

The potential for environmental management accounting development in China

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Abstract

Purpose – This paper aims to explore the extent to which Chinese businesses are ready for Environmental Management Accounting (EMA) development as a means to help address ongoing tensions between economic growth and environmental degradation.

Design/methodology/approach – Case studies were conducted in three large manufacturing companies in the Central China region. Data gathering included 34 interviews with managers at different levels and departments in these companies.

Findings – Through the institutional lens of EMA development, it was found that coercive and cognitive institutions have helped build the potential for EMA development. Coercive institutions encouraging corporate EMA development are manifested through increasing regulatory pressure for environmental management and reporting and increasing pressure for compliance under certified environmental management systems. Cognitive pressures are mainly from the perceived need for cognition by international supply chain alliances. Results also revealed that normative institutions serve to reduce the positive impacts of coercive and cognitive institutions on EMA development.

Research limitations/implications – Findings imply that managers in heavy manufacturing companies are generally willing to change and prepare for EMA development under perceived high regulatory, economic, environmental and international pressures. However, the readiness of managers to embrace EMA depends on how soon concerns about regulatory inconsistency at local levels and low environmental awareness among employees can be resolved.



The authors would like to thank the two anonymous reviewers for their helpful feedback on this paper. The authors also acknowledge the helpful comments received at the 2013 Global Environmental and Sustainability Management Accounting Conference (Gold Coast, Queensland, July 2013) on an earlier version of this paper. Special thanks are given to Professor Zahizul Hoque and Associate Professor Muhammad Azizul Islam for their valuable suggestions on institutional theory and different angles/perspectives adopted in this theory during the discussion at the conference. Thanks are also given to the guest editors of this special edition, Associate Professor John Sands and Dr Ki-Hoon Lee, for their encouragement for the study of environmental management accounting in China.

Originality/value – This is the first study of EMA in the largest developing country. It enhances the understanding of environmental activities in business and identifies issues associated with the development of EMA in Chinese industries.

Keywords China, Environmental management, Developing country, Institutional theory, Environmental management accounting

Paper type Research paper

1. Introduction

Environmental Management Accounting (EMA) is a system which enables businesses to trace, collect, collate and analyze physical and monetary environmental information to support decision-making and performance management (Schaltegger and Burritt, 2000). In essence EMA brings together environmental and economic accounting data to help managers address decisions affecting the interrelationship between these two areas and corporate performance (Burritt *et al.*, 2002). Where environmental impacts of organisations are of concern then EMA can provide management with relevant information to encourage reduction (Jasch, 2003; Qian *et al.*, 2011).

Discussion about EMA and its role in the incorporation of environmental considerations and information into business decision-making activities and processes has increased significantly in the past decade (Burritt, 2004; Schaltegger *et al.*, 2012; Christ and Burritt, 2013). EMA has grown in importance in many European and some Asian countries, such as Japan and the Philippines (Burritt and Saka, 2006; Burritt *et al.*, 2009). Demonstrable benefits include improving corporate environmental performance, cost saving, improving pricing and product-mix decisions, helping waste reduction, improving efficiency, increasing revenue and accessibility to new markets and improving capital investment decisions (Parker, 2000; Dunk, 2002; Deegan, 2003; Gibson and Martin, 2004; Ferreira *et al.*, 2010; Burritt and Schaltegger, 2010; Henri and Journeault, 2010).

However, discussion about EMA is predominantly conceptual and limited to Western industrialised nations. China, the largest developing country has not so far been brought into the core of such discussion. China has experienced very high economic growth for over three decades, and this has created unprecedented environmental degradation at the same time. With a wide range of environmental problems evident, the Central Government in China has recognised that there is a need to achieve economic growth which is environmentally benign. This recognition has been at the highest political level. In 2005, Pan Yue, the Vice Minister of China's State Environmental Protection Administration (SEPA), warned that "the [economic] miracle will end soon if the environment can no longer keep pace" (Economy, 2007, p. 1). It has been increasingly accepted that China needs to transform its pattern of economic growth and industry from low efficiency and heavy pollution to high efficiency and low pollution (UNDP and Renming University 2010, p. iii). In light of this State objective, business corporations in all industries, in particular heavy industries in China, have been urged to take more environmental responsibility and reduce their adverse environmental impacts (Liu and Anbumozhi, 2009; Li and Liu, 2010).

Previous studies argue that development of EMA would help companies build a foundation for greater awareness of the tension between economic growth and environmental impacts, as well as the possibilities for reducing environmental impacts while improving economic performance (Birkin, 1996; Bennett and James, 1998;

[Schaltegger and Burritt, 2000](#)). The inference for Chinese business is that EMA would be a useful tool to help improve the awareness of industrial managers of the environmental impacts of their organisations and identify possible financially advantageous opportunities to reduce such impacts. Given that business corporations in China are under enormous environmental pressures and they are looking for solutions to align their environmental and economic objectives, it is critical to establish the following research question:

RQ1. What are the potential and challenges for Chinese companies in developing EMA?

Through the lens of institutional theory, this study explores the extent to which China's current economic and institutional environments, business management attitudes and perceptions are likely to accommodate EMA development in companies and thereby contribute to the reduction of a degrading environment in China. The result of this exploration will provide two main contributions. First, it will lead to suggestions for business managers as to what needs to be changed to address ongoing tensions between economic growth and environmental degradation in China. Second, it will enhance our understanding of the environmental activities of business and identify issues associated with the development of EMA in Chinese industries. This can help government and researchers design appropriate policies to encourage the use of EMA for future environmental as well as economic benefits in China.

The remainder of the paper is structured as follows. Section 2 provides an overview of existing environmental problems in China, with a focus on the contribution of industries to these problems. Section 3 reviews EMA literature, including recent applications of EMA tools in different industries and countries, and discusses the theoretical lens and institutional settings adopted. In Section 4, research methods are considered, followed by a discussion of findings in Section 5. The paper concludes in Section 6 with acknowledgement of limitations and further discussion.

2. Contribution of industries to environmental problems

China suffers from severe environmental problems, with the country being home to 16 of the world's 20 most polluted cities ([Economy and Lieberthal, 2007](#)). Mounting evidence has shown that industries are the major contributor to these problems. For example, in terms of air pollution, China has surpassed the USA to become the world's largest absolute contributor of CO₂ emissions ([McKinsey and Company, 2009](#); [Netherlands Environmental Assessment Agency, 2007](#)). Almost half of China's urban residents live in areas with air quality below the Organisation for Economic Co-operation and Development (OECD) ambient air quality standard ([Liu and Diamond, 2005](#); [OECD, 2007](#)). Also, it is estimated that 3 million people die prematurely each year in China as a result of air pollution ([Wang, 2007](#)). Among these astonishing air pollution figures, 61,227.52 billion cubic metres of waste gas was emitted by industries in 2007, out of the country's total 63,720.37 billion cubic metres of emissions (i.e. 96 per cent attributable to industry).

With regard to water quality and supply, pollution and shortage are also of increasing concern ([Liu and Diamond, 2005](#); [MEP China, 2009](#); [Varley, 2005](#); [World Bank, 2001](#)). The [OECD \(2007\)](#) estimated that three quarters of the water flowing through China's urban areas is unsuitable either for drinking or fishing. About 25

per cent of all lakes in China are adversely affected by eutrophication (MEP China, 2008, 2009; World Bank, 2001). Industry again is a major source of water pollution. The Report on the State of Environment 2008 (MEP China, 2009) shows that of total 4.565 billion tons of wastewater generated in China, discharge from industrial sources, is 1.541 billion tons.

As with land degradation, soil erosion has recently become a major concern, with 70 per cent of the Loess Plateau on the middle stretch of the Yellow River eroded, and the sediment discharge from erosion on the Yangtze River exceeding the total amount of discharges of the world's two longest rivers, the Nile and Amazon, combined (Liu and Diamond, 2005). Solid and hazardous waste also contribute to land degradation. The national census on pollution sources 2010 (MEP China, 2010) reveals that total discharge of industrial solid waste and hazardous waste in China reaches 3.852 billion tons, the largest contributor to land pollution. In summary, evidence shows that about 70 per cent of major pollution in China is caused by industries (Cole *et al.*, 2008; Sterner, 2003), including industrial waste gases, wastewater discharges and hazardous waste (Liu and Diamond, 2005). Clearly, if these environmental issues are to be taken seriously, business managers need systematic information about their current environmental management approaches, opportunities and failings and the adoption of EMA could be a new opportunity to help inform the moves to create cleaner industries in China.

3. Literature review

Previous discussion of EMA focuses on its applicability in different industries and countries, and the theoretical perspectives about EMA development. The following review of EMA literature covers these two aspects.

3.1 EMA use in different industries and countries

EMA has been used and studied in various industries to help managers identify direct information needs for energy efficiency and cleaner production (Schaltegger *et al.*, 2012). For example, in the examination of several world-leading Japanese manufacturing companies, such as Cannon and Hitachi, Burritt and Saka (2006) find that EMA helps identify the hidden costs associated with environmental impacts and provide a comprehensive record and analysis system to trace these costs.

Gale (2006) extends EMA implementation into the paper industry, a highly polluting and energy intensive industry in Canada. The study examines application of the EMA framework, focusing on the estimation and allocation of environmental costs. Gale (2006) finds that environmental costs made apparent under EMA are at least twice as high as generally considered by business managers, and this reinforces the usefulness of EMA in supporting informed decision-making. In a similar industry, Jasch (2003) presents a case study of a Swedish pulp and paper company (Jasch, 2003). EMA tools involving material and process flow accounting identify and compare environmental spending incurred for end-of-pipe disposal and preventative technologies and training, thereby raising awareness of managers to the magnitude of environmental costs of operation.

Deegan (2003) studied four Australian businesses located in the education, manufacturing and finance industries. Although a broad range of direct EMA benefits are acknowledged, such as reducing liabilities and costs, better decisions on product mix and pricing, and improving environmental performance, understanding by managers of

EMA and, in particular, environmental costs, is seen to be limited. The study also finds that a more comprehensive consideration of EMA information is neither expensive nor difficult to implement if approaches an incremental manner based on existing costing systems. More recently, [Ferreira et al. \(2010\)](#) conducted another study of EMA use in four Australian industries, namely, manufacturing, hospitality, transport and construction. They find that EMA use is low but has been increasingly adopted. The greatest benefit from EMA noted by industrial managers is its usefulness in assisting identification of new opportunities and improving reputation and decision-making.

[Burritt et al. \(2009\)](#) and [Schaltegger et al. \(2012\)](#) extend the understanding of EMA in the context of emerging markets and examine the applicability of EMA in developing countries. [Burritt et al. \(2009\)](#) investigate the use of EMA in the rice milling industry where considerable environmental impacts are associated with dumping and burning of rice husk, such as greenhouse effect by releasing methane emissions, reducing productivity of the land on which husk is burnt and air pollution caused by smoke and particulates. Their study provides evidence that using EMA tools, particularly monetary and physical environmental investment appraisal, has significantly helped managers assess process alternatives to reduce the above-mentioned environmental impacts and improve overall environmental performance. [Schaltegger et al. \(2012\)](#) conducted a case study of a beer-brewing facility in Vietnam. Their study finds that EMA techniques and tools have significant potential for supporting the information needs associated with both cleaner production and the implementation of environmental management system in corporate practice, thereby reinforcing the message from earlier studies.

[Herzig et al. \(2012\)](#) compiled 12 comparative EMA case studies in various industry sectors in southeast Asia. Consistent with many Western studies ([Henri and Journeault, 2010](#); [Guenster et al., 2011](#)), the search for economic benefits was identified as an important driver for EMA implementation. In addition, as EMA information is largely anchored to actual environmental operations, EMA tools have also been used to justify or support measures of environmental effectiveness such as reduction of freshwater consumption, carbon emissions, toxic waste or smoke pollution, etc. However, their analysis suggests that the diversity of EMA applications in the emerging market is associated with not only direct economic or technical rationales but also institutional as well as political reasons. Although the enforcement of environmental regulation was not found to be strong, in some cases where political support was seen as a key success factor, legitimacy and conformity with political expectations were important drivers for EMA application and environmental improvement in general.

As an emerging country, China shares similar achievements and problems as its southeast Asian companions. However, the distinguishing features of the Chinese political and economic system makes this super power in Asia different from other emerging countries and leads to the questioning of whether findings considered above are relevant in the Chinese context. For example, the central government in China has near complete power controlling the development and enforcement of laws and legislation for environmental protection. The advantage of this one-party autocracy is its potential strength to oversee enactment and implementation of laws and rules, while the disadvantage is its low tolerance of dissent, even though the dissent may help environmental protection. In addition, rapid economic development in China has facilitated development of clean technology industries and investment at an

unparalleled speed. For example, China has surpassed the USA in investment in wind turbines and solar cells, and has become the world's leading clean-energy powerhouse (China Daily, 2010; UNEP, 2010). Clearly, it is inappropriate to apply Western studies or other Asian studies of EMA to the Chinese context without considering its unique institutional settings, economic standing and technology development. A much needed study is to investigate environmental challenges and EMA potential by exploring real industrial practices and the views of business managers in China's own institutional environment.

3.2 Institutional perspective on EMA development

Despite the paucity of theoretical perspectives examined in previous EMA studies, institutional theory has been suggested as providing useful insights in understanding EMA adoption (Bouma and van der Veen, 2002; Ball, 2005; Ball and Craig, 2010). It has been argued that coercive, cognitive and normative institutions have all been positive driving forces for EMA development (Delmas and Toffel, 2004; Qian and Burritt, 2008; Qian *et al.*, 2011). Each is briefly examined.

3.3 Coercive institutions

Coercive institutions provide organisations with a force for compliance as well as rules, schemes and inferential settings, which organisations have to use when selecting and interpreting information for their further development (DiMaggio and Powell, 1983). Coercive pressures can come from different sources such as government, regulatory bodies, licence authorities or dependency based bodies such as parent companies. For instance, environmental regulations are imposed to change corporate behavior on environmental management; licenses are approved when rules are complied with. Where there is a violation, the expected consequence may be loss of earnings, a damaged reputation or even loss of the license to operate (Oliver, 1991). Many previous studies suggest that the increasing regulatory enforcement and policy guidelines on environmental protection and reporting of environmental protection provide a direct incentive as well as pressure for business corporations to identify and collect EMA information (Burritt and Saka, 2006; Qian *et al.*, 2011).

3.4 Cognitive institutions

Cognitive institutions connote a certain social behaviour or relationship that is collectively accepted and internalised in an organisational field (Scott, 1995). Institutional settings and social processes bound the range of possibilities of organisational actions, so that these actions are consistent with a set of common and legitimate rules and practices determined by the group of organisations that makes up the organisation field (Scott, 1991; Hoffman, 2001). Member organisations in an organisational field prefer to behave in acceptable ways in the eyes of other members so that they are not to stand out or be noticed as being different (Hoffman, 2001). If the organisation does not create the appearance of being different by adopting a widely accepted innovation, such as environmental costing (Bouma and van der Veen, 2002), it will lose its membership identity as well as support from other members in the field.

3.5 Normative institutions

Normative institutions emphasise the role of preferred or desirable expectations or norms in influencing behavior (Kostova and Roth, 2002; Kostova *et al.*, 2008). Social

values and norms are often intangible, especially those shared norms and values that are unspoken, but have been “morally governed” or “internalised” (Scott, 1995, p. 40). To match a situation to the demands of a position, social actors (individuals or organisations) would do what they would be expected to do in such position or situation (Scott, 1995). In this regard, management perception about public opinions and community expectations in relation to sustainability (Burritt and Schaltegger, 2010), recycling (Qian *et al.*, 2011) and ecological development (Boons *et al.*, 2000) could influence organisations’ activities as well as their management systems, which may potentially encourage the adoption of EMA.

It appears that, for each institutional perspective – coercive, cognitive and normative – there is a reason for companies to adopt EMA practice. Institutional pressures can be drivers for EMA development. However, stabilised or institutionalised norms and values may also be “resistant to change” (Zucker, 1987, p. 446). Scapens (1994, p. 306) noted that social institutions not only have the enabling quality that “enables actors to act in a highly complex world” but also have the quality that constrains individual ability to innovate. To examine and understand the potential and challenge for EMA development in China, the institutional settings discussed above and their respective roles, either driving or constraining EMA adoption, are explored through three company case studies.

4. Research methods

Given the exploratory nature of this study, the case study method is used. As suggested by Yin (2009), this method helps retain the holistic and meaningful characteristics of real-life events in the field. This is particularly the case when multiple case studies are applied to develop a rich understanding of real-life practices and problems (Scapens, 2004). Three large manufacturing companies in the Central China region were selected where heavy industries have been dominating economic growth for decades.

Central China industry consists of the oldest bases such as steel, machinery, automobiles and electronics production. These industries have flourished in recent years as China’s manufacturing sector moves away from coastal regions to central areas. As directed by the 11th Five Year Plan (2006-2010), Central China has become the focus of the most recent rapid economic growth in the country and is therefore an excellent target for considering EMA developments as environmental problems are exacerbated by rapid economic development.

Manufacturing industry was chosen as the basis for case studies for two reasons. First, manufacturing industry is a major pillar behind the strengthening of the Chinese economy and upon which there has been an intense focus. Recent statistics show that manufacturing accounts for nearly 47 per cent of total Gross Domestic Product growth in China (CSB, 2010). Second, as a significant contributor to economic growth, manufacturing has also been criticised for causing serious environmental problems. Evidence shows that almost two-thirds of the major pollution in China is caused by manufacturing industry, particularly heavy industry (Sterner, 2003; Cole *et al.*, 2008). According to Chinese national environmental protection guidelines, “State’s Key Industry Cleaner Production Technology Orientation Catalogue”, steel and machinery/equipment manufacturing are identified as the two main priorities for developing cleaner production (MEP China, 2010).

The following table describes the profile of manufacturing companies investigated and interviews conducted in each company. For ethical reasons, the companies studied and interviewees are not named and are referred to as company A, B and C. In each case, a CFO in the accounting department was our first contact, through who other senior managers as well as relevant personnel were introduced and connected. The departments and formal positions of all interviewees are noted below (Table I).

Both Company A and Company B are state-owned enterprises founded in the 1950s. Company A is the largest steel-making company in the region with total assets over RMB 11 billion (approximately AUD 2 billion). It mainly manufactures and assembles steel tubes and casings for automobile, petroleum, boiler and coal mining industries. Companies B and Company C are both equipment and machinery producers of similar size, but since 2000, Company C had been a state-owned public company but more recently privatised. All three companies have finance and accounting departments responsible for corporate finance and accounting issues. Company B and Company C include safety and environmental management in their production departments, while Company A has separate environmental and production departments.

Interview, observation and archival study were three methods used for data collection. Altogether, 34 people (mainly senior corporate executives, managers and chief officers) were interviewed. Primary interviewees were from finance and accounting, safety and environment and production departments. Considering the important influence of the central communist party and culture in management of state-owned companies, senior members in party committees, work unions as well as cultural development in Company A and Company B were also interviewed to provide richer data for analysis. In addition to the interviews, site observation was conducted in each case. This included informal interviews with general administrative staff and production workers and attending meetings about environmental management issues. Archival documents, including corporate environmental policy and guidelines, annual reports as well as corporate internal newspapers and reports were used to supplement interviews and observation so that information gathered could be triangulated where possible.

To explore the potential of EMA development in the perceptions of business managers and in the context of organisational challenges within current economic and institutional environments in China, we used Braun and Clarke's (2006) thematic analysis procedures to analyse field data. Braun and Clarke (2006, p. 24) elaborate an accessible and theoretically flexible approach to analyzing qualitative data. In particular, their approach offers a deliberate and rigorous way not only to ground analytic claims in the data but also to go beyond the "surface" of the data. The six phases we used in accordance with Braun and Clarke's (2006) approach involve transcribing data (in our case, this includes language translation), generating codes, searching for themes, reviewing themes, defining themes and reporting themes. As the key to data conceptualisation is theme or pattern identification, the discussion in the following section about the research results focuses on various themes identified in the data analysis.

5. Analysis of results

The case study revealed that none of the organisations investigated had established a systematic EMA system to help with management of environmental/economic

Table I.
Company profile and
interview personnel

Company	Ownership	Industry classification	Employee no.	Interview department	Interviewee no. and position
A	Publicly listed	Steel manufacturing	5800	Finance and accounting Safety and environment	1 CFO 3 deputy managers 5 accountants 1 manager 1 director 1 manager 1 manager 1 manager 1 chairman
B	Publicly listed	Equipment/Machinery	1600	Production Purchasing Culture and communication Party committee Managerial Administration Development Finance and Accounting Production (including safety and environment)	2 party secretaries 1 manager 1 manager 1 CFO 1 accountant 1 chief engineer 1 engineer 1 chairman 1 head of department
C	Private	Equipment/Machinery	1400	Party committee Human resource Work union Finance and Accounting Production (including Safety and environmental issues) Managerial administration International business	1 director 1 chairman 1 CFO 1 manager 1 cost accountant 1 chief engineer 2 managers 1 manager 34
Total					

performance. However, the collection and use of EMA information such as environmental cost information, material flow information and adoption of EMA tools such as environmental budgeting and investment appraisal were frequently observed in the field. For example, the general ledgers in the existing accounting system (with financial accounting as the pillar) did not account for environmental costs separately, but accumulated and separately reported them in overhead accounts. Although the application of environmental costing in the case organisations was not through an individual account for environmental cost, there were subsidiary ledgers capturing many environmental expenditures and investments. This implies potential applicability of EMA in accounting and management practices, which is similar to the findings and inferences in previous EMA literature (Bartolomeo *et al.*, 2000; Parker, 2000; Gale, 2006; Qian *et al.*, 2011; Schaltegger *et al.*, 2012).

Through the application of the institutional lens to EMA development, two sets of pressures for EMA were identified. First are direct environmental and economic pressures for resource (material and energy) efficiency and the associated need for information. Second are coercive and cognitive institutions. Pressure from coercive institutions is manifested through:

- increasing regulatory pressure on environmental management, in particular, recent regulations on providing the foundation for reporting environmental pollutants; and
- increasing pressures for more EMA information for compliance with the introduction of certified environmental management systems.

Cognitive pressures favouring the development of EMA are mainly based on the perceived need for international supply chain alliances to have environmental legitimacy. However, it is found that normative institutions serve to reduce the positive impacts of coercive and cognitive institutions on EMA development. Normative barriers include lack of consistent local government support, lack of confidence in regulatory power and lack of environmental awareness and skills among employees. Figure 1 illustrates relationship between institutions as either drivers or barriers and EMA development.

The findings are explained in detail as follows.

5.1 Direct information need for improving efficiency in resource utilisation

The case studies revealed that material and energy saving was prominent in motivating corporate environmental management and development of EMA. The Chinese economy is typified as high in resource and energy consumption. However, business managers interviewed strongly argued that the existing pattern of economic growth with high consumption and low output was economically and environmentally inefficient and in need of rapid change. There was a consensus about the need for managing and controlling material and energy flows in production processes and more importantly having a system that can trace and visualise cost savings associated with material and energy flows. The consensus existed without knowledge of terms such as material flow cost accounting.

In Company A, a separate “Energy-savings Department” was established specifically for providing daily statements on the energy consumption of water, electricity and natural gas. Energy cost information for production lines was gathered

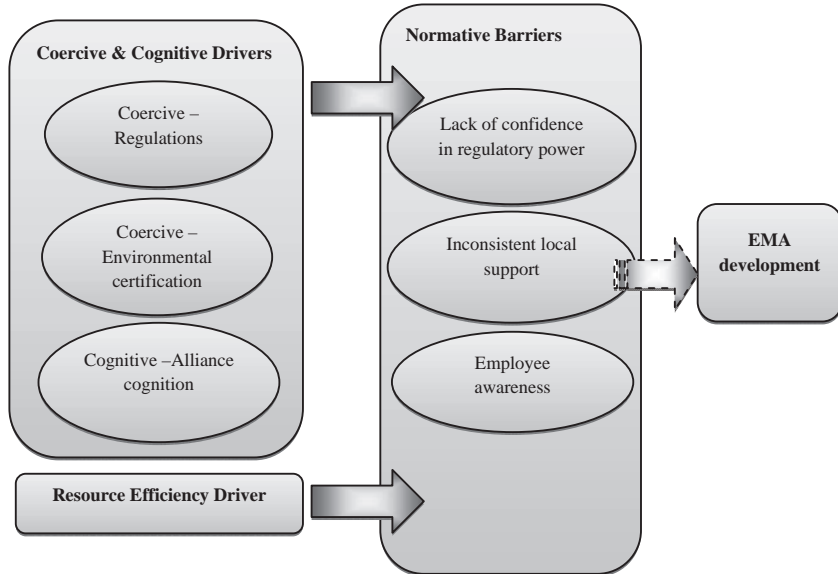


Figure 1.
Drivers and barriers
for EMA
development in
China

for main products and decisions on energy cost savings for each product were made. As the company Production Manager further explained:

Energy costs are allocated to different types of steel as they consume different amounts of electricity, depending on the size of steel tubes, whether they are alloy steel, and whether they are high or low pressure processed steel. This is important in determining methods for saving these costs (Production Manager, Company A).

The separate department for Energy Savings in Company A not only promoted energy efficiency among workers on the production lines but also put energy saving pressures on office workers in non-production departments such as in managerial administration and accounting departments, as they had to identify and report energy information about their workplace on a regular basis. Efficient resource utilisation in Companies B and C focused on material flows and consumption. Both companies conducted monthly analysis of the efficiency of raw material consumption at different workshops in different production lines, which was then reported to departmental and then top management levels so that appropriate cost drivers could be identified and strategies developed by senior management. For example, Company C used its Engineering Technology Department to collect and report information on material efficiency. One of the managers in Managerial Administration Department indicated that:

The benefit of using our engineering department to collect and report material flow information is that when they conduct efficiency analysis, they can come up with improved performance indicators or improved product design at the same time. This will help bring future efficiency and savings (Manager of Managerial Administration Department, Company C).

The recent active pursuit of resource efficiency in China may be largely attributed to rapid growth in demand for resources and severe environmental problems related to air

pollution. The Chinese economy contains a large proportion of heavy industry, which, because of consistently strong gross domestic product growth over several decades, has led to fast consumption of raw materials and energy, exacerbating environmental as well as social problems (McKinsey and Company, 2009, UNDP & Renming University, 2010). High energy consumption along with other indicators suggests that China has followed an extensive growth path with high resource inputs and heavy pollution (Zheng *et al.*, 2009; Irmen, 2005). For example, energy consumption per unit of gross domestic product in China is about 20 per cent higher than the OECD (2007). To produce goods worth US\$10,000 China needs more than seven times the resources used by Japan and almost six times the resources used by the USA (Lorenz and Kessler, 2006). More recently, China overtook the USA to become the largest energy consumer in the world (Smith and Schmollinger, 2010). Energy consumption is also the major contributor to greenhouse gas emissions and because of this China has become the world's top CO₂ emitter since 2006 (McKinsey and Company, 2009; Zhang, 2012).

While recent government policy has been redirected to improving resource efficiency and promoting renewable energy, rising material and energy prices are threatening the competitive advantage of business corporations, particularly manufacturing companies (Zhang, 2012). Company C has witnessed the closure of a large number of local small- and medium-sized machinery manufacturers which lost ground when competing for resources in the past few years. The CFO of the company claimed that "we cannot lose this battle. We need innovative methods to control energy usage". It seems that with the continuing increase in resource prices accompanied by additional environmental degradation, business managers feel an immediate need for improvement in efficiency, better management control and information systems.

5.2 Information needs under institutional pressures

Results indicated the importance of three types of institutional pressure – coercive through regulation and environmental certification; cognitive pressures from international alliances; and normative through the lack of confidence in the fair implementation of regulatory power, consistency in local support, etc.

5.3 Coercive – increasing regulatory pressure

The power of government regulation to enforce environmental management and information reporting repeatedly appears as a theme in the interview data encouraging EMA development. Government has a strong effect on the perception of managers about how and to what extent companies must react to environmental pressures, sometimes irrespective of economic reasoning.

There is no shortage of environmental laws and regulations in China's recent history. In fact, burgeoning environmental legislation has come into force since opening up and reform in 1979. Legislation includes the Environmental Protection Act (1979, 1989), Water Pollution Control Act (1984), Mineral Resources Law (1986), Air Pollution Control Act (1987), Solid Waste Pollution Prevention Law (1995), Energy Conservation Law (1997), Environmental Impact Assessment Law (2002), Renewable Energy Law (2005) and many more (Alford, and Shen, 1997; Jin, 2006; McKinsey and Company, 2009). Since the establishment of New China in 1949, the country has developed and established 9 environmental protection laws; 15 natural resources protection laws; and 800 national

environmental protection standards with relevant indicators, criteria and parameters (Jin, 2006; SCIO, 2006).

However, environmental regulation with a focus on business corporations only intensified after 2007 with the introduction of the first business environmental information reporting requirement, the Environmental Information Disclosure Act 2007 (Ma and Ortolano, 2000; McKinsey and Company, 2009; Richerzhagen and Scholz, 2008). This was followed by a series of regulations and guidelines in 2008, such as Guidelines on Environmental Information Disclosure by Companies Listed on Shanghai Stock Exchange 2008, Guideline on Fulfilling Social Responsibility by Central State-owned Enterprises 2008, Guidelines on Social Responsibility for Industrial Corporations and Federations 2008 (11 national industrial federations and associations encourage all Chinese industrial companies and industrial federations to establish a corporate social responsibility system including reporting and performance indicators) and the China Sustainability Reporting Verification Rules and Instructions 2008. In the following year, the State-owned Assets Supervision and Administration Commission of the State Council established requirements for state-owned enterprises to issue a corporate social responsibility report within three years and China's first version of corporate social responsibility reporting guidelines was issued by Chinese Academy of Social Sciences in that year. The Academy then further updated their Guidelines in 2011 and 2013.

The series of regulations since 2008 has been viewed as providing a signal for policy reorientation to improve corporate environmental and sustainability performance. Many interviewees, in particular senior managers and environmental managers, highlighted the intense pressures from increasingly more stringent regulations. For example, one production manager in Company A made the following comment:

Now environmental information has to be collected and reported to the Statistics Bureau of the city and the provincial governments every month. According to the Eleventh Five Year Plan, for large state-owned companies like us, energy consumption needs to be reported to the Hunan Economic Committee every quarter and to the China National Development and Reform Committee annually. They have fixed reporting forms to complete, for example, the reporting form of the China National Development and Reform Committee is about 10 pages long (Production Manager, Company A).

Interview data indicated that coercive pressure from government is perceived as being the most crucial driving force for business to incorporate environmental considerations into its management and reporting systems. The government in China not only represents political authority but also practically acts as an "invisible" manager of many public companies. This was frequently observed from the field study as well as clearly reflected in the following representative statements from two Party Committee members:

The government has clearly set much stricter regulations in regard to environmental protection. If you go against these regulations, your management position and career will be under threat (Director of Party Committee, Company A).

Everything the company does, be it economic activities, or contracting, you will have to deal with the government. Consider the environment. If you do not care about the environment, you will face difficulties in doing everything because you cannot be promoted or get any government support (Chairman of Party Committee, Company B).

The government has also introduced some incentives linking environmental performance with company reputation as well as senior managers' personal promotion, such as including environmental performance as a consideration when awarding top brand names or naming successful entrepreneurs. For example, the manager in the Managerial Administration Department of Company C proffered:

For some environmental aspects, the government did not specify details and requirements, however, when we apply for some prizes established by the government, they are awarded only if we have met this standard. [...] Most of the prizes need an environmental performance report from the company, such as *China Famous Brand*, or if our CEO applies for *China Entrepreneur* (Manager in Managerial Administration Department, Company C).

5.4 Coercive – information need for environmental certification

The recent increase in the adoption of environmental management systems under ISO 14001 has provided a systematic foundation for establishing environmental (mainly physical) information management. To be accredited with the environmental certificate, companies have to follow rules and meet specific criteria. Environmental information records and systems need to be in place to facilitate the compliance of rules and criteria. As mentioned earlier, Company A has set up a separate department specifically in charge of material and energy consumption and records relating to a voluntary environmental management system. This department is responsible for meeting all certification needs and one of the key performance targets for the manager in this department is to obtain and maintain environmental management systems certification. In Company B, every workshop had its own cost accountant in charge of feeding environmental cost information back to the financial manager on a daily basis. Monthly meetings were held to compare the cost of the current level with that from the previous month to formulate the best strategy for the coming month. The chief accountant commented that:

We have a cost accountant in every workshop. So environmental information can be constantly gathered and passed onto Management Department. The information we gather would then be evaluated and compared with the standards set in ISO14001 as well as our own past records of raw material usage for every workshop (Chief Accountant of Finance and Accounting Department, Company B).

Company C has individual management accountants working to ensure that environmental information is collected on a routine basis rather than as *ad hoc* practice. The manager of Managerial Administration department explained that:

When we started environmental accreditation of ISO14001, the focus had been on environmental solutions such as categorizing and sorting out disposals. Now the focus has been pushed to documentation and information tracing in operations. For example, we have eight workshop management accountants. Material usage has to be traced and recorded on a monthly basis and then adjusted according to the "Plan-Do-Check-Act" approach required for ISO 14,001. Energy consumption analysis is to meet the accreditation requirement (Manager in Managerial Administration Department, Company C).

5.5 Cognitive – information need for cognition by international supply chain alliances

Another critical theme observed from interviews was that supply chain pressures from international partners were seen to be of growing significance in developing corporate

environmental policy/strategy. Information requests about environmental performance and quality control from product buyers in developed countries was mentioned on several occasions as forcing companies to gather and report environmental information as other alliance partners do. Most management interviewees perceived developed countries as being more socially and environmentally responsible with social and environmental performance of greater importance. To stay as a legitimate member of their international alliances, business managers have to ensure their social and environmental performance and activities do not lag behind their peers and partners. This is despite the fact that none of the companies explored has systemically linked information needs of international supply chain partners with their own management and information systems.

It was made clear in the case studies that international pressures are expected to continue to grow and environmental information systems such as EMA are expected to become of increasing value with this growing pressure. The increasing relevance is clearly reflected in the following comment made by a manager from the Party Committee office in Company A:

Our products are exported to more than 50 countries. They [foreign markets and customers] would check our environmental certification first, and then quality. There are some international environmental management experts visiting our company more than 10 times. (Manager of Party Committee Office, Company A).

Another example can be seen in the comments of the chief engineer in Company B:

Pressures come from our headquarters who want to satisfy our American partner. You know, they pay more attention to environmental issues, employee welfare and social responsibility. We have obtained environmental accreditation as requested. We are now applying for SA8000 to show our effort in improving social accountability. So our American partner will consider us to be different from other joint venture partners (Chief Engineer, Company B).

The above themes all point to the potential influences on and opportunities for EMA adoption in Chinese businesses. However, as per normative institutions, such as norms and values embedded in management perceptions, attitudes and behaviour, our case studies revealed that they serve to reduce the positive effects of coercive and cognitive pressures on EMA development, which are detailed below.

5.6 Normative barriers for EMA development

Although coercive pressures are seen as the most powerful driver for organisational change for EMA, and the cognition among supply chain alliances are perceived to provide incentives for EMA development in the future, companies need to have “morally ready” attitudes and perceptions to accept, “internalise” (Scott, 1995, p. 40) and implement change. Based on the observations and interviews in all three large manufacturing companies, this normative pressure is minimal and largely constrained by a number of institutional barriers.

5.7 Normative – lack of confidence in regulatory power

While no one should underestimate the power of the Central government in China and the enforcement of its regulations and policies, confidence in regulatory power is often reduced because of perceived policy discretion and human management. This has

created a cultural institution where business managers consider environmental sanctions can be altered, delayed, or avoided. For example:

China is still a country of human management. It is not really based on legal regulations. We can have a lot of environmental laws and regulations, but they may not be effective, depending on who implements them and how to implement them (Deputy Manager, Company A).

Although we do have laws and regulations on environmental management, the issue is with their implementation. As there is little you would need to pay in terms of violation, even if there is violation, there would always be ways that you can get away with it (CFO, Company B).

Regulatory power has also been compromised because of the perceived policy discretion and instability. The government may keep making and issuing new environmental policies to regulate corporate environmental management, but it also keeps introducing changes. Therefore, business managers would generally prefer “watch” and “action” rather than taking rapid structural change for environmental management. As the Chief accountant in Company A argued:

The policies often change too quickly to actually follow. If today we follow this one, tomorrow when we wake up, we have to follow another one (Chief Accountant, Company A).

This was confirmed by an accountant in the finance and accounting department, who commented that:

Generally speaking, for all state-owned companies, there are plenty of policies and rules to follow. They are often ineffective because the decision making process is just the leaders’ random thoughts. (Accountant, Company A).

5.8 Normative – lack of consistent local support

Environmental management promoted by the Central government was to help the company achieve better environmental performance, but interviews showed this was often discounted at the local level because business managers have to cater for different needs of local government. The managers’ understanding and attitudes towards different levels of government meant there were different responses to coercive pressures. Depending on where the coercion came from, the managers had a different interpretation of the pressures, for example, whether it came from the central government or the local government. One manager commented on the local government:

The general regulations the Central government issues are getting better and better. But China is huge, the effect of their implementation depends on local government, which again then has to do with how well local government is run and whether they actually support you (Head of Human Resource Department, Company B).

It seems that while the Central government aimed to promote and implement environmental management in companies, local government has a different agenda. This perception might have caused the central government’s coercion of the company in terms of environmental protection to be discounted, as the company had to consider the imperatives for local government, such as paying more tax to local government if local support cannot be obtained. Company managers generally perceived that local government focuses merely on economic achievements, ignoring environmental pollution. As one Vice Manager in the Finance and Accounting Department commented:

Local government considers their tax revenue important. For economic purposes, local or regional protection is quite strong. They could loosen environmental protection regulations if considering a company a big contributor to local economy, that is, a big tax payer to local government. Some of local government officials come to our company, and we have to spend a lot of money on hospitality. But this is important (Deputy Manager, Company A).

This overemphasis on local economic growth seems to lead to the ineffective implementation of environmental regulations.

5.9 Normative – lack of employee environmental awareness and skills

The accountant plays a vital role in establishing EMA systems for companies and this demands new and multidisciplinary skills, knowledge and awareness. The field observation revealed that the accountants interviewed lacked such training. It seems challenging for accountants to lead any organisational change for environmental management (Monteiro and Aibar-Guzman, 2010). As one accountant remarked:

A lot of smaller companies would not consider environmental costs or benefits. Even for us, a relatively big company with a large accounting department, we are not clear why and how to gather such information for our boss, things like emission standards, and how they affect the operation of the company, how much we save by environmental investment, etc. We sort of feel it may help us save costs, but nobody is clear how to figure out exactly how much (One office accountant in the Finance and Accounting Department, Company B).

Also, while the company leader went abroad and learnt about international green practice and wanted to mimic that practice and promoted EMA, this appreciation was not shared with general employees. Mimicry of environmental management could be disturbed because of resistance from general employees to their old way of doing things. As another manager in the Finance and Accounting Department commented:

We have been accredited ISO14000, and it was so detailed. Carefully implementing it will get an ideal result. However, sometimes workers could not really follow it. This may be to do with the habit of workers, or their attitudes. Different attitudes lead to different results (Deputy Manager, Company A).

With regard to the communication of information, it has been shown that there was a lack of communication about EMA both between the different departments and between the corporate top management and shop-floor workers. While it was found that the top managers generally had a better understanding of the environmental status and the meaning of environmental management, among the general workforce in the companies, understanding was very limited. People had not yet grasped the rationale behind managing environmental impacts of companies. From this, managers should be encouraged to gather environmental information and also to share the information:

Routines and customs among workers are hard to change, and it needs a lot of effort and takes a long time [...]. We are planning to establish “excellent company culture”, i.e. a common value system, which can then guide environmental behaviour of our employees (Director of Human Resource Department, Company B).

The manager in the Production Department of Company B stated that there was a lack of awareness about the importance of EMA among general employees:

We have got the necessary training. For example, the new employees all need to be trained in the Environmental Health System (EHS), among which environmental risks are important

elements. This again includes waste water treatment, dangerous waste treatment, etc. But there has been some violation. For instance, it is required that the mechanical oil is recycled, but some employees are lazy, and still pour it down the drain, which would cause environmental problems [...] I think we need education about quality. If we all have the awareness of caring for our environment, caring and protecting our home, then things will be totally different [...] regarding environmental management [...] currently it is "I am required to do", but it should be "I want to do". This process takes time. Now the employees are asked by the managers to do so, and they feel it is troublesome (Chief Engineer in Production Department, Company B).

6. Conclusion

This paper explores the extent to which Chinese businesses are ready for EMA development. The focus of this exploration is to discover the potential of and barriers to EMA development in China. Institutional theory is applied to examine the economic and institutional environments as well as management perceptions in three large manufacturing companies in Central China. Such exploration is distinctive and provides theoretical as well as practical insights for corporate EMA development in the world's largest developing economy. It is also a timely response to the current increasingly serious environmental issues.

The key findings from this study are as follows. First, through the examination of EMA implementation in current Chinese companies, it is found that there is still considerable room for improved use of EMA as a means to inform Chinese managers about corporate environmental impacts and opportunities. Current practice does not systematically use EMA tools to identify environmental costs in separate accounts. The result is that potential long-run pollution reduction opportunities can be overlooked.

Second, in response to the research question about the potential for EMA development in China, the study reveals several institutions that are likely to drive EMA development. It is found that high regulatory and economic pressures have encouraged business managers in heavy manufacturing companies to change and prepare for EMA development, especially in relation to material and energy flows and efficiency. In technical terms, existing environmental management systems also have the potential to impose pressures on companies to re-examine their current practices and obtain support from EMA information. In addition, the growing demand for environmental information from supply chain alliances is likely to encourage the adoption of EMA tools which would enable the collection of environmental information.

Third, despite positive driving forces from coercive and cognitive institutions on EMA development, the study reveals that normative institutions play a constraining role, reducing the positive impacts of coercive and cognitive pressures. It is found that management readiness to embrace EMA depends on how soon the number of normative barriers can be resolved. The challenges in relation to normative institutions include perceived policy discretion by the Central government and the long-standing issue about individual human power and cultural relationships overriding regulatory power, particularly at local levels. These negative perceptions have prevented companies from making structural changes such as establishing EMA systems in the short term. As pointed out in [Dobers and Halme \(2009, p. 242\)](#), corporate social responsibility may be "twisted" in countries where institutional systems are weak and the enforcement of law and regulations is arbitrary. Another important normative barrier to EMA development

relates to the perception of managers that employees have insufficient environmental awareness, knowledge, skills and sometimes willingness to account for sophisticated environmental impacts of the companies and assess the economic impacts of these.

To accelerate EMA development, it would appear from the findings of this exploratory study that government policy-makers need to provide certainty about the stability of environmental regulation and enforcement in implementing regulations at local levels. Furthermore, clear scope for developing education and awareness was evident. Greater investment in and reinforcement of environmental education and training, particularly for large numbers of manufacturing management and workers, are needed to increase their environmental awareness and skills. With such reinforcement in place, the managers interviewed felt that their Chinese businesses would be better placed to help address the tensions between economic growth and environmental degradation so crucial to the future.

However, because of several limitations, caution needs to be taken when interpreting the above findings. One caveat to our findings is that the research sample is limited to a few large manufacturing companies in one industrial region in China. Generalisability may have been compromised because of this sample selection. Another limitation in this study lies in the method used in data analysis. While we consider researcher judgement, with some flexibility retained, is necessary to determine themes or patterns (Braun and Clarke, 2006), it has to be acknowledged that the subjectivity involved in data interpretation may reduce the rigidity in data analysis as displayed in large empirical studies.

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