

**THE INFLUENCE OF ENVIRONMENTAL KNOWLEDGE AND VALUES ON
MANAGERIAL BEHAVIOR IN CHINA: A COMPARISON OF MANAGERS IN
GUANGZHOU AND BEIJING**

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This study explores linkages between what Chinese managers generally know about environmental issues, how strongly they value environmental protection, and different types of behaviors/actions they may take within their organizations on behalf of the environment. In a sample of 151 managers from Guangzhou, it was found that environmental values have direct effects on a fairly broad range of managerial behaviors while environmental knowledge had no significant effects. In Beijing, 154 were questioned. With this sample, however, environmental knowledge was found to have a significant influence while the effects of environmental values were restricted to the least overt behaviors. In addition, environmental knowledge was found to interact with environmental values in promoting the least overt behaviors (i.e., keeping informed and utilizing existing mechanisms) in the Beijing sample. [126 words]

Various forms of environmental degradation challenge most policy makers; however, such challenges are especially broad ranging and urgent in China (Ross, 1988; Smil, 1993; Edmonds, 1994; Sinkule and Ortolano, 1995; *The China Quarterly*, 1998; Lo & Leung, 1998; Ma and Ortolano, 2000). China's natural capital is being depleted at an alarming rate (Loptcheih and Chen, 1997; Zheng & Wang, 2001). Desertification now claims over 25% of its total area (Li, 2002; *People's Daily*, 2001) while acid rain seriously affects more than 40% (State Environmental Protection Administration, 2001). Fish stocks have collapsed in virtually all coastal areas and fresh water supplies are reaching crisis levels in much of the Northern and Western regions (State Environmental Protection Administration, 2001). Moreover, the toll on public health and economic development from pollution is mounting (McElroy, 1998; Banister, 1998; World Resource Institute, 1998). It has been reported that between 20 and 30% of all adult men suffer from impotence linked to stress and pollution, while toxic metals have greatly diminished sperm counts. Air pollution is so severe in most urban areas that it is the leading cause of premature deaths (Xu, 1998). In addition, China's leaders are extremely concerned that their global image is related to its environmental policies (China Environment Year Book Editorial Board, 2000, 2001). This has been driven in part by their long battle to gain WTO membership, but also their need to greatly improve the environment leading up to the Olympic Games in 2008 (Lo & Chung, 2002).

The more enigmatic side of this issue is that while China's policymakers now more readily admit to this environmental debacle, devising an effective package of measures will be extremely difficult. Many factors appear to block the way. For example, although the authorities have passed many regulations, their enforcing them has proven difficult. This can be attributed to such factors as China's "fragmented bureaucracy", limited financial resources, and propensities toward corruption (Sims, 1999; Lo & Leung, 2000; Ma & Ortolano, 2000). A second problem is related to rapidly

escalating levels of consumption in many urban areas in combination with the extremely high levels of population density (Zhou, 1997). Although affluence takes many forms, at the rate Chinese are trading in their bicycles for automobiles, China is expected to surpass the United States as the leading contributor of greenhouse gases within the next two decades. A third problem is that China is highly dependent on coal and older technologies to keep its state owned enterprises afloat (McElroy, Nielsen and Lydon, 1998; Smil, 1998; Vermeer, 1998). A final point is that although large segments of the urban population may be experiencing benefits from globalization, even *larger* segments in rural China appear to be headed for even greater poverty (Zweig, 1997; Oi, 1999). Sustainable development must ultimately embrace a semblance of social equity (Elkington, 1998; Hart, 1997).

Although one can certainly anticipate that the Chinese authorities will promulgate additional decrees and regulations, given this combination of urgency and enigma, considerable emphasis must also be given to the broad range of non-regulatory approaches involving both economic and communicative mechanisms (Wang & Lu, 1997; Panayotou, 1998). In this regard, one group whose participation will be especially vital for the implementation of various communicative approaches in China are its managers. Obviously, managers need to be actively engaged in such programs as ISO 14001, recycling, and various forms of partnerships. Equally important, however, is that the major pollution problems in China, as elsewhere, are more often the result of the aggregation of a multitude of small behaviors rather than from major spills, accidents, or other newsworthy events (Smil, 1992; Edmonds, 1994; Banister, 1998; Ma & Ortonlano, 2000). Indeed, the intention behind many such non-regulatory mechanisms (e.g., taxes, rebates, ecolabels) is to have such a small effect on the multitude (Stavins, 2000).

Although the effectiveness of economic instruments (i.e., as a category) can be safely assumed, that of communicative approaches are more often taken as an article of

faith. As one major example, the overall effectiveness of ISO 14001 in improving companies' environmental performance remains largely unproven. The same can be said for most broad educational campaigns. Not only it is relatively difficult to undertake effective research to confirm the linkages between environmental education, environmental knowledge and environmentally-oriented behaviors, it is probably also true that challenges to the value of education run some risk of upsetting numerous vested interests.

While it is certainly *not* our purpose to refute linkages between environmental knowledge and managerial behaviors on behalf of the environment, the *strength* of such a linkage between environmental knowledge and organizational behaviors in China certainly warrants empirical investigation (Yu & Dong, 1997; Liu, 1997). Accordingly, the purpose of this study is to examine the relationships between Chinese managers' environmental knowledge, their values regarding environmental protection, and various types of actions they may take in their companies on behalf of the environment. These matters will be examined in the contexts of two contrasting settings — Guangzhou, the economic hub of manufacturing in Guangdong Province and Beijing, the nation's capital city.

BACKGROUND

Managers and Pollution

There can be little doubt that managers have a disproportional — and usually negative — impact on the natural environment. One need only point to massive ecological disasters such as the Bhopal and Exxon Valdez incidents or cite massive infrastructure projects, such as the Three Gorges dam project (China). However, as stated previously, the aggregated influence of a multitude of large and small businesses' decisions/actions taken on a daily basis is far greater, which encompass such mundane events as selecting modes of transport, designing products, maintaining equipment,

packaging goods, and waste disposal. In addition, the business community often has considerable influence on government and its policies. A recent example of this can be seen in the Enron bankruptcy debacle and its alleged influence on energy policies. In Asia, the influence of business interests may be just as extreme. In Hong Kong, property developers virtually hold the government hostage; elsewhere in Asia (e.g., Indonesia, Philippines), although these relationships are considerably “murkier”, they are just as potent.

As much as managers have previously been castigated as environmental villains, many observers are concluding that they must also be its salvation. As Hart (1997: 75) put it, “Like it or not, the responsibility for ensuring a sustainable world falls largely on the shoulders of the world’s enterprises, the economic engines of the future.” Although the business community has relatively less political “clout” in Mainland China (Guthrie, 1999), they clearly poses the creative energy and the resources to determine whether or not China moves onto a more sustainable path of development.

Environmental Knowledge

For managers to understand the relationship between decision alternatives and outcomes related to the environment, they need fundamental scientific and practical knowledge about a broad range of issues which could include such considerations as: 1) An appreciation of the current situation (i.e., condition of the local environment and global interrelationships); 2) The value of natural capital to the firms operations. This would encompass the negative impact and risks of degraded resources on the firms’ operations; 3) Personal consequences of a degraded environment (e.g., personal health risks); 4) The range of alternatives available to solve a problem or attain a goal (e.g., technological options); 5) The causal-linkages between actions implied in various decision alternatives and the outcome set; and, 6) The relative overlap among desired

outcomes (i.e., instances where environmental performance and economic performance are compatible).

Thus, managerial motivations to act on behalf of the environment are presumed to be contingent upon environmental knowledge in making these assessments.

Environmental knowledge can be defined as a general knowledge of facts, concepts, and relationships concerning the natural environment and its major ecosystems. Thus, in simple terms environmental knowledge involves what people know about the environment, key relationships leading to environmental aspects or impacts, and collective responsibilities necessary for sustainable development. A closely related concept is “environmental literacy.” However, as currently used this term carries rather strong normative implications — even embracing deeper spiritual elements (Golley, 1998).

Given that managers greatly influence the consumption and condition of natural capital, the elevation of environmental knowledge among managers would appear to be inherently desirable. As Ashford (1993: 277) stated, “The key to success in pollution prevention is to influence managerial knowledge of and attitudes toward both technological change and environmental concern.”

Given their impact on the environment and emergent public interest in the environment, it is surprising that most Chinese managers and business students have had effectively no formal training to improve their environmental knowledge. However, it should be pointed out that this gap is not peculiar to Asia as evidenced by a 1991 study of American business executives where Booz Allen reported that a majority (67%) believed that environmental issues were extremely important, yet a handful (7%) were confident that they actually understood the environmental issues that their company was facing (Newman & Breeden, 1992).

Environmental Values

Values define priorities that are crucial for the resolution of ethical dilemmas

(Hosmer, 1987). As previously mentioned, for managers to change their actions and behaviors to be more environmentally sensitive, they must also value environmental outcomes. In such a setting environmental outcomes will be valued if the organization's culture values them or the manager personally values them. Not surprisingly, values are purported to play a particularly important role in determining actions and behaviors related to environmental issues where complexity, uncertainty, interconnectedness, extended consequences of actions, and diverse stakeholder views must be coped with and reconciled (Schmidheiny, 1992; Shrivastava, 1995).

Such values are usually embedded within a larger belief system, "worldview" or paradigm of the individual. Regarding environmental issues two "ideal types" of paradigms have been proposed (Catton & Dunlap, 1980). The first — the dominant social paradigm or "DSP" — has long been in place in Western society. The DSP is anchored in the following convictions: 1) Economic growth relying heavily on technological advancement; 2) The sanctity of private property rights, 3) The existence of fluid and efficient markets; and 4) Laissez-faire government (e.g., Gladwin, Kennelly & Krause, 1995; McLaughlin, 1993).

In some countries and regions of the world, this dominant paradigm appears to be giving way to an alternative — termed the new environmental paradigm or "NEP" (Dunlap & Van Liere, 1978). The elements of this paradigm are principally grounded in a belief that humans as equal members with the natural world (Andersson & Bateman, 2000) rather than having dominion over it. From this premise it follows that: 1) limited natural resources restrict economic growth; 2) technological skepticism is warranted; and, 3) that humans must learn to live in harmony with nature.

In much of Asia it would appear that the dominant paradigm (i.e., DSP) appears well entrenched, especially in such places as Hong Kong and Taiwan (Devall & Sessions,

1985). However, because of five decades of Communist ideology, the paradigm in Mainland China may be different. While the single-minded emphasis on military and economic development has dominated environmental consideration, the strength of the second and third elements of the DSP have only recently been revived. Laissez-faire government as a principle is seldom espoused, but is certainly strongly evident in the marketplace. In many sectors of the economy there is much less government oversight than might be presumed and problems with corruption have undermined the rule of law.

Managerial Behaviors on Behalf of the Environment

Managers' environmental knowledge and values are of little practical interest unless they lead to (or explain in a methodological sense) actions or behaviors that mitigate their organization's impact on the environment. As di Norcia (1996:784) put it, "...an environmental ethic cannot be satisfied merely with the espousal of general care for nature...commitment itself must result in performance of the appropriate ecologically beneficent practices."

One can consider such organizational behaviors along a continuum of visibility within the organization. The least outwardly visible form of behaviors on behalf of the environment would be to gather information or to utilize *existing* organizational procedures so as to improve their environmental performance (i.e., through frequent equipment maintenance or purchasing energy efficient lighting based on their greater payback). At a more visible level, managers may initiate various programs/projects within their domain of responsibility. This could include projects that could save energy, reduce pollution, improve resource productivity, or reuse waste streams. At the most visible level, managers could advocate on behalf of the environment outside of their immediate domain of responsibility. In light of these different types of managerial behavior, a model linking environmental knowledge, values, and behaviors is proposed in Figure 1.

Insert Figure 1 about here

As indicated in Figure 1, there are a number of actions/behaviors of managers that are presumed to follow from knowledge gained about the environment. Thus, we hypothesize that:

H1: Environmental knowledge is positively related to managerial behaviors associated with environmental protection.

As has been pointed out, dealing with environmental issues in modern organizations requires the resolution of numerous ethical dilemmas. For example, the tradeoffs faced a property developer often involve tradeoffs between short term costs and more durable, energy efficient alternatives (which may be hidden to the buyer but may tarnish the builder's reputation in the longer term). In addition, on environmental issues individuals often have considerable latitude in how they choose to frame various issues. Thus, for example, a person with relatively stronger environmental values may view an increase in fuel prices as an environmental opportunity as opposed to a threat.

Consequently, it is hypothesized that:

H2: Environmental values are positively related to managerial behaviors associated with environmental protection.

Although we have hypothesized independent, direct effects of environmental knowledge and values on managerial actions to promote the environment, an interaction effect seems likely. This is to say that environmental knowledge *in the presence of* environmental values is likely to have a particularly strong influence on actions or behaviors to promote the environment. This may be most obvious in the case of environmental advocacy as managers may be relatively unwilling to promote environmental issues within their organization unless they can provide factual knowledge about the benefits of such actions to the firm (i.e., knowledge) and they place personal priority on environmental performance (i.e., values). Thus, we hypothesize that:

H3: Environmental values will interact with environmental knowledge in predicting managerial actions associated with environmental protection.

METHODOLOGY

Sample and Data Collection

The data for this study was collected both in Beijing and Guangzhou. Both locations are large urban settings with over 6 million people. In both cities the data was collected from practicing managers in a broad range of enterprises with the help of the Beijing Academy of Social Sciences and Guangzhou Academy of Social Sciences between March and November 2001. The Beijing survey was deliberately designed to obtain relatively equal distribution of four major types of industry — manufacturing industry of the light industry, cultural accessories and printing industry, chemical product manufacturing industry, and the machine and electronics industry. A limit was also set on having no more than three personnel at managerial ranks from a single enterprise. A self-compiled list of known manufacturing plants and factories from existing sources was prepared for random sampling. As a result, 158 enterprise personnel at managerial ranks (that is, factory managers, deputy factory managers, general managers, and deputy general managers) or equivalent (that is factory party secretaries, deputy factory party secretaries, chief accountants, financial controllers, chief engineers, and chief designers) from 53 enterprises were approached. The Guangzhou survey had more relaxed requirements and enterprises were randomly selected from different sources. Altogether 164 managerial personnel at both high and middle levels in 44 enterprises were contacted. After the elimination of a few unusable questionnaires in each locality, a total of 305 cases – 154 in Beijing and 151 in Guangzhou – were obtained. A comparison of these two cities is provided in Table 1.

Insert Table 1 about here

In administering this survey, trained research assistants actually visited with managers and stayed throughout its administration. This provided the advantage that the research assistant could answer questions while allowing us to achieve a high response rate. Small gifts were provided. Follow-up checks were conducted to ensure that each manager was visited, and to verify the name of the interviewer and the length of the interview. Consequently, the non-response rate was very low in both cities, while the successful rates in terms of usable questionnaires were 97% in Beijing and 92% in Guangzhou.

Measures

Environmental knowledge. Along with the neglect of the environment in business education, little effort has been made to develop regionally appropriate measures of environmental knowledge. Among more global efforts, the World Business Council for Sustainable Development (WBCSD) currently provides a self-assessment of environmental knowledge on their website (<http://www.foundation.no/sdc>). Visitors that take this test and pass it receive a certificate. However, this test is lengthy, local issues are not covered, and no evidence of reliability or validity is provided. Other efforts are either seriously dated, unreliably out of context, or both. For example, Maloney, Ward & Braucht (1975) proposed a 15-item instrument to measure environmental knowledge. Possibly because this scale is dated, Benton in 1994 attained a Cronbach's α of only .38 in an attempted replication. A number of other scales are less useful for research purposes than to capture reader interest. For example, the publication *World Wastes* proposed a five question self-assessment entitled "Test your environmental knowledge." Such approaches are fairly typical and point to the need for a more flexible, current instrument with valid measurement properties.

As a result and recognizing the need for some local content, a "test" of 40 questions was created drawing from a range of sources including, concepts or information

that the authors felt managers in region should know, a South China Morning Post (Hong Kong's daily newspaper) supplement on Pollution (Jan. 28th, 2000), some major articles in the China Daily, and information from local EPD officials. The items were intentionally meant to inquire about global and regional issues, as well as both broad concepts and specific facts about the environment. Because some items focused on local issues, they had somewhat different "right answers" in the two samples.

Each item had four choices from which the respondent was to select "the best answer". Correct choices were awarded 2 points. For many questions, partial credit of 1 or .5 points was given for choices with less merit. Subsequent analysis of the items using item assessment routines and factor analysis led to the elimination of some items (e.g., those with negative item-to-total correlations). The resulting scale of 30 items has an statistic of .741 across both samples (the "exam" and scoring key are provided in Appendix 1).

Managerial Actions/Behaviors. Eleven questions were written to cover the different categories of managerial actions and behaviors drawn from the framework depicted in Figure 1. The respondents indicated their agreement or disagreement on a 7-point Likert-type scale. Three general categories were measured that spoke to different levels of organizational visibility: 1) Less Overt Behaviors. Managers may rather quietly engage in behaviors on behalf of the environment that may or may not be readily apparent to their coworkers and superiors. For example, they could gather information about the environment that is pertinent to their business or industry or run operations in the manner consistent with current practice, but that is more environmentally sound. For all of these items, the manager may not be easily recognized as having an environmental agenda. Thus, these represent politically safe options for managers to practice environmental protection. The mean of these five items was taken from a scale with an reliability statistic of .74:

- *“When I skim the newspaper, I often read articles that appear to address the environmental impacts of my company and industry.”*
- *“I make it a point to stay up-to-date about changes in environmental laws and regulations related to this business.”*
- *“I put a lot of effort into being aware of the environmental aspects and impacts of my business.”*
- *“Prior to making decisions with environmental implications, I prefer to obtain the opinions of environmental or community groups.”*
- *“I ensure that equipment is properly maintained and running as efficiently as possible.”*

2) Initiating Programs and Taking Actions. A manager may more visibly take actions or initiate programs on behalf of the environment that are within his or her sphere of responsibility. While these actions are more visible and the managers would be responsible for the outcome, they would be apparent to the managers' subordinates, but need not involve a great deal of discussion or controversy. The mean of two items measured this propensity was calculated and had an reliability statistic of .70. These two items were:

- *“I take actions where possible to reduce the amount of resources used in my company's processes.”*
- *“I take measures to recycle waste in areas I'm responsible for.”*

3) Environmental Advocacy. At a much more visible level a manager can take a more proactive position to champion the cause of the environment more broadly in the organization. The mean of these three items measured the extent that respondents were vocal in advocating on behalf of the environment in their firms and had an reliability statistic of .80. These three items were:

- *“I often find that I'm speaking out on behalf of environmental issues in my company.”*
- *“I am often the one to bring environmental problems to the attention of top management.”*
- *“I make it a practice to incorporate energy efficiency ratings of products into any purchase decisions.”*

The pattern matrix from an oblique rotation of a principle components analysis of these items is provided in Table 2. The result is favorable in that each item loads clearly on the factor it was intended, a priori, to represent.

Insert Table 2 about here

Managerial Values. The 11 item “NEP” scale developed by Dunlap & Van Liere (1978) was used to measure how strongly the respondents adhered to the “new environmental paradigm” (NEP). These items were measured on a 5-point Likert-type scale and had an α statistic of .65 (.69 in the Guangzhou sample and .62 in the Beijing sample).

Control variables. Several variables were included as controls: 1) Gender was included as a control variable because Western research indicates that females are somewhat more likely to adhere to the NEP (Egri & Herman, 2000). This variable was coded as “0” for males and “1” for females, respectively. 2) Age was included as a control variable because the era in which one is brought up — especially in Mainland China — should be important in shaping environmental values. 3) Education was included given its obvious relationship to knowledge and, less obviously, to value formation. This was coded as an ordinal scale from 1 (primary school) through 6 (doctorate degree). It warrants pointing out that the responses for marital status and religious (or philosophical) orientation (that we intended to use as control variables) were nearly invariant so as to preclude their use as controls (95% percent reported being married and 85% professed “atheism”).

Analysis

The hypotheses were tested using hierarchical regression in a three step approach using the AMOS 4.0 structural equation program (Arbuckle & Wothke, 2001). One advantage to this approach is that it permits the simultaneous estimation of a model containing all three dependent variables for each sample. This permits the residuals of

each regression model to be correlated and also allows more flexible comparisons across the two samples.

Initially a model was estimated with only the three control variables. In the second step the main effects of environmental knowledge and values were entered. In the final step the single interaction term was entered. Following the recommendations of Aiken and West (1999), in order to minimize the effects of multicollinearity when testing for interactions, the environmental knowledge and environmental values scales were centered (i.e., the means were subtracted from the values for each case) prior to computing their interaction for entry in the third step (i.e., as a product of the centered values).

RESULTS

The descriptive statistics are provided separately for each sample in Table 3. The means, standard deviations, and correlations for the Guangzhou sample are reported to the left and below the diagonal; those for the Beijing sample are above and to the right. Comparisons of the means of the two samples reveal three significant differences ($p < .01$): 1) The Beijing sample has substantially more females (40%) than in Guangzhou (20%). 2) The Beijing sample also has significantly lower values for environmental knowledge. Because two questions had somewhat different answers in Beijing and Guangzhou, we recalculated the score without these items and obtained the same result ($p < .001$). 3) The Beijing sample also had significantly lower values for the NEP scale ($p < .01$).

The question of whether these differences are due to systematic differences in the samples or actually reflects somewhat greater environmental knowledge and values in Guangzhou is an intriguing one that warrants more systematic study. Given Guangzhou's relatively close proximity to Hong Kong, we might speculate that one factor may be their greater exposure to international media coverage on global environmental issues.

Insert Table 3 about here

At the same time, the means related to *managerial behaviors on behalf of the environment* in the two samples revealed no significant differences. Generally speaking the predominant value of around 5.0 to 5.5 would indicate that the average respondent “slightly agreed” with the statements. Given the inevitability of some social desirability bias in such questions, it is probably safe to say that the typical manager in China proclaims that they are mildly predisposed to such behaviors; however, it is doubtful whether such behaviors are particularly widespread in Chinese organizations. Although there were no differences in the means, it was found that the variance of the responses was significantly more constrained in Beijing ($p < .001$). In other words, respondents in Beijing were much more similar to each other in terms of their reported behaviors than their counterparts in Guangzhou. This may be related to generally held beliefs that people in Guangzhou are somewhat less subject to political influences than their counterparts in Beijing.

A few of differences in the correlations also warrant some comment. It appears that the three categories of behaviors are more strongly intercorrelated in Guangzhou than in Beijing. Indeed, the highest correlation ($r_{x,y}=.67$) between advocacy and “keeping informed” in Guangzhou raised some question about the independence of these two dimensions in that sample. At the same time, this correlation is relatively modest ($r_{x,y}=.27$) in the Beijing sample. It is also of interest that the environmental knowledge and environmental values scales are rather strongly correlated in both samples ($r_{x,y}=.37$ in Guangzhou and .41 in Beijing). This is taken as an indication that environmental knowledge and environmental values go hand in hand, although perhaps less so than might be widely assumed. That individuals who value the environment should also be

relatively better informed about environmental issues (and vice-versa) conforms to common sense expectations.

The results from the hierarchical regression models are provided in Table 4 with Guangzhou sample results shown first and the Beijing sample shown second. For both samples the control variables proved to be relatively inert in predicting managerial behaviors. In the Guangzhou sample, however, the gender coefficients were initially significant in the models predicting the least overt managerial behaviors on behalf of the environment (i.e., keeping informed and conforming with existing procedures) and environmental advocacy; however, both of these findings become insignificant as the models are elaborated. A similar phenomenon was observed in the Beijing sample with the variable for the respondents' age.

Insert Table 4 about here

The hypotheses involving main effects of environmental knowledge and values are tested in the second step of the hierarchical regression procedure. The first hypotheses found partial support only in the Beijing sample where it was found to be positively related to managers' willingness to initiate environmental programs within their domain of responsibility and, more weakly, to the less overt behaviors. Environmental knowledge was not related to environmental advocacy with their organizations in either sample, being especially inert in the Beijing sample.

The second hypothesis anticipated a relationship between environmental values (in this study operationalized as adherence to the "new environmental paradigm") and managerial behaviors on behalf of the environment. In the Guangzhou sample environmental values appeared to have a broad effect, although the coefficient dropped below the level of significance when the interaction term was entered. In comparison, the

influence of environmental values in Beijing was limited to the less overt behaviors on behalf of the environment.

The third hypothesis anticipating interaction effects was only partially supported in the Beijing sample where such an effect was observed between environmental knowledge and environmental values in predicting the less overt managerial behaviors on behalf of the environment. In order to interpret this result, this interaction was plotted as shown in Figure 2.

Insert Figure 2 about here

This plot suggests that for managers in the Beijing sample high environmental values must be augmented by high environmental knowledge before managerial actions are taken to keep informed about environmental issues of importance to the respondents' business and industry and/or conforming to current operations in a way that may benefit the environment. On the other hand, if general knowledge about the environment is low, then the respondents are considerably less active in this regard. Equally interesting is the observation that when Beijing managers value the environment, but lack general knowledge about the environment they are similarly less active. Not surprisingly, when the respondents lack both environmental knowledge and environmental values they are least active on this behavioural dimension.

DISCUSSION AND CONCLUSIONS

The purpose of this study was to investigate the strength of linkages between environmental knowledge, environmental values, and managerial behaviors and actions. Although it is widely assumed that knowledge and values will lead to enlightened environmental behaviors, the relationship between environmental knowledge, values, and behaviors has yet to be examined in a managerial sample and, we believe should not be

taken for granted in Mainland China. In this section, we shall begin by focusing on differences between the two samples and then move to more general findings and implications. We will conclude with a discussion of key limitations of this study.

Among the more interesting findings from this study is that managerial samples in Guangzhou and Beijing have somewhat different relationships between these constructs. In the Guangzhou sample, environmental *values* (as measured by the NEP scale) were found to be relatively more important than environmental knowledge in influencing managerial behaviors related to environmental protection. This was generally the case both in terms of the relative strength of the individual coefficients, but it was also observed that environmental values were also more influential in evoking the more visible forms of managerial behavior. One interpretation of these findings could be that managers in Guangzhou feel relatively freer to act on their values than do their counterparts in Beijing. This conforms to the general view that the Pearl River Delta region is relatively more liberal than Beijing due to its proximity to Hong Kong, its distance from Beijing, and because the authorities have appropriately tended to use this region as a testing ground for market liberalization (Vogel, 1989; Cheng, 1994, 1998; 2000; Yeung, 1998). This also applied to the overall explanatory power of the models, which in the Guangzhou sample ranged from an R^2 of around 23% for the least overt behaviors to 12% for environmental advocacy in the full models.

By comparison, in Beijing environmental *knowledge* appears to be relatively more important in shaping managerial behaviors. Indeed, in this sample the coefficients linking general environmental knowledge and the initiation of programs was relatively strong. Both environmental knowledge and values appear to positively influence the least overt behaviors, while environmental values having coefficients very near zero for the more visible forms of managerial behavior. For the Beijing sample, the explanatory power of the models ranged from 17% for initiating actions down to 1% for environmental

advocacy. Overall, these models are relatively weaker models than those for the Guangzhou sample. It is also interesting that the model for environmental advocacy is so utterly impotent in this context. In this regard, it should be recalled that the Beijing managers reported similar levels of behavior; thus, it cannot be concluded that their level of environmental advocacy is different from that in Guangzhou. It can be concluded, however, that the variables in this study — including environmental knowledge and values — explain essentially none of its variance.

This relative “role reversal” of environmental knowledge and values in the two samples is interesting and warrants further speculation. If we assume that Beijing managers are probably under more pressure to conform to a particular set of organizational/political pressures, then one explanation could be that they feel a need to provide a factually grounded rationale for any new initiatives. However, this line of reasoning would appear to beg a question of why Beijing managers would be willing to take initiatives in the first place if they perceive some risks in doing so. On the other hand, it should be noted that actions to protect the environment are currently being strongly advocated by both national and municipal officials in the capital city as conduits of broader official policies in support of staging a green Olympic Games in Beijing in 2008. In addition, local people warmly receive the idea of a Green Olympics and there is a strong societal consensus on a green transformation of the city (Lo & Chung, 2002). For the sake of political correctness, managers in Beijing may be willing to initiate new programs, believing they must be more explicitly linked to this factual rationale than their counterparts in Guangzhou.

In addition, in the Beijing sample it was also found that environmental values and environmental knowledge have a *joint* effect in influencing whether Beijing managers engage in such behaviors. The results of this plot confirmed a disordinal relationship in predicting how likely a manager was to engage in the least overt behaviors. Although a

combination of high environmental knowledge *and* values clearly worked together to promote such activities, environmental values in the absence of knowledge was a much less potent combination. Interestingly, managers with high environmental knowledge and low values were less likely to engage in such behaviors than managers who were low in both attributes.

Taken together, some fairly broad generalizations may be proposed about these relationships in Mainland China. First, it is interesting to observe that these relationships (i.e., between both knowledge and values with environmentally friendly behaviors) are roughly hierarchical. That is to say that if knowledge or values, for example, initiates programs, it is also likely to be positively related to the less overt behaviors (i.e., keeping informed about developments of importance to their company and working within existing procedures). Similarly, relationships to advocacy would appear to imply relationships to both other categories of behavior. Thus, it appears that relationships may begin with the least overt behaviors and then become more proactive as the climate for more visibility liberalizes over time; however, additional research would be needed to firm up such a conclusion.

A second broad generalization is that the control variables used in this study are relatively inert in explaining whether or not managers take actions on behalf of the environment in their organizations. Indeed, no control variable had a significant relationship in the “full model” (i.e., that including the interaction term). While there was some indication that women managers in Guangzhou may be somewhat less reluctant to engage in the least overt organizational behaviors, the relationship was weak and it is difficult to say that such reluctance, if it exists, is specific to environmentally related behaviors. Nevertheless, the general conclusion is that “demographics” appear to have relatively little influence on the relationships between environmental knowledge, environmental values, and managerial behaviors on behalf of the environment.

A final conclusion could be that the relationships between both environmental knowledge and environmental values with managerial behaviors are arguably weaker than might have been expected, a priori. Although the relatively low reliabilities of the environmental knowledge “test” ($\alpha = .74$) and environmental values ($\alpha = .65$) may have contributed to lower R^2 s, we also suspect that the potential for many managers to act based on their knowledge and/or values could be relatively more constrained in China.

Thus, although we firmly believe that environmental education has an important place in moving China toward a more sustainable society, it should also be recognized that education — at least as currently practiced — is no panacea. Clearly, for China to move onto a more sustainable path will require a broad range of mutually supportive regulatory and market-based measures from policy makers and more supportive organizational cultures. At the same time, education is needed so managers don't suffer the fate of being “slowly boiled frogs” and do not know when to change their environmental conditions. However, it is probably also true that some efforts should be made to try to make environmental education more relevant to non-engineers and general managers. This is because environmental issues are still largely considered as engineering, technical concerns, reflected in the poverty of environmental education in business curricula. As a result, efforts to move environmental issues into mainstream business education will, hopefully, provide a potent step forward.

Limitations

When all data for a study are drawn using a single instrument and from a single person, concerns are legitimately raised about a mono-method, mono-source bias. However, to the extent that such bias exists almost always serves to strengthen the relationship among variables and usually does so in an even manner. Consequently, the low explanatory power of some models would appear to suggest that such biases are not particularly strong in this study. Moreover, such influences would probably not operate

differently in the two sampling locations, so that comparisons between the samples would be unaffected. Finally, because the measure of environmental knowledge took the form of a rather challenging “test”, it would appear that much of the concerns are removed involving this particular measure. Thus, although it is impossible to rule out the presence of mono-method bias, it would not seem to have been a potent influence here.

A second limitation of this study speaks to its external validity. Although having two distinct samples would appear to strengthen the potential to generalize the findings to other regions in China, the differences between the two locations clearly underscores the fact that the nation is heterogenous and that generalizations should be made cautiously and considered as tentative pending additional research.

CONCLUSION

In conclusion, this study looked at the influence of environmental knowledge and environmental values on different forms of managerial behaviors toward the environment. It was found that these relationship differ between samples of managers in Guangzhou (Southern China) and Beijing (Northern China). Whereas environmental *values* were found to have significant and rather broad effects on these behaviors in Guangzhou, environmental *knowledge* appeared to be relatively more important in shaping such behaviors in the Beijing samples. In addition, some interaction effects between environmental knowledge and environmental values were observed in Beijing for the less overt behaviors. From this study it is suggested that environmental education could probably have more influence on managerial behavior if it were incorporated into mainstream business education. Moreover, although environmental education undoubtedly has an important role to play, it must be considered as but one of many mechanisms that will be required to move the nation toward more sustainable business practices.

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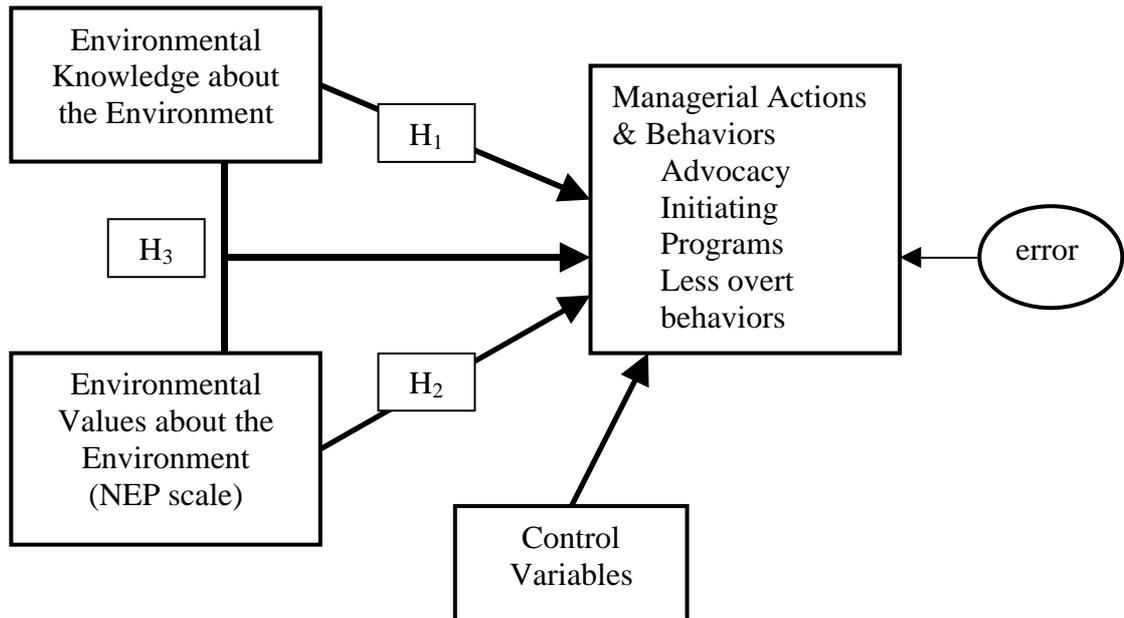
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FIGURE 1

Model of the Effect of Environmental Knowledge and Values on Managerial Actions to Promote the Environment



Appendix 1 Environmental Knowledge Scale

- 1) Why has the disposal of wastes caused problems for freshwater and marine ecosystems?
 - * a) All ecosystems have a limited capacity to absorb waste
 - # b) Both types of ecosystems cannot tolerate industrial waste
 - c) Both types of ecosystems are too old to adapt their “sink” capacity
 - d) Scientists have not yet solved the “limited sink” problem

- 2) In industrialized countries (e.g., North America and Europe), the largest environmental impact from ground transport results from?
 - a) Cars with four people driving on long recreational trips
 - b) Full commuter buses and trains
 - ^ c) Heavy trucks distributing goods
 - * d) Unaccompanied drivers travelling to and from work

- 3) Which of the following has declined by 50% worldwide since 1938 according to leading endocrinologists?
 - a) Follicle Stimulating Hormone (FSH)
 - b) Thyroxine (T4)
 - * c) Sperm counts
 - ^ d) Immunoglobulin G (i.e., gamma globulin)

- 4) The Environmental Protection Department says that [CITY NAME] will run out of landfill space between:

<u>Beijing</u>		<u>Guangzhou</u>
a) 2003	*	2001-2002
b) 2004	^	2006-2008
c) 2005		2008-2010
* d) 2006.		There is plenty of space for landfills

- 5) The concept of “ecological footprints” refers to a measure of?
 - a) Benefits from promoting walking as a transport alternative
 - ^ b) Costs from excessive consumption of natural resources
 - c) Production capacity of specific resources per capita
 - * d) Consumption based on the use of natural resources per capita

- 6) What is the main economic benefit to a business from reusing and recycling materials?
 - * a) Less cost in waste disposal
 - ^ b) Less insurance risk in transporting hazardous materials
 - c) Cost of packaging is reduced
 - ^ d) Penalties from illegal waste dumping are avoided

- 7) Design for environment (DfE) refers to environmental management tools that help achieve what benefit?
 - a) Guidelines for new standards
 - b) Guidelines for a product’s extra visual and functional qualities
 - * c) Improved environmental performance throughout a product’s life cycle
 - ^ d) Improved product performance on quality criteria

- 8) Business performance in the 21st century will likely seek what’s come to be known as a “triple bottom line” of?
 - a) Community, NGO and employee needs and expectations
 - * b) Economic, ecological and social needs and expectations
 - c) Environmental, conservation and ethical investment expectations
 - d) Insurability, credit and overall debt ratings

- 9) The sustainable challenge results most from which of the following sets of factors?
 - a) Exhaustion of both uncontaminated resources and new markets
 - b) Removal of subsidies and regulations on resources use
 - c) Decline in human population and disposable income levels
 - * d) Exhaustion of resources and irreversible damage to life support processes from wastes

- 10) Sustainable development is usually defined as, “meeting the needs of present generations without...?”
 - a) curtailing growth rates.”
 - # b) reducing access to natural resources by future generations.”
 - c) causing shareholders to discount future investments.”
 - * d) compromising the ability of future generation to meet their own needs.”

- 11) Sound environmental management is basically about business:
^ a) Anticipating trends and effects of social and cultural concerns
* b) Continuously reducing the environmental impact of their processes, products and services
c) Restructuring priorities to minimize the impact of regulations
d) Continuously promoting all operational sites as environmentally sensitive
- 12) When and where was the UN Earth Summit held?
a) Cairo, 1990
* b) Rio de Janeiro, 1992
c) Stockholm, 1994
d) Istanbul, 1995
- 13) Which of the following has the largest impact on air quality in [CITY NAME] during the winter months:
a) Ozone
* b) RSPs
c) Nitrous oxide
d) Sulphur dioxide
- 14) What is Agenda 21?
a) A comprehensive action plan to implement sustainability in 21 benchmarking firms
* b) A global action plan to implement sustainability for the 21st century
c) A global list of 21 sustainability policy items for government action
e) A globally agreed list of 21 chemicals to be phased out in the next century
- 15) How much of the Earth is freshwater (not including that locked in ice or snow)?
a) 7%
^ b) nearly 3%
c) 5%
* d) less than 1%
- 16) Technological “leap-frogging” allows developing countries to?
* a) Go straight to cleaner and safer technology
b) By-pass the bureaucratic confusion of unwarranted regulations
c) Establish networks of cleaner production sites
d) Development SMEs as suppliers to technologically advanced countries
- 17) Why are companies auditing the environmental quality of suppliers?
a) Compliance with environmental regulations requires it
b) Best competitive prices can then be negotiated.
* c) Their own environmental performance is at risk
d) International standards, such as ISO 14001, require it
- 18) “Full cost accounting” involves...
* a) Recording and considering environmental and social costs of a firm’s economic activities
b) Assessing the environmental savings from waste reduction
c) Disclosing sensitive details of all social actions
d) Covering all expenses fully
- 19) What is the ISO 14000 series?
a) A process standard defining toxic impacts
b) Standards for total quality environmental management (TQEM)
* c) A series of documents specifying the elements of a certifiable Environmental Management Systems (EMS) and other good practices
d) New publications related to the WTO (World Trade Organization)
- 20) What is the main message of “The Tragedy of the Commons”?
* a) Unconstrained use of common properties (i.e., public goods) governed by short-term economic rationality leads to common economic ruin (i.e., “freedom in a commons brings ruin to all”)
b) Maximizing the benefits from common properties requires some social subsidization
c) Agricultural systems relying on inorganic fertilizer must eventually collapse
d) State-owned enterprises, which are doomed to fail, should be privatized
- 21) Biodiversity is the?
a) Number of living matter (including bacteria)
* b) Natural variety of biological matter (animals, plants and microorganisms)
c) Cultural diversity based on location of ecosystems

- d) Variety of products able to be biologically absorbed in ecosystems
- 22) One main *potential* advantage of biotechnology is?
* a) Reduced dependency on pesticides
b) Less farming risks through monocultures
c) Increased yields from flood prone regions
d) Decreased risk of species loss
- 23) What is the main greenhouse gas and its cause?
* a) Carbon dioxide from burning fossil fuels
b) Methane from coal mining
c) Methane from agricultural livestock
d) Nitrous oxide from burning fossil fuels
- 24) Certification to ISO 14001 means that:
^ a) A facility's environmental performance must improve
b) That top management is committed to environmental performance
* c) That the company has an environmental management system in place with specified elements
d) That a firm's products/services are environmentally friendlier than its competitors' products/services
- 25) The main aim of environmental benchmarking is to?
a) Identify the profitability of environmental investments across divisions
^ b) Compare the performance and life-cycle impacts of new technologies
c) Evaluate the least-cost option for complying with environmental standards
* d) Identify ways of improving the environmental performance of operations, systems and processes
- 26) The "precautionary principle" states that:
* a) With serious threats, a lack of full scientific certainty should not be used as a reason for postponing measures
b) We must use care when disposing of hazardous materials
c) Siting of chemical plants should be located away from populated areas
d) A company should generally not release information to the public unless required to by law
- 27) Pollution taxes and charges, tradable pollution permits and resource quotas, deposit-refund systems, performance bonds, resource saving credits, differential prices, and the removal of subsidies are examples of....
a) Unwise government intervention
b) Statutory regulation
* c) Economic instruments
d) Administrative law
- 28) Acid rain now seriously affects ___% of the Mainland's land mass.
a) 5%
b) 15%
c) 25%
* d) 40%
- 29) What is the major toxic metal found in local rivers?
* a) Aluminum
b) Cadmium
c) Mercury
d) Arsenic
- 30) What is the percentage of raw sewage that is treated in [CITY NAME]?
- | <u>Beijing</u> | | <u>Guangzhou</u> |
|----------------|---|------------------|
| a) 15 | * | 13 |
| b) 20 | ^ | 20 |
| ^ c) 25 | | 28 |
| * d) 30 | | 35 |

= 2 points; # = 1 point; ^ = .5 point.
= .7405 for combined samples on total test score

TABLE 1
BASIC FEATURES OF GUANGZHOU AND BEIJING

	Guangzhou	Beijing
Geographical location	The largest city in the Pearl River Delta Region in Southern China	The Capital City situated in Northern China
Areas	7,434.6km ²	16,810 km ²
Population	6.85million	10.99million
Annual economic growth	Over 10% in the last 2 decades 1999: GDP – 206 billion yuan; economic growth, 1998-1999: 13.3%	Over 9% in the since 1993 1999: GDP – 217 billion yuan; economic growth, 1998-1999: 10.2%
Nature of the city	An old city lack of proper urban planning	An ancient city huge in scale with an industrial sector being the second largest in the country
Major environmental problems	1. Water pollution: particularly in the Pearl River 2. Air pollution: excessive vehicular emission 3. Excessive noise: a large number of construction works	1. Air pollution: the use of coal and excessive vehicular emission 2. Water pollution: particular in the rivers 3. Excessive noise: heavy traffic and industrial plants
Performance Rating (in annual assessment exercise of environmental protection work conducted by the State Environmental Protection Administration)	Ranked top 10 between 1988 and 1994; but has failed to achieve a top 10 ranking since 1995. The lowest rank was 29 in 1998.	Ranked top 3 between 1988 and 1995 except in 1992 and 1993; but has failed to achieve a top 10 ranking since 1998. The lowest rank was 15 in 1998.
Representation	Major cities in the coastal areas with strong pro-growth orientation: Beijing, Shanghai, Tianjin, Nanjing	Major cities in the coastal areas with strong pro-growth sentiment: Guangzhou, Shanghai, Tianjin, Nanjing

* A total of six cities were awarded as a model city in environmental terms in China as an inaugural event in 1996. The number was increased to 11 in 1998 and these 11 cities did not compete for ranking in the annual assessment exercise.

This table is compiled by using information from the following government publications: *China Environment Yearbook 1990-1999* (Beijing: China Environment Yearbook Press); *Guangzhou Statistical Yearbook 2000* (Beijing: China Statistics Press, 2000); *Dalian Statistical Yearbook 2000* (Dalian: 2000); and *Beijing Statistical Yearbook 2000* (Beijing: China Statistics Press, 2000).

Whereas economic mechanisms attempt to incorporate social costs of pollution into prices paid (and hence guide behavior in a market of economic exchanges), communicative mechanisms are those that inform, educate, persuade, or cajole the public or targeted groups about environmental issues in order to lead them to more appropriate actions and behaviors. Such approaches may include very specific programs (e.g., placing “ecolabels” on products to provide consumers with environmentally relevant information) or very broad education campaigns (e.g., a “keep our nation clean” media campaign). Compared to regulatory or economic mechanisms, such communicative approaches rely much more heavily on voluntary public participation.

FIGURE 2

Plot of the Interaction Between Environmental Knowledge and Environmental Values on Managerial Actions Related to Keeping Informed About Environmental Issues and Conforming to Current Practices (Beijing Sample)

