

Towards a New Era of Sustainability in the Automotive Industry: Strategic Human Resource Management and Green Technology Innovation

Reihaneh Montazeri Shatouri, Rosmini Omar, Kunio Igusa

Abstract—Although automotive industry has brought different beneficiaries to human life, it is being pointed out as one of the major cause of global air pollution which resulted in climate change, smog, green house gases (GHGs), and human diseases by many reasons. Since auto industry is one of the largest consumers of fossil fuels, the realization of green innovations is becoming a crucial choice to meet the challenges towards sustainable development. Recently, many auto manufacturers have embarked on green technology initiatives to gain a competitive advantage in the global market; however, innovative manufacturing systems and technologies can enhance operational performance only if the human resource management is in place to elicit the motivation of the employees and develop their organizational expertise. No organization can perform at peak levels unless each employee is committed to the company goals and works as an effective team member. Strategic human resource practices are the primary means by which firms can shape the skills, attitudes, and behavior of individuals to align with the business strategic objectives. This study investigates on the comprehensive approach of multiple advanced technology innovations and human resource management at Toyota Motor Corporation as the market leader of full hybrid technology in the automotive industry. Then, HRM framework of the company is described and three sets of human resource practices that support the innovation-oriented HR system, presented. Finally, a conceptual framework for innovativeness in green technology in automotive industry by applying a deliberate strategic HR management system and knowledge management with the intervening factors of organizational culture, knowledge application and knowledge sharing is proposed.

Keywords—Automotive Industry, Green Technology, Innovation, Strategic Human Resource Management

I. INTRODUCTION

THE advancement of automobiles has directly influenced society in many ways and radically changed the way people live all over the world. Certainly, besides the convenience they brought to everyone, their pollution affects human health and harms the earth as well. It is widely certified that car usage resulted in a broad range of air emissions that cause climate change, smog, green house gases (GHGs) and human diseases [1]. Thus, green solutions and environmental protection rises as necessity in the 21st century realm of the era.

Reihaneh Montazeri Shatouri is with Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia, 50300 Kuala Lumpur (phone: +6014-7268945; e-mail: montazeri.reihaneh@gmail.com).

Rosmini Omar is with International Business School, Universiti Teknologi Malaysia, 50300 Kuala Lumpur (phone: +603-26953318; e-mail: rosmini.omar@minotstateu.edu).

Kunio Igusa is with Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia, 50300 Kuala Lumpur (phone: +6016-3719289; email: kunigusa@gmail.com).

In recent decades, many automakers have embarked on green technology initiatives to gain competitive advantage in the global market. Several famous automobile manufacturers such as Toyota, Volkswagen (VW), Honda, Ford, GM, BMW, and Mercedes Benz are in close competition with each other in producing green cars [2]. However, sophisticated technologies and innovative manufacturing practices would only enhance operational performance a little, unless the human resource management (HRM) practices are in place to form a consistent socio-technical system [3]. The successful pioneering automakers have not only invested funds into new technologies and equipment, but they have also harnessed their human resources potentials, provided world-class skills and training to their workforces and winning the new markets [4].

This paper concentrates on the imperative of applying a set of strategic human resource practices to elicit employees' motivation in developing their organizational expertise [5]. Strategic human resource practices allow firms to discover and utilize knowledge and expertise in their organization, which then accelerate innovativeness and environmental management initiatives [3]. Indeed, an appropriate HR system can develop the organizational capabilities and enhance the competitive advantage of the firm. Thus, companies need to implement a strategic human resource management approach to attain the defined corporate mission and objectives [6].

II. LITERATURE REVIEW

Intense global competition, rapid technological changes, and product variety proliferation inspire many companies to conduct their business through some kinds of innovations to make more profit and stay ahead of the competition [4]. With the technological advancement, current consumers' preferences have been changing and the conventional products that once were completely satisfied the buyers become less attractive [7].

Innovation fields consist of multiple innovation projects typically related by one common theme that can be defined along several criteria such as customers' needs, core competences, technology platform or any combination of these [8]. Innovation includes discovery, experimentation, and development of new technologies in production process with the purpose of creating more effective products [5]. It is recognized as a crucial enabler for firms to create value and sustain competitive advantage in the turbulent business environment [3]. In specific, green technology innovation defines as innovations in products, processes, or in the business model that develop the firm to higher levels of environmental sustainability [9].

In fact, reducing toxic compounds in consumer products and the environment can mostly accomplish through investment in green technology innovation [8].

Since automotive industry is the largest consumer of fossil fuels, implementing green technology has become an inevitable choice for this sector to meet the challenges facing [10]. On the other side, increasing consumer awareness about the harmful effects of vehicles exhaust emissions has forced auto manufacturers readily going for technological improvements to produce green vehicles. Nevertheless, innovative manufacturing systems and technologies can enhance operational performance only if the human resource management is in place to elicit the motivation of the staff and develop their organizational expertise [3].

A. Strategic Human Resource Management in Green Automotive Innovations

In conjunction with the growth of automotive business industry, undertaking global actions for the development of human resources has become a priority issue [11]. A long-term sustainability of the auto industry can only be achieved via a broader focus on behavioral and system-level changes [12]. To be successful, auto manufacturers must strictly align their HR strategies with environmental technology opportunities, business plans, and the organization unique characteristics and distinctive competences. Firms with a poorly defined HR strategy that does not explicitly incorporate human resources will likely lose ground to their competitors [13]. Therefore, companies might well reflect on their behavior towards workforces as a key retention tool since they play a critical role in achieving superior performance in competitive priorities, such as innovation, quality, flexibility, low cost, and delivery [3].

Employees' behavior, attitude, necessary technical skills required by the job, and empowerment to foster teamwork among others consider as important factors improving firm performance [6]. Strategic human resource practices are the primary means by which firms can shape the skills, attitudes, and behavior of individuals to align with the business strategic goals [4]. Human resource management must be concentrated on selecting employees who are fit with the company's culture and train them in such processes to learn new skills, which may be associated with improving the operations. Generally, human resource management seeks ways to reduce personnel costs and attempts to find more effective means of offering employee amenities. The four basic HRM functions, staffing, training and development, motivation, and maintenance are indicated in Fig. 1 [14].

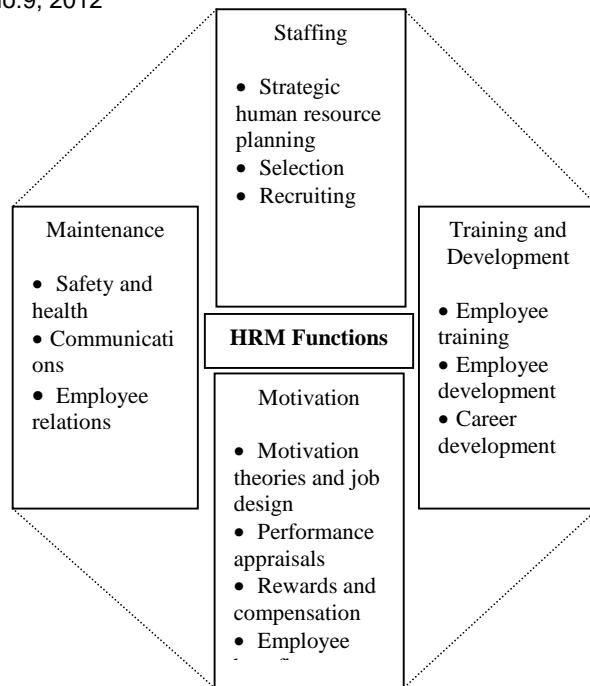


Fig. 1 Human Resource Management: primary activities [14]

In the pursuit of a sustainable transportation system, Toyota Motor Corporation has been following a comprehensive approach regarding multiple advanced technology innovations and human resource management [15]. The next sections will investigate on HRM in Toyota as the market leader of full hybrid technology in automotive industry.

B. Human Resource Development in Toyota Culture

Toyota Motor Corporation is known for quality world-class products and technology initiatives. The company has maintained a high profile in the HRM policies and strongly believed that human resource practices of Toyota can serve as a model, particularly in manufacturing and production oriented organizations. From the founding of Toyoda, its leaders believe that the key success factor to growing business opportunities is investment in human resources [15]. Toyota management principles called "The Toyota Way", as the first and foremost specific organizational culture is about respect to human capital and continuous improvement that has not changed since the company's founding [12].

Toyota is the leader of such specific methods that have been turned into programs like lean manufacturing, lean enterprise, and lean six sigma [12]. The company initiated effective manufacturing techniques such as Toyota production system (TPS) in 1960 and continued the production based on lean manufacturing system in 1980 [16]. The assumption of the lean programs is that the right tools applied to specific problems by expertly trained human resource will dramatically improve business performance in a relatively short period. The deployment process of lean manufacturing is viewed as a program with the aims of reducing labor, inventory and quality problems.

In Toyota's viewpoint, this system needs more highly developed people and deeper trust than a mass-production system as human resources become the most important part of the system and their willingness to identify and solve problems drives continuous improvement [12].

Whereas, Toyota Production System aims to intentionally develop fragile systems depending heavily on human resources, without highly capable and motivated people rigorously solving problems, the lean system will fail. Therefore, the system can be risky and stressful if management and workforces are not highly capable and there is lack of trust in the system. There are many distinctive characteristics of Toyota culture but the central feature is that Toyota people trust each other to an unusual degree for a large corporation. Furthermore, everyone is responsible for continuous improvement via Plan-Do-Check-Act (PDCA). PDCA has gone beyond a tool and become integral to the company's culture. Indeed, continuous improvement via PDCA has deeply become engrained in the Toyota culture and goes hand in hand with a high level of trust [12].

Generally, Toyota's holistic approach starts with a philosophy that the strength of the company is based on kaizen and respect for people. The company's fundamental assumption that is carefully selected and developed human resources over a long period will continuously improve the production system and service quality and ultimately leads to competitive advantage and mutual prosperity. Toyota is creating both tangible (a new learning facility) and intangible (course content) structures relating to team member development that ensures a steady flow of qualified human resources to conduct the firm's global business. In this respect, the firm conducts a systematic company-wide and divisional training program with an emphasis on on-the-job training (OJT) to ensure that employees can fully utilize their abilities in their work [12]. Fig. 2 indicates the Toyota-wide training to support professional staff.

C. The Toyota Way to Continuous Improvement

In 2001, Toyota Motor Corporation summed up its philosophy, values and manufacturing ideals calling it "The Toyota Way 2001." The Toyota Way is a set of principles underlying the Toyota's managerial approach and production system that is based on the two main pillars of "continuous improvement" and "respect for people". Fig. 3 shows the key principles of the Toyota way that are essential for continuous improvement. These five key principles include, working on challenges, Kaizen, going to the source of the issue or problem (Genchi Genbutsu) and ways of building respect and teamwork [12].

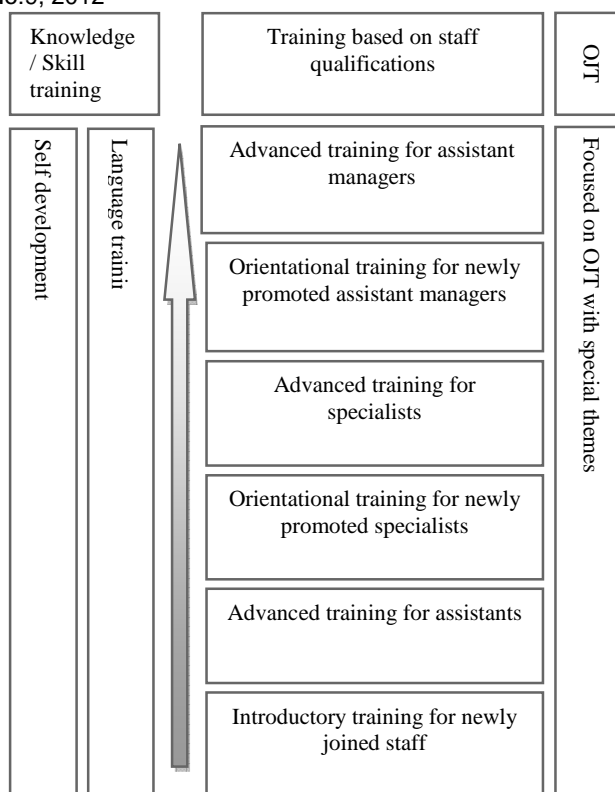


Fig. 2 Toyota-wide training to support professional staff [12]

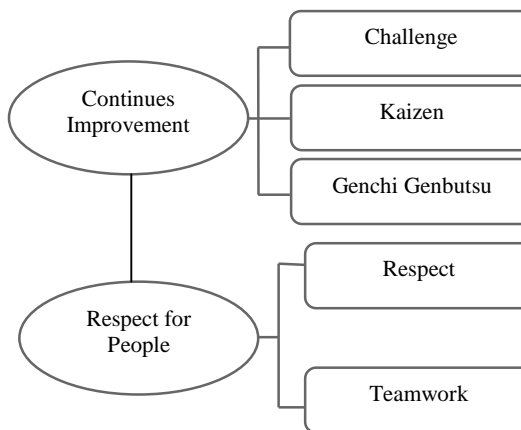


Fig. 3 Key principles of the Toyota Way [12]

D. Toyota Institute

In 2002, Toyota institute was established as an internal human resource development organization. The institute aimed to promote the human resources development of global Toyota in order to advance a true globalization and realize the improvement of Toyota's core values. In the Toyota institute, the global leadership and the management development schools comprise the specific content of the training programs [12]. Table I indicates the outline of the institute training programs.

TABLE I
OUTLINE OF TRAINING PROGRAMS [12]

Global Leadership School

Objective	Development of executive human resources capable of showing leadership from a global perspective
Content	Enhanced leadership ability based on the Toyota Way <ul style="list-style-type: none"> • Reinforced business management knowledge and skills • Global human networking
Attendants	Future global leaders from around the world
Management Development School	
Objective	Training of management to systematically understand and implement the Toyota Way as it relates to each core business area (production, sales, etc.)
Content	Production: Understanding of the Toyota Way at various functions at Toyota's manufacturing companies <ul style="list-style-type: none"> • Sales: Understanding of the latest marketing methods, etc., based on the Toyota Way in sales and marketing
Attendants	Middle management from around the world

E. HRM Framework of Toyota

The HRM framework of Toyota is broadly composed of four goals. Organizational integration as the primary goal of the HRM framework includes the integration of employees at both individual and collective level with the organization. This objective has been achieved through extensive use of teamworks that is subordinate to organizational aims. Employees' welfare is also received a wide attention as a part of this goal [15].

The second aim of Toyota HRM framework is commitment that a two-pronged strategy is followed to achieve this goal. Firstly, Toyota prefers semi-rural workforce for induction in its plants. The company management believes that people who are not contaminated by industrial culture tend to retain loyalty to the firm, which can be converted into organizational commitment. Secondly, measures such as suggestion schemes, quality circles, and employee involvement methods have been applied to gain commitment [15].

Flexibility and adaptability are considered as the third objective of the framework. Team authority in place of single individual holding all the powers has paved way for understanding flexibility in the organization. The teams are task-based and can be restructured depending on the situation. Additionally, the adaptability trait has been institutionalized through the approach of multi-skilling and job rotations [15].

Finally, the fourth goal of the Toyota HRM framework is quality. Self, peer and team surveillance techniques have been used to ensure the quality of products. Furthermore, a series of measures such as time-motion study, benchmarking, continuous process improvement, and employee involvement are contributed in obtaining this goal [15].

F. Strategic HR Management System for Innovation

Since human resources have proven to assist on the improvement of business performance, all businesses would embrace green innovations while deliberately manage their human capitals [3].

There are three sets of HR practices that support an innovation-oriented HR system. They include training-focused— concentrate on human resource investment and skills enhancement, performance-based reward— emphasis on rewarding employees' contributions and outcomes, and team development— focus on develop and fulfill team-based activities [17].

1. Focus on Training

The rapid pace of technological changes increasingly makes the role of training important. Since knowledge and skills that acquired through formal education or previous training will depreciate and become outmode, the workers need to be continually engaged in an ongoing process of skills acquisition [18]. Training enhances employees' knowledge and skills that are crucial to new product development. In analyzing the business operations improvement, it is found that high performing organizations spend more time on education and training, not only on technical task related skills but also on communication and teamwork abilities [17]. However, to achieve organizational effectiveness, HR trainings must be congruent with the firm strategy and work processes. In general, training-focused HR practices develop the human resources to achieve competitive advantage in the market [17].

2. Performance-based Reward

Training provides the opportunity for individuals and organizations to develop appropriate competencies. Nevertheless, to sustain competitiveness, learning behaviors have to be rewarded especially when individual performance has improved. HR system with performance-linked rewards has positive effects on the company performance mediated by employees' skills, attitudes, and behaviors. Performance-based reward can represent a commitment to employees, provides incentive for creativity, and subsequently reinforce innovative performance [17].

In the study of innovative product development, performance-based reward has been considered to be a significant compensation tool. Many innovation-oriented firms have been focused on various compensation packages to reward total quality management and employee involvement. In other words, performance-based payment is often found in HR systems that support innovation [17].

3. Team Development

Numerous technology-based studies [6]–[13]–[17] have revealed that teamwork plays a critical role in eliciting innovation. Team development planning is a core necessity to organizational development as it has a high impact on firm's performance and boosts productivity, innovativeness, and staff morale. Companies need to explore the capabilities and behavioral preferences of team members, highlight strengths and identify areas for team development. Professionally team development programs encourage teams to think as a unit and provide individuals to develop a variety of interpersonal expertise including communication, leadership and motivational skills [17].

TABLE II
ACTORS AFFECTING GREEN INNOVATION PERFORMANCE IN
AUTOMOTIVE INDUSTRY [3]–[17]

No.	Factors
1.	Training
2.	Performance-based Reward
3.	Team Development
4.	Organizational Culture
5.	Knowledge Management
5.1	Knowledge Sharing
5.2	Knowledge Application

Moreover, team cooperation, effective communication, and conflict resolution are important aspects in teams with an innovation expectation. Therefore, an HR system is required to create innovative culture include teamwork, autonomy, and an inclination towards technological innovation [17].

G. Importance of Organizational Culture in Firm Innovativeness

Towards a social-context theory of human resource management, organizational culture locates as an antecedent of employee attitudes and behaviors. A strategically proactive HR creates a corporate culture of innovation and creativity that is necessary for executing business strategies. There is a necessity to develop the technology-based culture in technology-intensive industries, since only with an innovation culture that is involved taking risks, worker participation, creativity, and shared responsibility; a company can be competitive in new product development. To promote this type of culture, employees must be managed towards constant learning, teamwork, and a considerable degree of work autonomy. The system that consciously plans to alter employees' schemas towards innovation would result in an innovative culture. It follows that organizational culture is an intervening element between strategic HR management system and firm innovativeness in green technology [17].

H. Managing Knowledge Workers

Innovation initiatives depend excessively on employees' knowledge, expertise, and commitment as key inputs in the value creation process [19]. Since companies enable to access the knowledge and expertise of the employees, they may require good capacities to exploit human knowledge management to ensure effective utilization of the human resource in achieving the organizational goals [20].

In recent years, many of the most profitable companies have been those that have successfully managed knowledge workers. Once a company has established its direction, it must create an environment to develop knowledge application and knowledge-sharing culture [19]. The knowledge-based viewpoint considers firms as repositories of knowledge and competencies. According to this view, knowledge and competencies of human resources are recognized as valuable assets of the firm because of their characteristics. Whereas knowledge-based resources are socially complex and usually difficult to imitate, diverse knowledge bases and competencies of the firms are the main determinants of sustained competitive advantage and superior corporate performance [3].

III. CONCEPTUAL FRAMEWORK

Innovation is driven by human resources leadership, company's culture, and strategic planning. Similarly, a proactive strategic posture usually leads to a flexible organizational structure that promotes innovativeness [4]. Nevertheless, implementation of corporate green management initiatives needs a high level of technical and management skills among employees. Green innovations can effectively happen if companies have right people with the right skills and competencies. In this respect, training programs, performance-based appraisal system, and team development aimed at increasing employees' environmental awareness and courses addressed to the development of new technical and management competencies are very important in fostering green innovations [3].

A strategic human resource management system plays a significant role in creating an organizational culture that promotes innovativeness in green technology. Organizational culture has a direct impact on firm innovativeness and contributes to a higher level of innovation and new product development. Thus, it can be conceptualized that organizational culture serves as the mediator between the strategic HR management system and innovativeness in green technology [17].

Furthermore, there is a positive relationship between knowledge management and green innovations [3]. Fig. 4 indicates a conceptual framework for innovativeness in green technology in automotive industry by applying a deliberate strategic HR management system and knowledge management with the intervening factors, organizational culture, knowledge application and knowledge sharing.

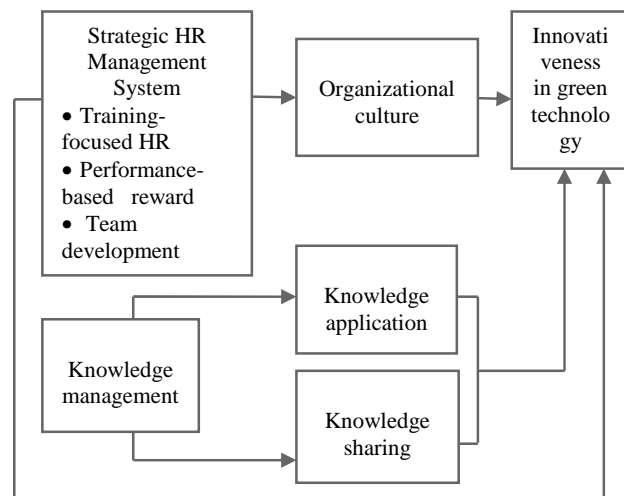


Fig. 4 Conceptual framework

IV. CONCLUSION

This research was investigated on the impacts of strategic human resource management and knowledge management on innovativeness in green technology at the automotive industry. The strategic HR components like training, performance-based reward, and team development have positive effects on green innovation performance in the auto industry, while organizational culture serves as a mediator.

Moreover, knowledge management has a direct impact on the firm's green innovativeness through knowledge sharing and knowledge application. However, the framework is still open for further exploration and empirical analysis. The future possible researches can be developed to explore the different effective parameters on green technology innovation in the automotive industry.

In specific, a successful performance in green technology necessitates HR strategies alignment with the environmental technology opportunities, business plans, and the organization unique characteristics and distinctive competences.

ACKNOWLEDGEMENTS

The authors would like to convey thanks to the Universiti Teknologi Malaysia (UTM), Malaysia-Japan International Institute of Technology (MJIT), and International Business School (IBS) for providing the financial support and excellent research environment.

REFERENCES

- [1] K. Frenken, M. Hekkert, and P. Godfroij, "R&D portfolios in environmentally friendly automotive propulsion: Variety, competition and policy implications," *Technological Forecasting & Social Change. J.*, vol. 71, no. 5, pp. 485–507, Jun. 2004.
- [2] R. Montazeri Shatouri, and W. Kh. Wan Ismail, "Green Technology Innovation in Volkswagen Passat (Published Conference Proceedings style)," *The International Conference on Management (ICM2011)*, Penang, Malaysia, 2011, pp. 1357–1365.
- [3] C. J. Chen, and J. W. Huang, "Strategic human resource practices and innovation performance — The mediating role of knowledge management capacity," *Journal of Business Research*. vol. 62, no. 1, pp. 104–114, Jan. 2009.
- [4] S. Laforet, "Size, strategic, and market orientation affects on innovation," *Journal of Business Research*, vol 61, no. 7, pp. 753–764, Jul. 2008.
- [5] C. López-Nicolás, and Á. L. Meroño-Cerdán, "Strategic knowledge management, innovation and performance," *International Journal of Information Management*, vol. 31, no. 6, pp. 502–509, Dec. 2011.
- [6] S. Ahmad, and R.G. Schroeder, "The impact of human resource management practices on operational performance: recognizing country and industry differences," *Journal of Operations Management*, vol. 21, pp. 19–43, 2003.
- [7] C. Zapata, and P. Nieuwenhuis, "Exploring innovation in the automotive industry: new technologies for cleaner cars," *Journal of Cleaner Production*, vol. 18, no. 1, pp. 14–20, Jan. 2010.
- [8] California Environmental Protection Agency, *New Report Aims to Spur Green Technology Innovation and Investment in California*. California: Department of Toxic Substances Control, 2008.
- [9] B. Nunes, and D. Bennett, *Green Innovation Management in the Automotive Industry*. Aston University: UK., 2008.
- [10] Y. Wang, and Q. Xu, "Evaluation of Green Technology Innovation Capacity of Automobile Manufacture Industry," *Applied Mechanics and Materials.J.*, vol. 44, pp. 206–212, 2011.
- [11] Toyota Motor Corporation, *Human Resources Development*. Toyota Environmental and Social Report, 2003.
- [12] A. Williams, "Product service systems in the automobile industry: contribution to system innovation?," *Journal of Cleaner Production*. vol. 15, pp. 1093–1103, 2007.
- [13] G. W. Bohlander, and S. A. Snell, *Managing Human Resources* (13th ed.), Boston, Massachusetts, United States: South-Western College Pub., 2003
- [14] D. A. DeCenzo, and S. P. Robbins, *Fundamentals of Human Resource Management* (9th ed.), Hoboken, NJ, U.S.A.: John Wiley & Sons, Inc., 2006.
- [15] J. Liker, and M. Hoseus, (2008, November 1). Human Resource Development in Toyota Culture. *Human Resource Executive*. Retrieved July 21, 2011, from <http://www.hreonline.com/HRE/story.jsp?storyId=142379047>
- [16] Ch. Gopal, *Global Automobile Industry: Changing with Times*, 2011.

- [17] C. M. Lau, and H. Y. Ngo, The HR system, organizational culture, and product innovation. *International Business Review. J.*, vol. 13, no. 6, pp. 685–703, Dec. 2004.
- [18] A. Remmen, and B. Lorentzen, "Employee participation and cleaner technology: learning processes in environmental teams," *Journal of Cleaner Production*. vol. 8, no. 5, pp. 365–373, Oct. 2000.
- [19] R. M. Hodgetts, and K. W. Hegar, *Modern Human Relations at Work* (10th ed.), Mason, U.S.A.: Thomson Higher Education, 2004.
- [20] S. Sudin, "Strategic Green HRM: A proposed model that supports Corporate Environmental Citizenship (Published Conference Proceedings style), *The International Conference on Sociality and Economics Development*, Singapore: IACSIT Press, 2011, pp. 79–83.