

# ENVIRONMENTAL SUSTAINABILITY INITIATIVES OF TOP GREEN IT FIRMS: IBM, HP, AND DELL

Rebecca Angeles, Faculty of Business Administration, University of New Brunswick  
Fredericton, New Brunswick, Canada, [rangeles@unb.ca](mailto:rangeles@unb.ca)

## Abstract

*This paper focuses on the findings of a qualitative content analysis study of the corporate sustainability reports of IBM, Hewlett Packard, and Dell with the purpose of exploring the sustainability initiatives in these firms using a number of theoretical frameworks. These three firms were among those highly rated in the information technology industry according to the annual Newsweek Green rankings, currently evaluated by Corporate Knights Capital. While all firms in all industries are expected to undertake their own sustainability efforts, firms that belong to the IT industry have a special role to play in terms of providing the tools and technologies their customer firms can use to promote the sustainability of their own business operations. The hypotheses tested in this study encompass the following theories: institutional theory, dynamic capabilities theory, and resource-based view of the firm theory. This study findings present positive support for all hypotheses proposed for these three firms.*

*Keywords: Environmental sustainability, institutional theory, dynamic capabilities theory, resource-based view of firm, Global Reporting Initiative.*

# 1 INTRODUCTION

According to the World Commission on Environment and Development, sustainability is a key corporate capability that ensures that the firm uses natural resources in the present without compromising the ability of future generations to meet their needs. This paper will feature the findings of the pilot study of three firms in the information technology industry that have been rated fairly highly in the annual Newsweek Green Firm rankings using the content analysis qualitative research methodology --- IBM, Hewlett Packard (HP), and Dell. The theoretical perspectives of the institutional theory, dynamic capabilities theory, and resource-based view of the firm will be used to test a number of hypotheses relating to these firms' corporate sustainability initiatives. This study will also cover both the concepts of green information systems and green information technology. "Green IT" addresses energy consumption and waste associated with the use of hardware and software. Examples include improving the energy efficiency of hardware and data centers, consolidating servers using virtualization software, and reducing waste associated with obsolete equipment (Watson et al. 2008). "Green IS," on the other hand, refers to the development and use of information systems to support or enable environmental sustainability initiatives. Examples include: collaborative group software and telepresence systems to enable remote meetings and reduce the negative environmental impacts associated with travel (Watson et al. 2008).

## 2 LITERATURE REVIEW

### 2.1 Green Reporting Initiative (GRI)

One of the tools used to inform interested and invested stakeholders is the annual sustainability report, which is expected to: (a) "... provide a broadly applicable and reliable set of standards used to communicate with internal and external stakeholders"; (b) create "...a framework to assess the company"; and (c) act as "...a source of public information" (Alonso-Almeida, Llach, & Marimon 2014). The GRI is the most widely recognized and used standard for reporting an organization's sustainability initiatives (Roca & Searcy 2012). Research on the GRI has found a positive correlation between environmental performance and level of discretionary disclosure using GRI standards among 191 firms belonging to various industries that create significant environmental pollution and are strongly regulated (Clarkson et al. 2008). Most of the firms covered in the annual Newsweek Green Firm rankings use the GRI standards in their sustainability reports.

### 2.2 Theoretical Frameworks Used

This paper uses key theoretical frameworks to explain the firms' motivation for pursuing sustainable initiatives (i.e., institutional theory) and resource use to set these initiatives in motion (i.e., dynamic capabilities theory) to both meet corporate sustainability objectives and also, possibly, gain competitive advantage (i.e., resource based view of the firm theory).

#### 2.2.1 *Institutional Theory*

The institutional theory will help explain how corporate environmental sustainability initiatives are driven, largely, by both internal and external stakeholders. To gain legitimation, firms seek to satisfy requirements/demands of government, industry, customers, local community, and other stakeholder groups by complying with established norms and regulations to avoid risks and penalties. By addressing these societal pressures, firms gain legitimacy, resources, and survivability in the marketplace (DiMaggio & Powell 1983). The theory articulates the concept of "institutional isomorphism" which is exercised through three mechanisms: normative, mimetic, and coercive isomorphism (DiMaggio & Powell 1983). Normative pressures occur when firms are conforming with the cultural expectations from its industry, government agencies, or professional circles. Mimetic

pressures happen when firms try to match the behaviors of other firms they are competing with. Coercive pressures are usually exerted by powerful stakeholders such as customers.

\* Firms that seek to meet sustainability goals in response to government regulatory requirements will create sustainability policies to comply with these requirements.

\* Firms that seek to meet sustainability goals in response to government regulatory requirements will create sustainability practices to comply with these requirements.

\* Firms that seek to meet sustainability goals in response to the guidelines/requirements of the industry they belong to will create sustainability practices to comply with these requirements.

\* Firms that seek to meet sustainability goals in response to customer requirements will create sustainability practices to comply with these requirements.

### 2.2.2 *Dynamic Capabilities Theory*

Dynamic capabilities theory refers to the capability of a firm to adjust its tangible and intangible resource mix to meet the fast-changing competitive forces in the marketplace (Teece et al. 1997). Such resources are considered imitable from the point-of-view of a firm's competitors --- to be distinguished from inimitable resources that are the focus of the resource-based view of the firm theory. This study distinguishes resources used within a firm's internal working units from those deployed to meet the need of dealing with its external supply chain trading partners.

\* Firms that are able to deploy imitable tangible and intangible resources within its affected internal organizational units to pursue their sustainability initiative will gain sustainability results/performance.

\* Firms that are able to deploy imitable tangible and intangible resources externally with its supply chain trading partners to pursue their sustainability initiative will gain sustainability results/performance.

### 2.2.3 *Resource-Based View of the Firm*

Assuming heterogeneous access to resources among competing firms, the resource-based view of the firm posits that a firm's competitive advantage depends on its ability to deploy valuable, rare, inimitable, and non-substitutable resources (Dierickx & Cool 1989; Barney 1991).

\* Firms that are able to deploy its inimitable tangible and intangible resources within its affected internal organizational units to pursue their sustainability initiative will gain sustainability innovations.

\* Firms that are able to deploy its inimitable tangible and intangible resources externally with its supply chain trading partners to pursue their sustainability initiative will gain sustainability results/performance.

### 2.2.4 *Sustainability Results/Performance*

Use of widely accepted sustainability performance indicators is still a contentious issue. "Considering the body of empirical research concerned with CEP [i.e., corporate environmental performance], it becomes apparent that a multitude of indicators has been used to measure this construct. This may be due to the somewhat paradoxical conjuncture that despite the long-standing engagement of scholars with CEP, neither a clear and undisputed definition of CEP nor an unequivocal conceptualization of its nature and dimensionality has been established so far...." (Trumpp et al. 2015). "Corporate performance indicators are usually divided into three main categories: 1) environmental impact (toxicity, emissions, energy use, etc.); 2) regulatory compliance (non-compliance status, violation fees, number of audits, etc.); and 3) organizational processes (environmental accounting audits, reporting, Environmental Management System, etc.)...."(Delmas & Blass pp. 246-247 2010). Even if a firm were using widely accepted sustainability performance measures, there is still the issue of having conflicting results for a set of indicators. For instance, a firm could be doing a good job of controlling

its greenhouse gas emissions, but could be doing very poorly in the areas of biodiversity, water consumption, and toxic waste generation in conducting its business supply chain operations. How, then, could the firm’s overall sustainability performance be assessed?

While there is no complete agreement on whether or not the sustainability measures included in the GRI reporting standards can, indeed, be considered corporate environmental performance measures, a selection of them were used in this study since they fit into the three categories of environmental impact, regulatory compliance, and organizational processes (Delmas & Blass 2010). Thus, the following selected indicators are considered fairly good proxies of sustainability performance for the purposes of this study: (1) materials used to produce and package primary products and services by weight or volume; (2) percentage of materials used that recycled input materials; (3) renewable and non-renewable energy consumed; (4) reduction of energy consumption from conservation and efficiency initiatives; (5) reduced energy requirements of products and services; (6) total water withdrawn from various sources; (7) percentage and total volume of water recycled and reused; (8) direct greenhouse gas (GHG) scope 1, 2, and 3 emissions; (9) reduction of GHG emissions; (10) emissions of ozone-depleting substances; (11) total water discharge by quality and destination; (12) total weight of waste by type and disposal type; (13) total number and volume of significant spills; (14) weight of transported, imported, exported, or treated hazardous waste; (15) extent of impact mitigation of products and services; (16) percentage of products sold and their packaging materials that are reclaimed by category; (17) monetary value of significant fines and total number of non-monetary sanctions for non-compliance with environmental laws; (18) significant environmental impacts of transporting products and other materials; (19) percentage of new suppliers that were screened using environmental criteria; and (20) significant actual and potential negative environmental impacts in the supply chain and actions taken.

### 3 RESEARCH METHOD

The study uses the qualitative research method of content analysis using pairs of coders who used “strength-of-evidence” (SOE) coding sheets (Seddon et al. 2010). The SOE coding sheets contained text extracted from the corporate sustainability reports that were considered data points for all the hypotheses tested in this study. The following rating scale was used in the SOE coding sheets: (1) an SOE score of “0” when there is no evidence of the stated hypothesis being supported by the data from the CSR report; (2) an SOE score of “1” when there is low evidence; (3) an SOE score of “2” when there is moderate evidence; and (4) an SOE score of “3” when there is strong evidence. The strength-of-evidence judgements of the coders were compared and differences in interpretations of concepts reconciled through subsequent meetings. Then, the gamma statistic (Seddon et al. 2010; Siegel & Castellan 1988) measuring inter-rater correlation for the SOE coding for each record associated with a hypothesis was computed. The following corporate sustainability reports were content analyzed for this paper: IBM Environmental Report 2010; Hewlett Packard’s 2010 sustainability report; and Dell’s 2011 Corporate Responsibility Report.

### 4 RESEARCH FINDINGS

As shown by the findings reported in Table 1, all hypotheses for all three firms in this pilot study were supported by this study’s content analysis results.

Theory	Firm	Number of Records	Gamma Statistic
Institutional Theory	IBM	87	1.0
	HP	14	1.0
	Dell	22	1.0
<i>Hypotheses Support</i>	All hypotheses supported for all three firms.		
Dynamic Capabilities Theory	IBM	108	.962264151

	HP	34	.967213115
	Dell	26	.916666667
<i>Hypotheses Support</i>	All hypotheses supported for all three firms.		
Resource-Based View of Firm	IBM	18	1.0
	HP	30	1.0
	Dell	24	1.0
<i>Hypotheses Support</i>	All hypotheses supported for all three firms.		
Grand total records analyzed	IBM, HP, Dell	195	

Table 1. Theories Tested in the Study and Resulting Gamma Statistics for Content Analysis

#### 4.1 Institutional Theory

All three firms declared observing the appropriate laws in geographical areas where they operate and created environmental sustainability policies which served as the strategic framework of their respective environmental management systems. All three firms declare meeting the requirements of the ISO 14001 Environmental Management System (EMS) standard. They are also members of the Electronic Industry Citizenship Coalition (EICC) which has launched initiatives that address sustainability concerns: EICC members are enjoined to manage their environmental data, generate environmental reports, and benchmark and track their supply chain's environmental performance.

#### 4.2 Dynamic Capabilities Theory

The following discussion features selected and the more notable efforts of all three firms to achieve dynamic capabilities to meet sustainability demands of internal and external stakeholders. All three firms use their own brand of energy-efficient data centers, virtualization, and cloud computing.

##### 4.2.1 IBM

IBM pursues product innovations to improve the energy efficiency of its hardware and software/services and data centers, increase reuse and recyclability, promote safe disposal at the end of life, encourage use of recycled materials, and minimize environmental impacts. IBM has a full menu of high performance computers (HPC) systems: the Productive, Easy-to-Use, Reliable Computing System (PERCS), IBM System Blue Gene, iDataPlex, and the Roadrunner supercomputer programs. The Blue Gene/P machine shifted from an air cooled to a hydro-air cooled system, saving the data center about 9 percent in total power used. The IBM iDataPlex system, used primarily for high performance, large-scale Internet and cloud computing applications, is using 40 percent less energy than the 1U industry standard servers and BladeCenter servers. IBM has developed a supply chain communication tool called the Environmental Reporting Tool (ERT) to automate notifications to suppliers of substance disclosure or reporting requirements of relevant organizations.

##### 4.2.2 HP

HP uses life cycle assessment (LCA), the methodology used to better evaluate the environmental impacts of product designs and production processes. HP manufactures imaging and printing products that use several chemicals listed in the U.S. Environmental Protection Agency (EPA) Toxics Release Inventory (TRI). HP claims using equipment and processes designed to monitor and control releases of chemicals they use included in the TRI and report manufacturing site releases following the requirements of relevant local laws. HP designs its various hardware products such as its desktop and notebook personal computer (PC) families and its printer line to be energy efficient through such technologies as HP Power Assistant and compliance with the ENERGY STAR typical energy consumption (TEC) standards and in fact, exceeding them by 37 percent. HP has also developed digital commercial print and publishing technologies that enable print-on-demand capabilities supporting personalization and targeted content. To save on business travel, HP uses HP Visual Collaboration, a suite of video conferencing tools and managed services, that enable virtual meetings

for its employees. For its customers, HP has made available a Web-based HP Carbon Footprint Calculator to help them evaluate energy use, estimated carbon emissions, and paper and usage costs of HP and non-HP products.

#### 4.2.3 *Dell*

Dell uses the strictest standards such as those of the European Union's Restriction on Hazardous Substances (RoHS) and REACH as its baseline in the choice of raw materials, while building in more energy efficiency as well. Dell now uses LED illumination in its laptop displays to eliminate mercury, and is using alternative materials to eliminate brominated/chlorinated flame retardants (BFRs and CFRs) and polyvinyl chloride (PVC) in producing its removable media storage devices. Dell combines the use of virtualization, high-temperature computing, improved power and cooling efficiency, and installing server upgrades to make its data centers more environmentally friendly. Dell discloses its data center carbon emissions (scopes 1, 2, and 3) to the Carbon Disclosure Project.

### 4.3 **Resource-Based View of the Firm Theory**

This section features notable innovations developed by IBM and HP that address the sustainability concerns of its customers. IBM's Green Sigma solution applies Lean Six Sigma principles in a firm's business operations encompassing energy, water, waste generation, and GHG emissions. It uses real-time metering and monitoring with advanced analytics and dashboard features. IBM's "Vehicle to Grid Charging and Storage" solution addresses vehicle telematics, embedded software, battery performance, network security, roaming and transaction management, smart grid integration, network optimization, renewables charging dispatch, and infrastructure planning. IBM's Intelligent Transportation and Traffic Prediction Solutions are supported by a scalable platform that collects data from multiple sources and devices --- cameras, radar, under-road loop detectors, Bluetooth-based systems, mobile technologies, and others. Gathered data provides real-time citywide visibility into traffic conditions such as traffic speeds and volumes on city roads to help predict future traffic conditions. Using digital sensors, advanced communication networks, and sophisticated analytics, the IBM Intelligent Utility Network Solution helps utility firms understand demand in near real time. Thus, they can more effectively optimize the regulation, generation, supply, and consumption of electricity. The IBM Wind Power Suite utilizes proprietary and IBM Business Partner solutions to transform a conventional wind farm into a smart farm. Field data gathered from turbines instrumented with sensors is stored in a comprehensive data repository. Technicians locate the turbine needing attention, diagnose the problem, repair the part, and restore it to working condition using global positioning system-supported field devices. HP's Central Nervous System for the Earth (CeNSE), a highly intelligent network of billions of nanoscale sensors, is designed to detect, sense, and gather data on a wide range of phenomena occurring on earth. A product of the HP Labs, CeNSE will harness HP's nanotechnology-enabled sensors, data storage and computation, business analytics, and optimization to address a new breed of business applications and web services. The first commercial application of CeNSE has been undertaken between HP and Shell Oil Company to enable the firm to cost-effectively tap difficult oil and gas reservoirs, increasingly explore alternative energy resources, and reduce environmental impact. HP also designed a Converged Infrastructure to integrate its facilities' resources such as servers, network devices, and storage to enable its customers to save energy. The HP Data Center Smart Grid is at the heart of this Converged Infrastructure and was designed to maximize energy efficiency using the following technologies. First, the HP thermal logic-based technologies are embedded in HP's servers. Second, a network of sensors is deployed to collect, monitor, and transmit power and cooling measurements from all areas of a data center, to enable its managers adjust energy consumption. Third, HP's Intelligent Power Discovery technology is an automated energy-aware network between IT systems and facilities, designed to track new server installation and enable power distribution while avoiding wasted power. Fourth, HP Insight Management is a central management console designed to help facilities managers make effective capacity planning and power consumption decisions.

## 5 CONCLUSIONS AND FUTURE RESEARCH DIRECTION

The findings from the content analysis results for the three firms --- IBM, HP, and Dell --- provided support for all proposed hypotheses covering the institutional, dynamic capabilities, and resource-based view of the firm theories. For the future, the objective is to make more persuasive arguments for the support of the hypotheses purported in this paper based on a larger data set. Firms belonging to various sectors of the IT industry have a unique role to play in assisting firms in other industries in pursuing their own sustainability initiatives. Appropriate sustainability-enabling tools and methods in the form of hardware, software, and services are critical in enabling corporations capture, store, distribute, and analyze environmentally-relevant data for their corporate sustainability reporting needs and for monitoring their “green” supply-chain related activities.

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