A Comparison of European, US and Asian Manufacturing Plants on the Use of Socially Responsible Practices

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ABSTRACT

Manufacturers around the globe are implementing socially responsible practices in their plants to comply with government policies, to create more value or for socially conscious reasons. Research has examined some aspects of the implementation of socially responsible practices, but little is known about the general level of implementation of such practices. Also, only a few studies have examined the degree to which such practices contribute to bottom-line manufacturing performance, or whether such practices differ in various regions around the world. The present study used a database of manufacturing plants to explore whether the practices of pollution prevention, waste reduction, recycling of materials and employee health and safety were related to indicators of manufacturing performance and competitiveness. Results showed that the use of socially responsible manufacturing practices was related to indicators surrounding the speed of delivery. Implications of the results for future research are discussed.

Key Words: social responsibility; manufacturing; green manufacturing

INTRODUCTION

The practice of socially responsible manufacturing and supply chain management has grown considerably (O'Brien, 2002; Kovacs, 2008) as governing bodies and industries have begun to establish environmental and socially responsible standards. In response to initiatives such as the United Nations Global Compact's commitment to environmental

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protection (Brown, 2008) and the European Union's (EU) leadership in establishing such responsible environmental protection policies for businesses (del Brio and Junquera, 2003; Grote et al., 2007; Kovacs, 2008), along with public calls for social and environmental responsibility, global manufacturers have initiated a variety of socially responsible practices. Whether using environmental standards in the selection of outsourcing or supply partners, adherence to employee health and safety standards internally, ethical behaviour in developing countries, or requiring environmental protection in upstream and downstream partnerships, manufacturers have begun to recognise the importance of social responsibility inherent in their activities (del Brio and Junquera, 2003; Trowbridge, 2001). In addition, industry standards are emerging from many fronts, such as ISO 14001 and the Institute for Supply Management's (ISM) Principles for Social Responsibilities. Within manufacturing, socially responsible practices include a variety of activities such as waste reduction, recycling, reuse, remanufacturing, conservation in water usage and employee safety precautions.

Whether the drivers of more socially responsible practices in the supply chain are government edicts, changes in industry standards or bottom-line performance is debatable. There have been a number of studies supporting the cost savings associated with green purchasing (Carter, 2005), pollution control (Klassen and Whybark, 1999) and other socially responsible practices (King and Lenox, 2001; Mitra and Webster, 2008; Shrivastava, 1995; Yang and Sheu, 2007). As noted by the ISM, the payback from socially responsible behaviour can be financial or ensuring that companies avoid difficult and embarrassing scrutiny, but the soft paybacks of integrity, honesty and reputation are the real foundation and rationale for such practices (Novak, 2004). Nonetheless, there is growing evidence of positive relationships with cost efficiency, quality, speed and supply chain performance (Brown, 2008; Carter, 2005; Vachon and Mao, 2008). Many of the studies have been performed on limited samples in specific industries or in smaller case studies. There is a call for more research on a broad level that examines the relationship between socially responsible practices in supply chain management and firm performance.

In addition, there might be variation in the emphasis such socially responsible practices receive in different regions around the world (Zhu et al., 2007). As noted above, the EU has moved forward on legislation and policies that set environmentally conscious standards for manufacturers and supply chain managers. For example, in 2005, a European Commission directive established that manufacturers of energy-using products would be required to examine the integration of eco-design into their standard designs (Grote et al., 2007). This directive has affected the social responsibility of the manufacturers of a wide variety of products including heating systems, computers, televisions, lighting and batteries. In the United States (US), the Environmental Protection Agency (EPA) has very stringent standards for the disposal for hazardous waste and the Occupational Safety and Health Administration (OSHA) standards have long existed for regulating employee health and safety, but legislation concerning other socially responsible practices has yet to be enacted. In Asia, variations by country exist, as Japan has much stronger policies toward environmental management compared to China, for example. Many companies in the US and

Asia have voluntarily adopted socially responsible practices, as the business case for social responsibility gains strength.

There is a need for broader research efforts examining the impact of socially responsible practices in supply chain management on firm performance covering multiple practices, multiple measures of performance and multiple regions around the globe. There is also a need for an agenda for future research in this area. The purpose of the present paper is to initiate research along these paths. First, we present an initial exploration of socially responsible practices in manufacturing facilities using an existing dataset drawn from a number of regions around the globe. The study focused on the practices of waste reduction, recycling, pollution prevention and workplace health and safety activities. The data were gathered as part of a larger effort by the Global Manufacturing Research Group (GMRG), and included samples from Europe, the US, Asia and Australia. In this study, we addressed the following questions:

1. What is the current reported use of socially responsible manufacturing practices in the EU, US and Asia?
2. Do the socially responsible practices correlate with indicators of manufacturing performance and competitiveness?
3. Does the level or use of such socially responsible practices vary by global region (EU, US and Asia)?

In addition, within the discussion of the results, we provide strategies and guidelines for future research in the area of socially responsible manufacturing and supply chain management practices.

LITERATURE REVIEW

Corporate Social Responsibility (CSR) is defined by the Commission of the European Communities (2001: 7) as

> …the voluntary integration, by companies, of social and environmental concerns in their commercial operations and in their relationships with interested parties.

One of the keys in the definition is that the integration of such concerns is voluntary, going beyond mere compliance with any regulations or legal rulings (Kovacs, 2008). Commercial business operations, while meeting the needs of shareholders through profits, exhibit CSR in order to address the concerns of a variety of stakeholders – the local community, government, employees, society at large or even the environment. Research on CSR in manufacturing and supply chain management has been conducted under a variety of terms, including green supply chain management, environmental management, sustainability management and others. Given the specific nature of the activities included in the present study, the term 'socially responsible manufacturing practices' was determined to be the most descriptive.

It is important to note the focus here is on practice, not philosophy or motive. In exploring these socially responsible practices, the present study assessed the perceived level of use of socially responsible practices themselves, not the social responsibility of the companies involved or their motives for engaging in the practices. It is understood that companies engage in these practices for many motives – to elicit a better reputation with the public or because of the need to comply with government policy – but the present study is not concerned with motives. At this initial phase of the research, the interest was only in the practices that the manufacturers have in place. Also, it is recognised that the global green movement is a powerful force, and that the ultimate measure will be whether companies can reduce the size of their carbon footprints in the global environment. The present study was limited by the items used in the GMRG survey, which simply focused on the perceived use of various socially responsible practices. Given the lack of data on this topic, the present study was able to explore some basic questions for over 1,000 manufacturers around the globe to understand a baseline level of activity.

Socially Responsible Manufacturing Practices and Manufacturing Performance

There are a number of categorisations that have been offered by researchers and practitioners as to the activities included in socially responsible manufacturing practices. The ISM has developed principles of social responsibility for its industry across seven areas. These areas include supporting communities, proactively promoting diversity, environmental responsibility, adhering to ethical standards or conduct, use of sound and transparent financial practices, protection of human rights and dignity, and safety in the work environment as well as in products and practices (Novak, 2004). In their confirmatory analysis of their survey measure for socially responsible supply chain management practices implementation, Zhu et al. (2008) reported five factors: internal environmental management, cooperation with customers, green purchasing, ecological design of products and investment recovery. Kovacs (2008) and others divide socially responsible practices into activities targeting upstream partners (i.e. purchasing from suppliers who are environmentally and socially conscious, ethical and responsive to human rights concerns) and those downstream (i.e. responsibility for the environmental impact of operations, including resource usage, employee health and safety, product safety, waste management, recycling and environmentally conscious packaging). For the purposes of the present study, socially responsible manufacturing practices are defined using four activities targeting downstream stakeholders: pollution prevention, recycling of materials, waste reduction, and employee health and safety.

Pollution Prevention

In the production process, pollutants can be released through the air, water or land. In the US, statutes such as the Clean Air Act (1970), the Clean Water Act (1977), the Resource Conservation and Recovery Act (1976) and the Pollution Prevention Act (1990) and many others were created to control pollution, with the EPA as the agency responsible for monitoring and enforcement. The specific goal of the Pollution Prevention Act was to reduce or eliminate pollution, and to improve technology, manufacturing and products that will reduce levels of pollution. In Europe, pollution control in member states is governed by hundreds of legal acts or directives that impose obligations which are sufficiently flexible to allow for differing legal and government systems. Asian efforts in pollution control vary by country, for example, Japan enacted initial pollution control laws in the 1960s and has furthered its legislation into the 1990s, while China is just beginning to enact such laws.

A few studies have been conducted examining the relationship between pollution prevention and manufacturing performance. Klassen and Whybark (1999) found that self-reported implementation of pollution prevention technologies was significantly and positively related to manufacturing performance with regard to cost, speed and flexibility. In the process of a manufacturer seeking ways to prevent (rather than control) pollution, engineers are driven to rethink and redesign the process or product, similar to the efforts in quality management practices. In fact, Rothenberg et al. (2001) found that the implementation of lean manufacturing practices was significantly associated with the reduction in air emissions of volatile organic compounds.

Recycling of Materials

A variety of recycling programmes have been developed in manufacturing settings, including recycling of waste materials, recycling outdated or old products, reusing parts and remanufacturing a defective product rather than disposing of it. Recycling generally requires the disassembly of the waste or product, separating parts into component materials, and then reprocessing the materials (Pun, 2006). Remanufacturing generally involves the replacement of old, worn out or obsolete parts of the product, while maintaining part of the original product. The internal cost of recycling or remanufacturing will usually be determined before a programme is initiated (Li et al., 2009). Manufacturers may also contract out to a third-party provider who would perform all of the necessary steps to prepare the recycled product for reuse (Meade and Sarkis, 2002). Thus, by design, a recycling programme should be cost efficient. Since recycling programmes are voluntary at this time, not subject to any legislation, then cost efficiency should be a driver of their implementation.

Waste Reduction

Waste from manufacturing production could take many different forms, including leftover product parts and packaging materials, unused or by-product chemicals and liquids that are part of the production process, or fluids and other materials used in cleaning or maintenance. Theoretically, then, reducing waste would involve activities intending to reduce any of these forms of waste. In practice, waste reduction can influence manufacturing performance in a fashion similar to that of pollution prevention (Piluso and Huang, 2008). In order to determine how to effectively reduce waste, engineers and designers re-evaluate production processes, inputs, fabrication technologies and methods for handling defective parts and by-products. As processes and products are redesigned or reengineered, waste reduction activities should improve production efficiencies.

Employee Health and Safety

Trowbridge (2001) presents a case study of the implementation of socially responsible practices at Advanced Micro Designs (AMD). Their driving policy was geared to provide a safe workplace for employees, protect the natural environment, enhance employee morale, assure compliance with applicable laws and regulations worldwide, and prevent damage to property. The metrics developed by AMD to assess and report on their annual performance in these areas showed a number of positive outcomes emerged in the manufacturing environment. Trowbridge (2001) noted that employee health and safety concerns also include the assurance that upstream suppliers and downstream partners act accordingly as well. Does the manufacturer support or partner with operations in which employees are exposed to a high risk of injuries or other health-related problems? While the cost of altering product and process designs to assure one's own employees' health and safety is challenging enough to compute, it is far more difficult to determine the costs for one's partners.

There is clearly a benefit to an operation if employees remain healthy and satisfied with their workplace (Wright et al., 2007), not to mention the decrease in lost time, replacement, slowdowns or stoppages, and related costs when employees are injured at work. In the US, the federal agency of OSHA oversees all issues concerning worker health and safety to assure safe practices. The EU, Japan and other countries have similar agencies and legislation. Thus, there is a compliance aspect to socially responsible manufacturing, yet the interest in voluntarily taking the attitude toward safety upstream and downstream would be viewed as a step beyond compliance.

In all, these socially responsible manufacturing practices – pollution prevention, recycling of materials, waste reduction and employee health and safety – should increase the effectiveness and efficiency of the manufacturing operation in various ways. Thus, it is predicted:

Hypothesis 1: Socially responsible manufacturing practices of pollution prevention, recycling, waste reduction, and employee health and safety will be significantly related to manufacturing performance; that is, as manufacturers report more socially responsible practices, they will also report more positive performance indicators.

International Differences in Socially Responsible Manufacturing Practices

Regions and countries differ in their relative emphasis on socially responsible manufacturing practices. As noted above, the EU has not only established considerable legislation, directives and policies surrounding pollution control and employee health and safety, but has also targeted producers of energy-using products to consider eco-design frameworks for waste reduction and recycling. In the US, while pollution control and employee health and safety regulations have set compliance levels for those practices, no broad policies exist at this time for waste reduction or recycling. Those practices are strictly voluntary. Japan and other Asian countries such as Taiwan, Hong Kong, South Korea and Singapore have enacted legislation similar to the US for pollution control and employee health and safety, leaving waste reduction and recycling to more voluntary arrangements. As for

China, environmental business practices have just begun, thus one would expect their use of socially responsible manufacturing practices to either be lagging other Western economies or possibly be up to date, given the likelihood of more cutting-edge technology and equipment. Given these differences, the following hypothesis can be stated:

Hypothesis 2: There will be significant differences in socially responsible manufacturing practices among the EU, the US and Asian countries (Taiwan, China and South Korea).

RESEARCH METHODS

The data were gathered by the Global Manufacturing Research Group (GMRG), a multinational community of researchers studying the improvement of manufacturing practices worldwide (see http://www.gmrg.org). The GMRG consists of leading international academic researchers from over twenty countries who developed the GMRG database survey instrument for use around the world. This survey facilitates a global comparison of the effectiveness of manufacturing practices (Whybark, 1997; Whybark et al., 2009). Since 1985, the GMRG has completed three rounds of the worldwide survey and is currently completing the fourth round, from which the present study obtained data. The questionnaires were translated and back-translated for all countries by several academics; in some cases the same language was modified to reflect country/regional differences. The database GMRG 4.0 has 1,072 samples from 17 countries (Table 1). The average number of responses per country was 63. The average firm size in our sample was 363 employees. Companies in Asia had a larger workforce than their counterparts surveyed from other regions of the world. There was no significant difference regarding the age of manufacturing equipment across countries. The GMRG survey is completed by the plant manager or a member of the plant manager's immediate staff.

Table 1: Sample Demographics

Region	Total Number of Responses (Plants)	Average Number of Plant Employees	Average Age of Manufacturing Equipment
1. Asia (China, Korea, Taiwan)	217	889	9.7 years
2. EU (Austria, Germany, Italy, Sweden, Finland)	297	350	11.2 years
3. Non-EU European (Hungary, Macedonia, Albania, Poland)	164	351	12.5 years
4. US	84	373	11.4 years
5. Others (Fiji, Mexico, Nigeria, Ghana)	310	245	12.5 years
Total	*1072*		

The measurement of socially responsible manufacturing practices consisted of four items from the GMRG survey. Each item was a response to the question, 'In the last two years, to what extent has the plant invested resources (money, time and/or people) in programmes in the following areas?' The four items were labelled pollution prevention, recycling of materials, waste reduction and workplace health and safety. The survey used a 7-point Likert scale ranging from 1 ('not at all') to 7 ('to a great extent'). Scores from the four items were summed and divided by four to obtain a single score for the variable of socially responsible manufacturing practices (SRMP).

To measure manufacturing performance, a latent construct of manufacturing competitiveness was derived by combining scores for five competitiveness goals. These indicators were:

1. Cost – manufacturing cost, product cost and raw material cost
2. Quality – product features, product performance and product quality
3. Delivery – order fulfilment speed, delivery speed and delivery as promised
4. Product variety – delivery flexibility, flexibility to change output volume and flexibility to change product mix
5. New product development (NPD) – manufacturing throughput time and new product design time

Within each goal, plant managers were asked to compare the performance of their plant relative to their competitors. Table 2 includes all of the measurement items, and Table 3 presents the correlations matrix for all scales. Since none of the correlations are above 0.8, multi-colliniarity was not considered to be an issue in this study (Hatcher, 1994).

Table 2: Confirmatory Factor Analysis of Competitiveness Performance and SRMP

Competitiveness Performance	Factor Loading
(1) Cost (Construct reliability = 0.848)	
CG02 – manufacturing costs	0.86
CG03 – product costs	0.88
CG04 – raw material costs	0.67
(2) Quality (Construct reliability = 0.864)	
CG05 – product features	0.82
CG06 – product performance	0.87
CG07 – product quality	0.78
(3) Delivery (Construct reliability = 0.901)	
CG08 – order fulfilment speed	0.87

(*Continued*)

Table 2: (*Continued*)

Competitiveness Performance	Factor Loading
CG09 – delivery speed	0.93
CG10 – delivery as promised	0.80
(4) Flexibility (Construct reliability = 0.809)	
CG11 – delivery flexibility	0.76
CG12 – flexibility to change output volume	0.79
CG13 – flexibility to change product mix	0.75
(5) NPD (Construct reliability = 0.660)	
CG14 – manufacturing throughput time	0.77
CG15 – new product design time	0.63
Socially Responsible Practices (Construct reliability = 0.893)	**Factor Loading**
IP32 – pollution prevention	0.67
IP33 – recycling of materials	0.80
IP34 – waste reduction	0.84
IP35 – health and safety	0.71

Table 3: Correlation Matrix of Competitiveness Performance Indicators and SRMP

	(1) Cost	(2) Quality	(3) Delivery	(4) Flexibility	(5) NPD	(6) SRMP
(1) Cost	1.000					
(2) Quality	0.402*	1.000				
(3) Delivery	0.412**	0.446**	1.000			
(4) Flexibility	0.384**	0.435*	0.625**	1.000		
(5) NPD	0.494**	0.452**	0.587**	0.585**	1.000	
(6) SRMP	0.180*	0.212**	0.233**	0.158**	0.273*	1.000

Note: * = $p < 0.05$; ** = $p < 0.01$

Measurement of Study Constructs

In this study, we used the multiple items to represent two latent constructs: socially responsible manufacturing practices (SRMP) and manufacturing competitiveness. For each latent construct, reliability and validity were assessed based on a three-step procedure with confirmatory factor analysis (CFA), shown in Table 2. Each latent construct was tested for internal consistency using Cronbach's alpha and construct reliability. The alpha coefficients were between 0.80 and 0.92, which are above the benchmark of 0.70 suggested by Nunnally (1978), and construct reliabilities were between 0.68 and 0.86, which are above the benchmark of 0.60 suggested by Bagozzi and Yi (1988). Overall, the results suggested a high internal consistency of measurement indicators and, hence, reliability of each construct was ensured.

Next, convergent validity and discriminant validity were assessed. Convergent validity is supported if the standardised factor loadings of observed items on latent constructs were above 0.50 (Bagozzi and Yi, 1988). The standardised factor loadings range from 0.55 to 0.95 and were statistically significant at $p < 0.05$. Therefore, convergent validity of the measurement indicators was supported. Discriminant validity is tested by comparing the correlation coefficients between latent constructs with the variance-extracted percentages for each construct (Fornell and Larcker, 1981). The variance inflation factors (VIF) of two latent constructs were below the recommended value of 10, implying the lack of multicollinearity, thus the discriminant validity of the constructs was supported.

To ensure content validity, appropriate measurement items were selected and evaluated by subject matter experts (Kerlinger and Lee, 2000). In this study, measurement items were extracted from the previous literature. Suggestions from operations management researchers and practitioners during the questionnaire design and pilot testing further corroborated the content validity of the constructs.

RESULTS

The sample size for the study was n = 1,072 companies reporting data. The mean score for SRMP was 4.21 (standard deviation = 1.47), thus just above the midpoint on the 7-point scale. Prior to testing the hypotheses, the control variable of organisation size was examined regarding its relationship to the socially responsible practices. It was found that SRMP was significantly correlated with both the number of production workers ($r = 0.13$, $p < 0.05$) and the total number of engineers ($r = 0.13$, $p < 0.05$). Among all regions, the Asian samples have the largest number of employees, production workers and engineers (Table 1). The literature indicated that larger manufacturers were more likely to be implementing socially responsible practices compared to smaller plants (Klassen and Whybark, 1999). In our analysis, the number of employees is treated as a control variable.

With regard to the relationship of SRMP to the rated performance indicators across the five competitiveness areas, five regression analyses were conducted. Table 4 presents the results of the analyses. We found that both quality and delivery were significantly related to SRMP. This finding suggests that socially responsible manufacturing practices were significantly and positively associated with the quality ($p < 0.05$) and delivery ($p < 0.05$) aspects of performance. Additional regression analyses showed no other significant relationships for SRMP and manufacturing performance on cost, flexibility and new product development. Thus the first hypothesis was only partially supported.

Table 4: OLS Regression Analyses of Socially Responsible Manufacturing Practices (SRMP) on Indicators of Competitiveness Performance

	Competitiveness Performance (Dependent Variables)				
	Cost	Quality	Delivery	Flexibility	NPD
Intercept	3.09**	4.48**	4.03**	4.62**	2.85^{+}
• Control variables					
• Firm size	0.00**	0.00	0.00	0.00^{+}	0.00^{+}
Industry	0.01	0.07	0.01	0.01	0.04
Independent variable					
• SRMP (Beta)	0.08^{+}	0.09*	0.08*	0.01	0.01
F-value for equation	*3.619*	*3.698*	*12.625*	*3.069*	*3.148*
R^2 for full equation	*0.033***	*0.036***	*0.115***	*0.030**	*0.028*
ΔR^2 for SRMP	*0.020***	*0.028***	*0.071***	*0.018^{+}*	*0.012^{+}*

Note: $^{+}$ = $p < 0.1$; * = $p < 0.05$; ** = $p < 0.01$

With regard to the predictions of SRMP by country, the data were divided into five geographic groupings: (1) Asia (China, South Korea and Taiwan), (2) EU (Austria, Germany, Italy, Sweden and Finland), (3) European but non-EU (Hungary, Macedonia, Albania and Poland (These data were collected prior to Hungary and Poland entering the EU, thus these two countries were treated as non-EU countries for the purposes of comparison.)), (4) US and (5) other countries (Fiji, Mexico, Nigeria and Ghana). Table 5 compares the means for SRMP across these five regions. The results show that the Asian region reported the highest levels of socially responsible practices (mean = 4.64), followed by the US (mean = 4.19) and the EU (4.13). The lowest reported levels of socially responsible practices were in the non-EU European countries (mean = 3.76), while the other countries reported a higher level (mean = 4.11). Statistical analysis showed the Asian region had significantly higher reporting of SRMP than the samples from the other four regions ($F = 14.54$, $p < 0.01$).

Table 5: Social Responsible Practices – Regional Differences

	Average for Total Sample	Group 1 (G1) Asia	Group 2 (G2) EU	Group 3 (G3) Non-EU	Group 4 (G4) US	Group 5 (G5) Others
Social Responsible Practices	4.21	4.62	4.13	3.76	4.19	4.11

Note: ANOVA comparison of means: $F = 14.54$, $p < 0.01$
Post-hoc test: G1 > G2, G1 > G2, G1 > G3, G1 > G4, G1 > G5 ($p < 0.01$)

DISCUSSION

There have been more voices calling for companies to implement socially responsible practices in manufacturing settings. Socially responsible practices, including recycling of materials, waste reduction, pollution prevention and employee health and safety measures, reflect a growing emphasis among manufacturers on the importance of environmental concerns. The motivation for implementing such practices could be that companies are becoming more socially responsible, or they are seeking a more socially responsible image, or they are simply complying with government policies. The question is whether these practices are accompanied by any financial or productivity advantages. Some research suggests that socially responsible practices complement quality management implementations, as both are seeking to reduce inefficient use of resources (Klassen and Whybark, 1999; Rothenberg et al., 2001). In essence, however, little is known about the actual degree of widespread implementation of these practices in manufacturers around the world. In addition, there are presumptions surrounding the use of such practices in various countries which have not yet been tested for accuracy. The present study was an initial attempt to report some data on these issues.

The findings of the present study answer some questions and raise others with regard to the implementation of socially responsible manufacturing practices both generally and regionally around the world. First, it is clear that, while the reported use of socially responsible practices is not high, it is also not low. The means found for the measures of SRMP suggest that many manufacturers have begun to utilise these practices to at least a moderate extent, if one considers the median point on our scale to be a moderate level of implementation. Also, the data suggest that if one of the four practices – pollution prevention, recycling of materials, waste reduction and employee health and safety concerns – is implemented, the other practices are also likely to be in place. The confirmatory factor analysis found all four practices loaded onto one factor, and the measure of internal validity showed strong correlations among the four practices. When companies decide to be more socially responsible, the efforts are likely multifaceted across the different types of programmes.

Evidently, as suggested by the regression analysis (Table 4), socially responsible practices are complementary to quality management practices, based on the relationships between the practices and quality as a measure of firm performance. This supports literature that draws parallels between the implementation of quality management processes and the implementation of socially responsible practices (Brown, 2008; Klassen and Whybark, 1999; Kovacs, 2008; Rothenberg et al., 2001). Similar processes are used to enact these programmes. All are aimed at being more conscious of improvement in qualitative aspects of the work environment. The improvement of quality involves developing group-based teams to reduce the amount of waste and inefficiencies in the production system, which overlay some of the targets of social responsibility practices. In programmes aimed at reducing waste or increasing recycling and pollution prevention, the firm is seeking ways to decrease the amount of discarded product or by-product. As inefficiencies in purchasing, production or shipping are corrected, not only will production and the supply chain improve in quality, but less waste will be emitted into the environment.

The use of socially responsible practices was also significantly correlated with the indicators of delivery speed and performance (Table 4). Therefore, firms that reported more use of socially responsible practices were also likely to report higher levels of speed in order fulfilment and delivery, as well as more delivery as promised. Many of the strategies for enhancing social responsibility also involve adjustments in the supply chain (Novak, 2004) as firms seek ways to decrease pollution, improve employee working conditions and reduce waste through recycling. For example, if a company is redesigning delivery routes to use less fuel, then delivery speed would naturally increase. Reducing the use of paper orders by digitising information into a computer network would not only reduce waste but also improve the accuracy of delivery orders.

The findings based on the country comparisons were a bit surprising, as the data showed the levels of socially responsible practices reported in the Asian region to be higher than those in the US or EU. Given the recent directives of EU policies toward socially responsible manufacturing practices, it was expected that such practices would be reported at significantly higher levels in the EU compared to other regions. It is possible that the finding reflects the relative newness of plants, equipment and processes in Asia compared to the EU. This phenomenon is true especially considering the majority of samples from Asia were computer manufacturers who have more advanced facilities which include cutting-edge pollution controls and up-to-date processes for waste management (Yang et al., 2010). On the other hand, although it was not included in the samples, Japan has had strong environmental policies in place for decades and firms in other Asian countries have had to make adjustments to their own environmental policies and practices in order to remain a supplier for Japanese firms. Another possible explanation to a higher SRMP score in the Asian region *may* have something to do with the way the survey question was asked. Interviewees were asked if they had invested more in these areas '*in the last two years*'. It is conceivable that the Asians are actually behind the EU and the US, for example, but they may be catching up and investing in these areas more in recent years. More research is necessary to properly understand the nature of this finding. It may be the case that combining all Asian countries together might mask between-country differences. Perhaps including Chinese firms with South Korean and Taiwanese firms ignores possible variance between countries. This is an avenue for further research.

Limitations of the Study

There are a number of limitations to the present study. First, the data were collected using a survey, and all measures represented perceived aspects of the manufacturers, their performance and their implementation of socially responsible practices. Given that all of the information collected depended on the knowledge of the plant manager or the administrative staff, as well as their motivation to provide accurate information, it could be argued that the data might not correlate highly with objective measures of the socially responsible practices or manufacturing performance. In addition, it is possible that the plant managers were motivated to enhance the perception of their own plants' practices. The GMRG survey has been used in many studies over the years, and is generally accepted as a valid set of data, yet it is possible that there was bias in the answers. A second limitation was that each of the four socially responsible practices – pollution prevention, waste reduction, recycling of materials and employee health and safety – was assessed with only one item. These practices involve a variety of behaviours, processes and programmes, and it is not expected that a one-item measure would fully capture the constructs of interest. It is not possible to tell from the responses of the plant managers the full extent of the range of practices included in the responses to the items. On the other hand, the plant manager would be the focal person in the firm who would be able to indicate the degree of emphasis placed on various potential goals and objectives. Finally, the representation of countries was incomplete. The EU region consisted of only a sub-sample of countries in Europe, and only a sample of companies within those countries. The GMRG survey is limited by its membership and their capacity to gather survey information within their home or other countries. Not all countries are represented in the GMRG, and one hesitates to draw too rigid a conclusion with a somewhat limited sample of countries. Thus, the findings should only be considered as a preliminary estimate, with future research seeking even broader representation among participating countries.

The strength of this study was its focus on manufacturing performance measures, despite the perceptual nature of such measures. That is, the measures gathered would be of interest to manufacturers. On the other hand, however, it is possible that the ultimate impact of socially responsible practices may be reputational. Companies become known among competitors and communities as those who 'do the right thing' in a socially conscious sense. This avenue of thought suggests that socially responsible practices might not pay in a financial or productivity sense, but that they will enhance the reputation of the manufacturer in the eyes of the community or society. Previous literature has noted this as a prime effect, and yet the present study did not assess reputation. Future research might want to include a measure of reputation as an outcome, as that clearly is an important aspect of the motivation for implementing socially responsible practices.

CONCLUSIONS

The implementation of socially responsible manufacturing practices is not simply a socially conscious choice made by the firm, as other factors generally weigh into the decision. The existence of government policy is one mechanism that drives companies to 'go green', as does a potential financial gain. If it can be shown that socially responsible practices also enhance manufacturing or supply chain performance, through cost savings, quality improvement, innovation in design or speed of delivery, eyes can be opened to the need to convert to more responsible practices. The present study found that the level of usage of socially responsible practices is not high in the manufacturing industry, and that such practices are associated with perceived manufacturing performance on quality as well as delivery. More research is needed to determine the generalisability of these findings by including more data, broader representation, stronger measures and the use of methods that are more capable of assessing causal properties among the variables. While some may presume that socially responsible practices are inherently better than the alternatives, manufacturers will require more data before they delve in too deeply.

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