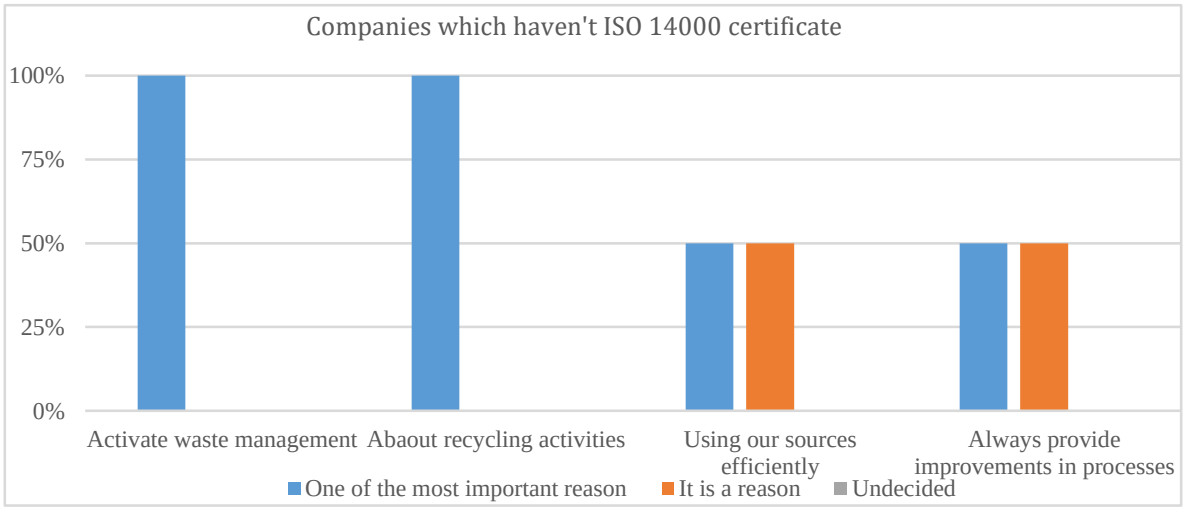
The question asked to activate the waste management for the attitude and improvement expectation of the companies holding the ISO 14000 certificate in their environmental activities was answered as the most important reason by 75% of the participants, and as "not" by 25%. The question that is about recycling activities was answered by 75% as one of the most important reason and 25% of participants answered as it is a reason. The question that is about using our sources efficiently was answered by 25% as undecided and 75% answered as one of the most important reason. In that direction, the question that always provides improvements in processes was answered by 50% as it is a reason and the rest of 50% answered it as one of the most important reason.

To the question of whether there are improvements in recycling activities through reuse of wastes or reuse of harmless wastes arising from the perceptions of companies holding ISO 14000 certificate regarding the improvement of their environmental management activities, 25% were undecided and 75% answered with reason. The question that is about a great contribution has been made to the updating and effective implementation of our environmental management system was answered by 50% as undecided and other 25% answered as it is a reason and the remaining 25% answered as one of the most important reason so it is indicated that it's a reason 50%. The question that is about reductions in the amount of waste and pollution that may occur at the end of the processes was answered by 75% as it is a reason and other 25% answered as one of the most important reason so it is indicated that it's a reason 100%. The question that is about improvements in social and environmental risk have been achieved by identifying the limits of responsibilities was answered by 75% answered as ıt is a reason and other 25% answered as not counting as a reason. The question that is about the expectations and criteria of the investor was fulfilled and thus the capital inflows were improved was answered by 25% as undecided, other 50% answered as it is a reason and remaining 25% answered as one of the most important reason so it is indicated that it's a reason 75%.

One of the most important reasons was answered 100% as one of the most important reasons for the question that companies that do not have the ISO 14000 certificate have improved their recovery activities through the reuse of wastes or the reuse of harmless wastes arising from the perceptions regarding the improvement of their environmental management activities. The question that is about a great contribution has been made to the updating and effective implementation of our environmental management system was answered by 100% as it is a reason. The question that is about reductions in the amount of waste and pollution that may occur at the end of the processes was answered by 50% as it is a reason and other 50% answered as one of the most important reason. The question that is about improvements in social and environmental risk has been achieved by identifying the limits of responsibilities was answered

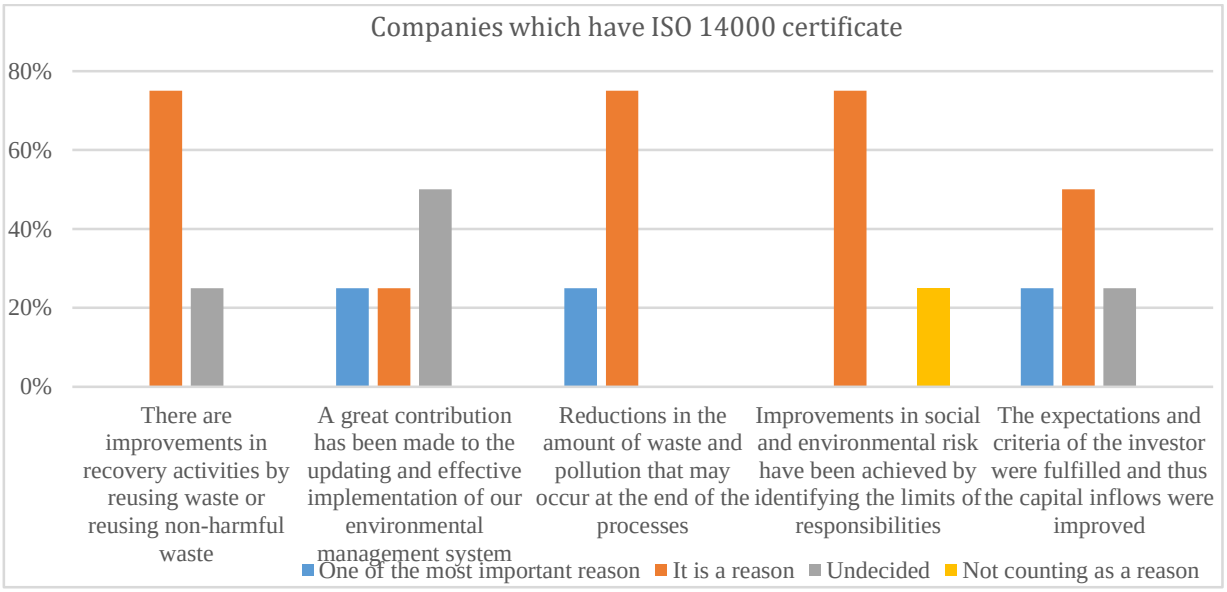
by 100% as it is a reason. The question that is about the expectations and criteria of the investor was fulfilled and thus the capital inflows were improved was answered by 100% as it is a reason.

(a)



(b)

Figure 1. Percentage of the importance of facts that attitude and to expectation for improvements in duration environment activities of companies which have (a) and haven't ISO 14000 certificate (b).



(a)

(b)

Figure 2. Percentage of perceptions about the improvement of processes related to environmental management activities of companies which have (a) or haven't ISO 14000 certificate (b).

5. CONCLUSION

Companies usually get an environmental management system for complying with regulations and laws, forming work safety in working place, providing improvements in every step on their own. Companies which have or don't have ISO 14000 environment management certificate are all agreed about some reason such as strategically importance of environment management regarding company management in the way of attitude and improvement requirements about in duration environmental action of the company, activating waste management, activating recycling activities, using resources efficiently, always providing improvements.

There are some benefits of practicing ISO 14000 environment management such as getting improvements about activities of environment management, providing improvements about recycling activities by reconditioning or using non-harmful materials, supporting to update and practice of environmental management system, forming decreases number of waste and pollution in results, improvements for decreasing the risk of social and environmental by determining limits of responsibilities, supporting to provide the criteria and requirements of investors, so to conduce to monitor for improvements when capital enters to company.

In this study, some companies didn't take standards even if ISO 14000 environment management system standards are obligated by rules because of lack of inspections. Some of them show that they took the certificate because they are working with corporate companies. It is thought that to be good at forming an efficient and powerful environment management system depends on jobs about the environment, complying with regulations and laws**.**

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