

# Top Management Team Characteristics, Property Right Nature and Environmental Protection Investment

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**Abstract:** environmental protection has become a constant concern of the country and the people, while as the main source of environmental pollution, enterprises should undertake the environmental governance. As the decision-maker of enterprises, the top management team (TMT) need to make decisions on the investment of all parties of the enterprise. The present paper explores the relationship between TMT and environmental protection investment (EPI) increase of enterprises based on TMT characteristics, and meanwhile analyze whether different property rights have an impact on environmental protection investment. It is found that (1) the older the average age of TMT, the larger the scale of enterprises' EPI; (2) the higher the average education level of TMT, the larger the scale of enterprises' EPI; (3) the larger the proportion of top managers with academic experience in the TMT, the larger the scale of enterprises' EPI, and (4) state-owned enterprises have a larger EPI scale in comparison with non state-owned enterprises. On the whole, the present research expands the research perspectives of enterprises EPI and TMT characteristics.

## 1. Introduction

At the 18th National Congress of the Communist Party of China, General Secretary Xi Jinping called for accelerating reform for promoting ecological progress to build a beautiful China, and meanwhile put forward the idea that lucid waters and lush mountains are invaluable assets. For the past few years, China has paid increasing attention to environmental protection and ecological civilization construction by virtue of continuously issuing various laws and regulations, and even establishing an environmental supervisory group in 2015. It is well known that enterprises are the main source of environmental pollution, especially in some heavy polluting industries, having cause tremendous damage to the environment. It is precisely because environmental pollution would exert an external impact on society, economy and other enterprises, therefore, the environmental cost should be internalized in line with the principle that who caused pollution responsible for cleaning up and who developed responsible for protection. we should actively invest in environmental protection and promote clean production, so as to play the main role of environmental governance. However, many enterprises still believe that environmental protection would be costly, but bring little economic benefit. Therefore, they refuse to spend on environmental protection. Nevertheless, as the continuous improvement and perfection of laws and regulations, enterprises began to make some mandatory EPI to meet the minimum standards set by the state, so as to avoid punishment. However, such investments are far lower than the cost required for environmental restoration. As a result, the government, which should have played a regulatory role, has become the main body of environment protection.

Top managers play a decisive role in the decision-making of enterprises. Every decisions and large expenditures of each project should be approved by them. Environmental protection is not only a strategic selection of enterprises, but also a significant part for enterprises to fulfill their social responsibility. As the main decision-maker of the financial behavior of enterprises EPI, their cognitive ability, values and other mental characteristics play a significant role in enterprises EPI. Their cognitive ability and values are determined by multiple factors such age, experience and identity.

Therefore, it is noted that TMT characteristics have an impact on enterprises EPI. TMT characteristics research is conducive to the selection of managers who are more suitable for corporate culture in terms of human resources in the future, and ecological civilization construction in China.

The present paper may expand the influencing factors of enterprises EPI from the perspective of TMT characteristics, while the previous researches mainly center on macro factors such as environmental regulation or micro aspects of enterprises, and seldom explore EPI from the perspective of management team. From this perspective will expand the influencing factors of enterprises EPI and enrich the research of TMT impact on micro aspects of enterprises.

## **2. Literature review**

EPI research consists of two types, including “cost theory” and “investment theory”. The former believes that the expenditure on EPI is not conducive to the development of enterprises. Enterprises’ expenditure on environmental equipment, prevention and relevant fees will not only increase enterprises cost, but also occupy their funds, so that enterprises are forced to give up investing in profitable projects (Porter M. e et al., 1995; Li Hong et al., 2016). Enterprises aim to maximize shareholders’ equity, while expenditure on EPI will not generate any income in the short term. Therefore, confronted with the great press of shareholders, the management will choose to allocate more enterprises resource to pursue private income of major shareholders, in the sense that they will choose physical and capital investment that can increase economic interests, but ignore EPI with weak profitability (Tang Guoping et al., 2013). With respect to the investment theory, some scholars argue that EPI allows enterprises to establish a good image and increase their values. Some data show that the fulfillment of social responsibility can improve enterprises reputation (Ariksn et al., 2014), and reduce public opinions on enterprises, and their interests loss in face with adverse situations (Kong Dongmin et al., 2013). In the meanwhile, in accordance with the “Porter Hypothesis”, pollution amounts to a waste, and enterprises should improve resource utilization by virtue of reducing pollution. Secondly, appropriate environmental regulation is conducive to stimulate enterprises innovation, improving resource utilization through recycling or redesign, so as to reduce costs thoroughly and increase revenues, and thus obtain competitive advantage. Both “cost theory” and “investment theory” rely on the judgement of top managers. Their practices varies with their different understanding of EPI. Jiang Fuxiu et al. demonstrated that due to different education background, work experience, team age and other characteristics, managers make different business behavior choice. Existing researches showed that top managers with poverty experience are prone to carry out targeted poverty alleviation (Chang et al., 2020). The higher the education level of top managers, the less likely the enterprise is to conduct excessive investment (Jiang Fuxiu et al., 2009). The younger the managers, the more adaptable and innovative they will be (Wiersema, Bantel, 1992). Given the above, the educational background, age, gender and other personal characteristics of managers will affect the decision-making of enterprises. (Thomas, Simerly, 1995; Boulouta, 2013; Huang Heshu, Zhou Zejiang, 2015).

Most existing literature centers on the follow-up impact of EPI, such as economic performance. Moreover, most researches on its influencing factors are based on macro environmental regulation. There are few literature to analyze in detail how different characteristics affect EPI from the perspective of TMT characteristics, which will be enriched by the present paper.

## **3. Theoretical analyses and research hypotheses**

In accordance with upper echelons theory, managers have a limited cognition due to the variability and uncertainty of both internal and external environment. Even within the scope of their perception, they can only conduct selective screening. Therefore, the existing cognitive ability and values of the management determine their explanatory power of relevant information. In other words, their characteristics have an impact on their choices. As a result, the strategic decision-making process and corresponding performance results are dependent on the mental structure of the management, such as

their cognitive ability, perceptive ability and values. The age of TMT can affect EPI of enterprises. As a significant part of TMT characteristics, different age groups have different acceptance, perception and understanding of things, which leads to different responses. Chen Danxia and Che Liping (2020) argued that in heavy pollution industries, the heterogeneity of the management age will affect EPI. Flood (1997) demonstrated that the older the management, the more experienced they are and the calmer they are in trouble. Young managers are more radical and prone to invest in profitable projects rather than EPI in comparison with older managers (Sun Haifa et al., 2002). In addition, young managers are more likely to change their jobs than older managers. They pay more attention to short-term benefits rather than investing in long-term projects with no return such as environmental protection. Zhu Guojun et al. (2013) argued that as the gradual increase of age, older managers tend to be mentally more stable, becoming more risk-averse and unwilling to take risks, and perform poorly in adaptability and response as the surrounding environment changes. As the country pays more attention to environmental protection, older managers are more willing to make EPI to avoid legal and political risks. In addition, the older the management, the more material satisfaction they achieve, thus paying more attention to spiritual pursuits, such as social reputation and self-worth. Enterprises EPI is conducive to improving their reputation and meeting the high-level needs of the management (Zhu Kunteng, 2018). Therefore, it is noted that the older the average age of the management team, the larger the EPI scale, based on which we put forward the following hypothesis.

H1:

Hypothesis 1: the older the average age of the management team, the larger the EPI scale.

The education level TMT can also affect the EPI of enterprises. People's idea can be tremendously affected by their education level. The decision-making of the management varies with the education level. The higher the education level of the management, the more positive impacts they will have on enterprises (Tihanyi, 2000). A company's cognition, attitude and management methods towards environmental issues can be affected by the characteristics of top managers. Slater et al. (2010) demonstrated that when the CEO has an MBA degree, the environmental performance of the enterprise will be significantly improved. Li Ruisheng et al. (2019) believed that when TMT members are highly-educated, they have stronger cognitive ability to the characteristics and change laws of objective things, thus making decision more conducive to the long-term development of the enterprise. One's education level has an impact on the formation of his values, which determines his attitude towards environmental protection. The higher the education level of top managers, the more inclined they are to invest in environmental protection. The reason is that the better the school is, the more it pays attention to the quality education of students. The environmental idea is rooted in everyone's mind from primary school. The longer you study in school, the more likely you are to be influenced by values such as "protecting environment" (Yuan Zeming et al., 2019). Therefore, the higher the education level of top managers, the more attention they pay to social problems such as protecting ecological environment. It is noted that the higher the average education level of the management team, the higher the EPI scale. Based on that, we put forward the following hypothesis.

H2: Hypothesis 2: the higher the average education level of the management team, the higher the EPI scale.

The academic experience of TMT has an impact on EPI of enterprises. For the past few years, some intellectuals who teach in colleges and work in research institutions and research associations enter enterprises as top managers. They have experienced rigorous academic training and developed a rigorous attitude and meticulous thoughts (Francis.B et al, 2015) in their early years, all of which would play a decisive role in decision-making of enterprises. In the meanwhile, they have strong social ethics and sense of social responsibility, which makes them more prudent, more responsible to the enterprise and pay more attention to the future development of the enterprise (Du Yong et al., 2016). Consequently, top managers with academic experience are more willing to invest in environmental protection. In addition, in the face of EPI behavior with high uncertainty, top managers with academic experience are more capable of making reasonable judgement and analysis on the future development trend of things, grasping the essence of enterprises EPI, and intensely recognizing the signal

transmission effect and reputation effect of EPI, and the long-term significance of EPI to the promotion of enterprise value (Yuan Zeming et al., 2019). It is noted that top managers with academic experience are capable of effectively improve the scale of enterprises EPI. Therefore, we put forward the following hypothesis.

Hypothesis 3: the academic experience of top managers will effectively improve the scale of enterprises EPI.

There is a connection between EPI and the nature of property rights. State-owned enterprises occupy a special status in China, and hereby attracted more social attention. Accordingly, they should undertake more social responsibility and have larger EPI scale (Zhang Gongfu, 2013). At the same time, state-owned enterprises embody the policy orientation of the country, so they should play a greater leading role in the process of industrial structure upgrading, and increase investment funds from a strategic perspective in respect of EPI structure (Chen Qi, 2019). In addition, top managers of state-owned enterprises are appointed by the government, and some of them hold public office. They should not only be responsible for the operation of enterprises, but also bear more social responsibility. However, managers of non state-owned enterprises are not appointed by the government. They are more concentrated on economic benefits rather than social responsibility. Given the above, it is noted that state-owned enterprises are more likely to participate in EPI and make greater contribution in comparison with non state-owned enterprises. Based on that, we put forward the following hypothesis.

Hypothesis 4: state-owned enterprises have larger EPI scale in comparison with non state-owned enterprises.

## **4. Research design**

### **4.1 Sample selection and data source**

We select A-share companies in Shanghai and Shenzhen from 2014 to 2018 as the sample, excluding ST and \*ST enterprises, the missing data related to the present paper and enterprises listed in those years. The financial data used herein derives from CSMAR database, and the EPI data are mainly collected from *Social Responsibility Report*, *Sustainable Development Report* and *Environmental Report* disclosed by listed companies. The data related to TMT mainly comes from the research board of CSMAR.

### **4.2 Definition of related variables**

#### **4.2.1 Explained variable:**

enterprises EPI. The logarithm for EPI is taken herein through referring the researches by Chen Danxia (2020) and Liu Changqing et al. (2018).

#### **4.2.2 Explanatory variable:**

characteristics of top managers, mainly including the average age and average education level of TMT and the proportion of academic managers. The average age is measured by dividing the total age of TMT members by total TMT members. The average education level is calculated by summing up the education level of all TMT members and dividing it by total team members. The education level ranges from one to five, respectively referring technical secondary school and below, junior college, bachelor degree, master's degree and doctoral degree. The proportion of academic managers is the proportion of top managers with academic experience in the total. The academic definition is consistent with the personal characteristics database of CSMAR managers. Academic experience primarily refers to teaching in colleges, and working in research institutions and research associations.

#### **4.2.3 Moderating variable:**

nature of property right. State-owned enterprises =1, and non state-owned enterprises =0. Table 1 shows the definition of variables.

Table 1 Definition of variables

Types of variables	Variables	Symbols	Definitions
Explained variable	Environmental protection investment	EPI	Taking the logarithm for EPI.
	Average age	Age	Dividing the total age of TMT members by total TMT members
Explanatory variables	Average education level	Edu	Summing up the education level of all TMT members and dividing it by total team members
	Proportion of academic top managers	Aca	Total academic top managers/total top managers×100%
Moderating variables	Nature of property rights	Soe	State-owned enterprises =1, and non state-owned enterprises =0.
	Capital structure	LEV	Asset-liability ratio = total liabilities / total assets
	Total net return on assets	Roa	Total return on assets = net profit / average balance of total assets
	Returns of stocks	Returns	Return of each stock
	Agent cost	Cost	Management expense ratio = management expense / operating income
	Growth rate of business revenue	Growth	Increase rate of business revenue = growth of business revenue of the current year / growth of business revenue of last year ×100%
	Board size	Board	Board size = Ln (board members + 1)
	Proportion of independent directors	Indep	Proportion of independent directors = independent director / total board members
	Year	Year	Dummy variable of the year

### 4.3 Model specification

For the purpose of testing the specific effect of TMT characteristics on EPI of enterprises, in the sense that whether the characteristics of top managers affect the EPI of enterprises, the following model is established herein:

$$EPI_{i,t} = \alpha_0 + \alpha_1 \text{Age}/\text{Edu}/\text{Aca}/\text{Soe}_{i,t} + \alpha_2 \text{LEV}_{i,t} + \alpha_3 \text{Roa}_{i,t} + \alpha_4 \text{Returns}_{i,t} + \alpha_5 \text{Cost}_{i,t} + \alpha_7 \text{Growth}_{i,t} + \alpha_8 \text{Board}_{i,t} + \alpha_9 \text{Indep}_{i,t} + \xi_{i,t}$$

## 5. Empirical analysis

### 5.1 Descriptive statistics

Table 2 Descriptive statistics

Variables	Mean value	Standard deviation	Minimum value	Maximum value	Median
EPI	15.0009	1.8819	6.9078	20.1504	15.0600
Age	49.9092	2.93582	40.00	61.36	49.9048

Edu	3.2553	0.4638	1.2000	4.5000	3.2500
Aca	0.1993	0.0039	0.0000	0.7000	0.1875
Soe	0.5200	0.0120	0.0000	1.0000	1.0000
LEV	0.4827	0.2059	0.0200	1.7600	0.4845
Roa	0.0282	0.2133	-2.8700	7.4500	0.0258
Returns	0.3287	1.3209	-6.7100	30.1100	0.1975
Cost	0.0963	0.0863	0.0100	0.9600	0.0021
Growth	0.0282	0.8814	-0.7400	21.7000	0.0258
Board	2.2765	0.1781	1.6100	2.9400	2.3026
Indep	0.3654	0.0622	0.0200	0.6700	0.3300

As shown by descriptive results in Table 2, there are significant differences between the minimum and maximum values of enterprises EPI, and the standard deviation is 1.89, indicating that there are tremendous differences in EPI among enterprises. The average age of enterprises top managers is 49.91. Managers in this age are more experience and prudent, and prone to be risk averse. Their average education level is 3.26, indicated that most managers are highly educated and have bachelor or master's degree. However, there is a significant difference between the minimum value and the maximum value of the average education level. The minimum value has just exceeded the technical secondary school, while the maximum value approximated to doctoral degree, indicating that there are outstanding individuals in respect of education background and significant difference among managers. The average academic experience of top managers is 19.93%, showing that among top managers of listed enterprises, 19.93% of them had academic experience, which is consistent with the previous researches. With respect of the nature of property right, 52% of the sample enterprises are state-owned enterprises.

## 5.2 Multiple regression analysis

Table 3 Regression results of enterprises EPI

	(1)	(2)	(3)	(4)	(5)
Age	4.363*** (0.067)				3.234*** (0.052)
Edu		2.175** (0.207)			1.104 (0.106)
Aca			3.105*** (0.853)		3.300*** (0.918)
Soe				3.931*** (0.370)	3.182*** (0.313)
Roa	1.507 (0.322)	1.527 (0.327)	1.661* (0.356)	1.495 (0.319)	1.590 (0.338)
Growth	-3.348*** (-0.167)	-3.465*** (-0.173)	-3.690*** (-0.184)	-3.362*** (-0.167)	-3.396*** (-0.168)
Board	2.148** (0.634)	2.845*** (0.830)	3.152*** (0.913)	2.101** (0.625)	1.459 (0.437)
Indep	0.944 (0.883)	1.039 (0.976)	1.088 (1.019)	0.798 (0.749)	0.441 (0.412)
Return	6.809*** (0.240)	7.285*** (0.257)	7.166*** (0.252)	6.988*** (0.246)	6.696*** (0.235)
Cost	-3.535*** (-1.816)	-3.511*** (-1.811)	-3.616*** (-1.863)	-3.571*** (-1.836)	-3.630*** (-1.854)
Lev	8.659*** (1.973)	9.023*** (2.057)	9.310*** (2.129)	7.932*** (1.851)	8.123*** (1.888)
Adjust-R <sup>2</sup>	0.111	0.099	0.102	0.105	0.117

Note: \*, \*\*, \*\*\* respectively represent significant at the levels of 0.1, 0.5 and 0.01 (the same below).

Table 3 shows the multiple regression results, in which column (1) is the regression result between the average age of top managers and EPI of enterprises. As shown in column (1), the average age coefficient of top managers is positive and significant at the level of 1%, in the sense that the older the average age of top managers, the larger the EPI scale of enterprises. The reason is that older managers are prone to make conservative decisions. They will increase their willingness to invest in environmental protection and increase the EPI scale for the purpose of reducing both political and legal risks caused by unqualified environmental protection. Consequently, hypothesis 1 is verified.

Column (2) shows the regression result between average education level of top managers and EPI of enterprises. The result shows that the average education level coefficient of top managers is positive (0.207) and significant at the level of 5%, indicating that the higher the average education level of top managers, the larger the EPI scale of enterprises. The main reason is that the higher the average education level of TMT, the longer the education of environmental protection idea they received in school, and the deeper the concept of environmental protection they have. Affected by such concepts, they will increase the EPI scale. Therefore, hypothesis 2 is verified.

Column (3) shows the regression result between the proportion of top manager with academic experience and EPI of enterprises. The result shows that the proportion coefficient of top manager with academic experience is positive (0.853) and significant at the level of 1%, in the sense that the higher the proportion of top manager with academic experience, the larger the EPI scale of enterprises. This is consistent with the foregoing deduction, namely the academic experience of top managers enables them to be more prudent, logical and thoughtful in making decisions. EPI is a long term investment for enterprises, which will not be taken into account by radical decision-makers, while top managers with academic experience will pay attention to it. Therefore, hypothesis 3 is verified.

Column (4) is the regression result between the nature of property rights and EPI of enterprises, indicating that the coefficient of the nature of property rights is positive (0.370) and significant at the level of 1%, namely, state-owned enterprises have larger EPI scale in comparison with non state-owned enterprises, which is consistent with the foregoing deduction. This is mainly because state-owned enterprises are controlled by the country, and their top managers are required to bear both economic responsibility and more social responsibility. EPI is a social responsibility and a part of the 13th Five-year Plan. It is necessary for top managers of state-owned enterprises to increase their EPI scale so as to pass the examination by the country. Hypothesis 4 is hereby verified.

Column (5) shows the regression of the full sample, in which the average age of top managers, the proportion of top managers with academic experience and the nature of property rights are significant at the level of 1%, which is consistent with the foregoing deduction.

We adopt the following methods to conduct robustness test: (1) assigning the explained variable in a new way, that is, measuring the EPI by the ratio of the enterprises EPI to their average assets, and (2) replacing the original returns on assets with net returns on assets. The results are consistent with the above analyses. The average age, average education level and academic of TMT have a significantly positive impact on EPI behavior of enterprises.

## 6. Conclusions and suggestions

The present paper explores the impact of TMT characteristics on EPI of enterprises through analyzing the data of A-share companies in Shanghai and Shenzhen from 2014 to 2018. The results shows that (1) the older the average age of TMT, the larger the EPI scale of enterprises; (2) the higher the education level of TMT, the larger the EPI scale of enterprises; (3) the larger the proportion of top manager with academic experience in TMT, the larger the EPI scale of enterprises, and (4) state-owned enterprises have larger EPI scale in comparison with non state-owned enterprises. Our exploration of the relationship between TMT characteristics on EPI of enterprises has effectively integrated both upper echelons theory and brand theory, which will enrich the related researches. In the meanwhile, the present research will provide a practical thought for enterprises to increase their EPI scale, that is,

enterprises should try to alleviate the problem of insufficient investment in environmental protection through adjusting the composition of their TMT. Based on the above, we put forward the following suggestions: (1) introducing an appropriate proportion of older managers into TMT to alleviate risk preference and increase EPI scale of the enterprise; (2) reviewing their education background during the recruitment of top managers or internal promotion of top managers, so as to improve their average education level; (3) appropriately introducing top manager talents with academic experience in TMT from colleges and research institutions, and (4) the government should strengthen the evaluation of environmental protection in the performance examination of state-owned enterprises, making top managers pay more attention to environmental issues and increase EPI scale of the enterprise.

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