Adoption of Sustainability in IT Services: Role of IT Service Providers

Abhijit Datta
Indian Institute of Management Calcutta, abhijitdx2010@email.iimcal.ac.in

Shankha Roy
Indian Institute of Management Calcutta, shankharx2010@email.iimcal.ac.in

Monideepa Tarafdar
College of Business University of Toledo, Monideepa.Tarafdar@utoledo.edu

Follow this and additional works at: http://aisel.aisnet.org/amcis2010

Recommended Citation
Datta, Abhijit; Roy, Shankha; and Tarafdar, Monideepa, "Adoption of Sustainability in IT Services: Role of IT Service Providers" (2010). AMCIS 2010 Proceedings, 41.
http://aisel.aisnet.org/amcis2010/41
Adoption of Sustainability in IT Services: Role of IT Service Providers

Monideepa Tarafdar  
College of Business  
University of Toledo  
Monideepa.Tarafdar@utoledo.edu

Sachin Modi  
College of Business  
University of Toledo  
Sachin.Modi@utoledo.edu

Shankha Roy  
Indian Institute of Management Calcutta  
shankharx2010@email.iimcal.ac.in

Abhijit Datta  
Indian Institute of Management Calcutta  
abhijitdx2010@email.iimcal.ac.in

ABSTRACT
This paper examines the role of the IT Services Provider (ITSP) in facilitating adoption of sustainable IT and IT management practices in client organizations. Informed by resource dependency and inter-organizational knowledge transfer perspectives and based on primary data from five large ITSPs from India, it shows that ITSPs can influence adoption of IT sustainability in client organizations by delivering the Sustainable IT Services Value Chain, providing access to sustainability-related expertise, and exemplifying their own sustainability initiatives as illustrations. The outcome of such action is to enhance client organizations’ performance and cognizance relating to sustainable IT. The paper furthers the sustainable IT literature by introducing the hitherto lacking ITSP’s perspective on sustainable IT.

Keywords
Sustainable IT, Sustainable IT Services Value Chain, IT Service Providers, Case Study

INTRODUCTION
Research on sustainable IT has addressed areas such as organizational diffusion and maturity of IT sustainability practices (Sayeed and Gill 2008), green IT readiness (Molla 2009), energy management analytics (El-Gayar and Fritz 2007) and green systems development life cycle (Huang 2008). These investigations have taken the perspective of organizations that are users of IT. Another important perspective is that of the supplier of outsourced IT services, the IT Service Provider (ITSP). ITSPs represent one of the primary channels through which organizations develop and implement IT solutions. Over the last decade the ITSP industry has experienced significant consolidation, as a result of which ITSPs have considerable institutional power by virtue of their scale and scope of operations. They also have access to consolidated IT resources and knowledge. Thus, they have significant influence on the creation and deployment in client organizations, of state-of-the-art IT services related knowledge, products and initiatives. In the context of IT sustainability, it is therefore critical to understand the role of the ITSP in facilitating adoption of sustainable IT practices and technologies. Existing research is deficient in such an ITSP-centered perspective.

We address the exploratory research question- What is the role of the ITSP in facilitating adoption of sustainable IT and IT management practices in client organizations? Specifically, we aim to understand (a) mechanisms and activities through which ITSPs promote such technologies and practices in, and (b) outcomes from these activities for, the client organizations. Two theoretical perspectives - resource dependency and inter-organizational knowledge transfer – guide our investigation of the research question. Based on primary and secondary qualitative data from senior technical and business managers from the “green” functions in five of the industry's largest ITSPs, we find that ITSPs can influence adoption of IT sustainability technologies and practices in client organizations by delivering the Sustainable IT Services Value Chain (SITSVC), providing access to sustainability-related expertise, and exemplifying their own sustainability initiatives as illustrations. The intended outcome of such action by ITSPs is to enhance their clients’ economic and environmental performance relating to IT

The primary theoretical contribution of this paper is in furthering the sustainable IT literature by introducing the ITSPs perspective on sustainable IT. Given the nascent stage of literature, such enunciation provides considerable value by broadening the theoretical basis for its future development. A second contribution is in conceptualizing the SITSVC, defining
its constituent activities, and identifying the role of ITSPs in them. From a managerial perspective, the paper provides guidance for ITSPs to structure their IT services related to sustainable technologies and practices, and by client organizations to assess “sustainability preparedness” of their ITSPs.

THEORETICAL BACKGROUND

The global IT Services industry (which includes providers of outsourced application development and implementation, and infrastructure management and maintenance services), estimated at $1.66 trillion in 2009 has three salient characteristics. One, it is highly consolidated. For instance, ITSPs in India accounted for revenues of $57 billion in 2008 (Palvia 2003). Two, ITSPs often have operations (owned or outsourced) in many countries, giving them a large international spread. They adopt the “Follow the Sun model” (Buelen et al 2005) and operate real-time across multiple time zones. Three, they provide IT services across a wide scope and range of activities - such as development, implementation and maintenance - and across multiple business and geographical units of the same customer, allowing them to have a central role across the IT services value chain. To investigate the role of ITSPs in the IT services value chain we start by conceptualizing the SITSVC as two intersecting chains, i.e. the supply chain (Porter, 1985) and development chain (Simchi-Levi et al 2008). Following this, we view the value chain through the lens of resource-dependence theory (Aldrich 1976) and, the inter-organizational knowledge transfer view (Loh and Venkatraman 1992) to understand the nature of the exchange relationship between ITSPs and client organizations. We start by briefly discussing these perspectives before proceeding to the conceptualization of the SITSVC.

First, from resource-dependence theory (e.g. Aldrich 1976), inter-organizational dependencies are created because organizations need to acquire scarce or valuable resources from outside their firm boundaries, thus depending upon suppliers, usually other organizations, to acquire resources. The extent of dependence varies with the importance of the resource to the focal organization, access to alternative sources, and viability of switching (e.g. Aldrich, 1976). In the context of IT outsourcing and application service provision, this theory indicates that, an organization’s dependence on an ITSP will depend on the importance of the services or applications provided, the number of potential suppliers and the cost of switching suppliers (e.g. Cheon et al 1995,Jayatilaka et al 2003). In the case of IT services, the importance of the services to the client is high. Given the extent of business processes in those services, contracts are extensive and complex, leading to high switching costs. We therefore expect that organizations would be highly dependent on their ITSPs. In the particular case of IT sustainability, they would depend on their ITSPs to incorporate sustainability practices in the services they provide.

Second, inter-organizational knowledge transfer view indicates that a leading reason for engaging the services of an ITSP is access to specialized resources and capabilities (e.g. Loh and Venkatraman 1992). Indeed outsourcing has been shown to be a function of gaps in the IT capabilities of firms (e.g. Loh and Venkatraman 1992). This transformational view of outsourcing implies that the firm with the superior capability or expertise (i.e., ITSP) can increase the level of awareness and knowledge of the less informed firm, (i.e., client) in the outsourced domain. We thus expect that ITSPs, if they have access to expertise about sustainability, would raise the level of sustainability cognizance of their clients.

The above theoretical perspectives inform our expectation that ITSPs would have a significant role in driving adoption of IT-related sustainability in organizations.

IT SERVICES VALUE CHAIN

A firm’s value chain (Porter, 1985) or supply chain (Mabert and Venkataramanan, 1998) describes activities required to bring a product to the market. Based on the widely used Supply Chain Operations Reference (SCOR) model developed by the Supply Chain Council, it is typical to describe the supply chain as a “chain” of four execution processes - Source, Make, Deliver and Return (SCC 2008). “Source” includes processes to procure goods. “Make” includes processes that transform sourced materials to a finished state. “Deliver” has activities enabling delivery of finished products to customers. “Return” activities accomplish post-delivery support, returns-handling and product-disposal. In the context of ITSPs, Source includes procurement of software (e.g. databases, middleware and operating systems) and hardware (e.g., servers, desktops and mobile devices). Make includes development and deployment of solutions and application suites by combining hardware and software. Deliver consists of delivery of services such as, IT integration, infrastructure management, and data center management. Return consists of disposal of phased-out hardware and software.

1 First, from resource-dependence theory (e.g. Aldrich 1976), inter-organizational dependencies are created because organizations need to acquire scarce or valuable resources from outside their firm boundaries, thus depending upon suppliers, usually other organizations, to acquire resources. The extent of dependence varies with the importance of the resource to the focal organization, access to alternative sources, and viability of switching (e.g. Aldrich, 1976). In the context of IT outsourcing and application service provision, this theory indicates that, an organization’s dependence on an ITSP will depend on the importance of the services or applications provided, the number of potential suppliers and the cost of switching suppliers (e.g. Cheon et al 1995,Jayatilaka et al 2003). In the case of IT services, the importance of the services to the client is high. Given the extent of business processes in those services, contracts are extensive and complex, leading to high switching costs. We therefore expect that organizations would be highly dependent on their ITSPs. In the particular case of IT sustainability, they would depend on their ITSPs to incorporate sustainability practices in the services they provide.

Second, inter-organizational knowledge transfer view indicates that a leading reason for engaging the services of an ITSP is access to specialized resources and capabilities (e.g. Loh and Venkatraman 1992). Indeed outsourcing has been shown to be a function of gaps in the IT capabilities of firms (e.g. Loh and Venkatraman 1992). This transformational view of outsourcing implies that the firm with the superior capability or expertise (i.e., ITSP) can increase the level of awareness and knowledge of the less informed firm, (i.e., client) in the outsourced domain. We thus expect that ITSPs, if they have access to expertise about sustainability, would raise the level of sustainability cognizance of their clients.

The above theoretical perspectives inform our expectation that ITSPs would have a significant role in driving adoption of IT-related sustainability in organizations.

1 Multiple references are relevant for Section 2 descriptions. To adhere to the word limit, we have not included all.
For firms offering services or product-service bundles (such as ITSPs), it is key to note that the customer becomes an integral part of the “Make” processes (Chase 1978). It is critical to consider the degree of customization that is required for the product-service bundle (Jacobs and Chase 2008). The Source-Make-Deliver-Returns conceptualization is directly relevant to manufacturing/pure product firms and does not consider the role of the customer in the “Make” stage. Additional considerations are thus warranted in conceptualizing the ITSV, keeping in mind that ITSPs offer service-product bundles highly customized to requirements of the specific client organization and engage in extensive customer contact. The client organization is thus an integral part of the “Make” processes. In introducing the role of the customer in the “Make” processes with respect to ITSPs, we draw upon the notion of a development value chain (Simchi-Levi et al 2008) that consists of “Plan/Design” and “Develop” processes. Plan/Design includes architecture design activities for IT product-service bundle. Develop includes coding, testing and quality assurance activities.

Thus the IT Services Value Chain - ITSV (Figure 1), is conceptualized to include both the supply chain and the development chain. The “Make” processes of the supply chain serve as the point of intersection for the supply and development chains (Simchi-Levi et al 2008). This conceptual representation forms the theoretical basis, in our study, for analyzing the sustainability activities of ITSPs in the context of service-product bundles provided by them to client organizations.

![Figure 1: IT Services Value Chain](image)

**METHODS**

We adopted a qualitative approach and used the case study method (Yin 2003), given the exploratory nature of our research question. Our study sites (described in Table 1) consist of four leading ITSPs based in India and one ITSP based in USA (described in Table 1) and having the bulk of its operations in India. We promised anonymity to the firms, therefore we henceforth refer to them as VA, VB, VC, VD and VE. The appropriateness of these sites is based on a) the primacy position of India in the IT services outsourcing industry (Palvia 2003, Davis et al 2006) and b) the size (revenues), leading positions and international scale of operations of these firms in the ITSP industry. VD, VA, and VC are listed on the National Stock Exchange in India and on the NASDAQ in USA. VE is listed on the NASDAQ. The leading positions of these firms was considered critical to identify state-of-the-art ITSP practices with respect to sustainability in the ITSV.

<table>
<thead>
<tr>
<th>ITSP</th>
<th>Operation in number of countries</th>
<th>Revenue (2008-2009)</th>
<th>Designations of interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>VD</td>
<td>67</td>
<td>USD 4.5 Bn</td>
<td>VP- Control and Compliance, Manager - Sustainability, Manager – Innovation.</td>
</tr>
<tr>
<td>VB</td>
<td>42</td>
<td>USD 6.1 Bn</td>
<td>Manager - Sustainability, Project Manager</td>
</tr>
<tr>
<td>VA</td>
<td>54</td>
<td>USD 5.7 Bn</td>
<td>Head of Sustainability Practices, Business Architect - IT for Green &amp; Sustainability</td>
</tr>
<tr>
<td>VE</td>
<td>52</td>
<td>USD 1.1 Bn</td>
<td>Senior Manager – Innovation, Manager – Sustainability</td>
</tr>
<tr>
<td>VC</td>
<td>&gt;50</td>
<td>USD 2.8 Bn</td>
<td>Group Head - Innovation, Project Manager, Developer</td>
</tr>
</tbody>
</table>

**Table 1: Study Sites and Interviewees**

For each organization, we focused our data collection on three aspects. First we studied their sustainability practices in each stage of the ITSV represented in Figure 1. Second, we looked at activities for influencing adoption of these practices in their client organizations. Third, we looked at potential client outcomes of these practices. We used a structured, open-ended interview schedule. The questions were based on the literature discussions. In keeping with the exploratory nature of this study we were open to emergent aspects during the interviews.

The data were collected between October 2009 and January 2010. The primary data were collected through face-to-face interviews, with 12 senior managers from the study sites, as detailed in Table 1. From each organization, we interviewed the senior most executive responsible for sustainability initiatives. Based on suggestions from these senior executives, we identified respondents for further interviews. Each interview, lasting 60 to 75 minutes, was recorded and transcribed. We also collected extensive secondary data provided by the interviewees. Because of the significant technical aspects and relatively embryonic nature of sustainability practices, a considerable portion of information relevant to this study was found in technical papers and internal literature of these organizations. This literature, consisting of about 50 technical notes and company documents was provided by our respondents, and included insight about IT sustainability initiatives and their intended impacts.

FINDINGS AND ORGANIZING FRAMEWORK

We organize our findings in the framework presented in Figure 2 and describe them below against the backdrop of our research objectives. We find that there are three ways in which ITSPs can promote IT sustainability in organizations - by (1) designing and delivering a Sustainable IT Services Value Chain (SITSVC), (2) client education and (3) exemplifying their own IT sustainability efforts. These three mechanisms lead to two outcomes for client organizations - (1) adoption of sustainable practices in their IT services acquisition and (2) increased cognizance of IT related sustainability. We next analyze these activities and outcomes and provide data illustrations.
Figure 2: Framework for understanding how the ITSP can facilitate adoption of IT sustainability in client organizations

**Sustainable IT Services Value Chain**

- **Sourcing**: Energy Star, TOC, ISO 14000 certifications, monitoring energy footprint of procured hardware and associated vendor development.
- **Planning and Design**: Use of collaboration platforms for distributed development teams.
- **Development**: Minimize number of lines of codes, Create reports that require less paper to print.
- **Production**: Provisioning and Cloud Computing.
- **Delivery**: Data center management (virtualization, capacity utilization, energy efficient lighting and renewable energy cooling), Power management, Energy consumption analytics, Assessment of Energy Usage Profile.
- **Disposal**: Recycling and Waste Management.

**Sustainable Supply Chain**

**Resource Dependence Perspective**

- Client firms’ adoption of sustainable practices in their IT services acquisition: Economic, Environmental, Social Impacts.

**Inter-organizational Knowledge Sharing Perspective**

- ITSP’s Self IT Sustainability Efforts
- Client Education
- Client firms’ cognizance of IT related sustainability
### Table 2: The Sustainable IT Services Value Chain - ITSP Activities and Client Outcomes

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activities</th>
<th>Sustainability Practices of ITSP’s</th>
<th>Client Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and Design</td>
<td>Product design and architecture</td>
<td>Use of collaboration platforms for distributed development teams</td>
<td>Decreased use of processing and hardware leading to decreased energy consumption.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Decreased physical travel leading to higher savings, greater employee well-being and lower environmental impact.</td>
</tr>
<tr>
<td>Development</td>
<td>Product development</td>
<td>Minimizing number of lines of codes</td>
<td>Decreased use of processing and paper leading to decreased energy consumption.</td>
</tr>
<tr>
<td></td>
<td>Coding and testing Quality Assurance</td>
<td>Interaction with users for creating reports that require less paper to print</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>Application and hardware deployment</td>
<td>Provisioning of hardware and network capacity, operating systems and applications. Cloud Computing - infrastructure, application and platform as services</td>
<td>Decreased utilization and decreased duplication of hardware leading to decreased energy consumption.</td>
</tr>
</tbody>
</table>
| Sourcing               | Purchase and acquisition of hardware, databases, networking equipment, systems software and middleware applications | **Basic conformance:**
|                        |                                                                           | • Standard adherence for energy consumption (Energy Star)                                          | Use of environmental friendly materials                                          |
|                        |                                                                           | • Standard adherence for use of hazardous materials (TOC)                                         |                                                                                   |
|                        |                                                                           | **Going beyond Basic conformance:**                                                                |                                                                                   |
|                        |                                                                           | • Monitoring of energy footprint of procured hardware at various levels of usage                   |                                                                                   |
|                        |                                                                           | • Vendor development and education regarding specific sustainability requirements and parameters   |                                                                                   |
| Delivery               | Implementation of application suites                                       | Data Center Management - technology (application virtualization, capacity utilization)            | Decreased use of processing and hardware leading to decreased energy consumption. |
|                        |                                                                           | Data Center Management - physical facilities (renewable energy use for cooling, space utilization, energy efficient lighting, lighting reduction) |                                                                                   |
|                        |                                                                           | Power Management - automated equipment switches for turning off and on, automated adjustments of cooling temperatures to accommodate lower loads during specific times |                                                                                   |
|                        |                                                                           | Energy Consumption Analytics - installation of IP power meters, measurement of energy consumption by |                                                                                   |
| Disposal               | Management of obsolete hardware and software                               | Recycling of obsolete hardware and software - gifting to non-profits                              | Social                                                                           |
|                        |                                                                           | Waste management of obsolete hardware and software - buybacks, landfills and third party providers |                                                                   |

*Procedures of the Sixteenth Americas Conference on Information Systems, Lima, Peru, August 12-15, 2010*
The Sustainable IT Services Value Chain (SITSVC)

We find that ITSPs can drive IT related sustainability in organizations by designing and delivering what we conceptualize as the SITSVC. We describe below and summarize in Table 1 and Figure 2, its different stages, along with sustainability-related practices of ITSPs for every stage. We use the ITSV conceptualized in Section 3 for framing our descriptions.

Planning and Design

The focus of sustainability efforts was on collaborative practices for directing knowledge flows among members of design teams. At VE, we found the use of collaboration platforms such Domino 8.5 and Rational Team Concert for distributed design teams. We did not find a high level of awareness regarding sustainability practices for this stage. One of the respondents mentioned, “Most of our work involves software customization and interface building and there is not much scope for sustainability practices in fundamental software design.”

Development

Development practices focused on using less processing power, as mentioned by one of our respondents, “At VA we try to ensure that code we write doesn’t use much processor or CPU”. According to another respondent forms and reports were designed to eliminate extra lines and headers, for minimizing print paper. Quality assurance activities focused on conformance to functional specifications and did not include assessment against sustainability parameters.

Sourcing

All the study sites had policies for procuring client-related equipment that included conformance to use of a) energy conserving components in monitors and processors and b) recyclable and bio-degradable materials for external casings and packing materials. With regard to the first, basic-level conformance included purchasing equipment with appropriate labels such as Energy Star (EPA 2009). A respondent from VD mentioned, “Energy Star is a hygiene factor only. We go beyond it. We define what we want and let the vendors come up with ways to meet those requirements. We work with our suppliers to improve on energy consumption.” A respondent from VC stated, “We measure power consumption of machines under various conditions, e.g., 100% or 50% processing and use the data to work with vendors [to replace or further develop the hardware]”. ISO 14000 certification was a compliance issue only for specific hardware items sourced from specialized and smaller suppliers, since most of the standard hardware vendors were certified. For the second, compliance with the TCO certification label, which includes criteria on electromagnetic discharge of monitors, energy consumption, ergonomics, and the use of hazardous materials in construction (Proto et al 2007) was used. VA had an explicit “chemical policy management” document that had guidelines for avoiding the use of materials that were hazardous to human health and the environment.

Production

A number of sustainability strategies were used in production activities. First was provisioning to automate the deployment of operating system images, middleware, applications, networks and storage among different clients, as and when required, thus decreasing duplication. Second was cloud computing, that is, providing platforms, infrastructure and applications as services to client organizations. This was a relatively new concept and most of our respondents mentioned that their organizations were, at the time of the study, exploring and learning rather than actively delivering. One of them said, “Deploying these concepts in production can significantly save on processing and hardware requirements, however, they require complex coordination at different levels, starting from capacity planning and going up to application delivery. At this point, we are getting up to speed but have not started using them on a large scale with our clients.”

Delivery

The most prominent activity related to the Data Center (DC), the central location where client firms stored their servers, networking equipment and data. DC management, i.e., management of technology and physical facilities constituting the DC is a primary deliverable for ITSPs. Sustainability practices for managing technology included server consolidation and capacity utilization, achieved through use of tools that allowed virtual (instead of physical) replication of application stacks. From one of the reports provided by a respondent from VE, “Typical server utilization is approximately 10%-15%. With virtualization, utilization rates as high as 80% can be achieved. Capacity planning exercises give insight into workload and how much consolidation can be achieved while maintaining service level requirements.” Sustainability practices for managing physical facilities included use of renewable energy sources for cooling/air-conditioning, energy-certified lighting, space management and LEED specified building design. There were limits to physical facility management however. A respondent from VB mentioned that “the proliferation of computing devices at all levels – increasing number of transistors
on chips to more blades and disks in a rack, and growing number of racks in a machine room” meant that even if the number of servers was reduced due to virtualization, stacking was limited because of the heating. Respondents from VE and VD mentioned the use of power management techniques such as powering down equipment or adjusting cooling temperatures to accommodate for lighter loads during weekends.

Another important activity related to energy consumption analytics. Respondents from VA, VB, VD and VE mentioned the use of power meters connected to the network to measure energy consumption by type of use i.e. by servers or lighting or air-conditioning. One of the respondents from VD mentioned, “We provide data on hourly or weekly energy consumption and then look at leakages and improvements.” VE provided clients with dashboard-type software to monitor and measure DC energy consumption.

**Disposal**

The Disposal stage, which emerged from the data, includes activities for environment-friendly disposal of used computer hardware and software. Of our five study sites, VA and VE provided the most advanced services. A respondent from VA mentioned, “We take physical and financial responsibility towards the recycling of hardware purchased from us”. It offers physical facilities in India for collecting retired hardware from customers and facilitating their recycling through accredited waste management companies. It is working with the government to influence policy regarding disposal of hardware. From one of the respondents from VE “We have a separate department for reusing and safely disposing of used assets. This department buys back used equipment. Nearly 90% of it is reused or resold; the rest is refurbished, sold as parts, used for maintenance or safely scrapped. Less than 1% goes to landfills.” Not all of the firms our study were active in this stage. VC and VD for instance had their own recycling activities, which did not extend to services provided to customers.

**Client Education**

Another way for ITSPs to drive sustainability was by educating and creating sustainability related awareness among clients. In this context, one of the respondents mentioned, “Not all of our customers are aware of IT related sustainability. We find that many of the solutions we suggest are new to them and that we can educate them.” The extent of IT sustainability related awareness, as indicated from our conversations with the respondents, was the highest in energy utility firms, followed by those in the shipping and logistics, automobile manufacturing and banking/financial services sectors. ITSPs engaged with the clients to generate sustainability awareness through the Request for Proposal documents and sales presentations. VB had “innovation days” where they shared insights with customers about technology solutions (e.g. cloud computing and virtualization), legislation and certifications relating to IT sustainability. From VC however, we found that the larger customers were often not willing to consider sustainability related practices without a strong cost saving argument. “We do try to share solutions with customers but whether or not they are adopted depends on cost.”

**Exemplifying Self Sustainability Efforts**

A third mechanism was to showcase and demonstrate their own IT sustainability efforts to client organizations customers. VD had a separate sustainability function that was in charge of infrastructure and IT related sustainability issues. VC had a “Go Green” program for IT sustainability that deployed desktop power saving, server virtualization and consolidation and DC management policies. VD had centralized printing policies through print servers and a near total absence of individual printers. VE’s “Project Green” initiatives included centralized power management, and server and network consolidation, implemented through applications for carbon management, power consumption monitoring, data storage optimization and asset management. VE also had its own research and development activities with respect to virtualization and consolidation, which fed into solutions provided to customers. VC and VD were in the process of developing environment-sensitive policies for partnering with specialized waste management companies and suppliers for recycling or disposing off old computers. At VB, according to one of their respondents, “exploring lease/buyback options and working with authorized agencies/vendors to ensure close to 100% recycling/reuse after lifetime, even for the equipment donated to charities/NGOs” were some of the disposal initiatives.

**Outcome 1: Adoption of sustainable practices in IT services acquisition**

As described in detail Table 2, incorporating sustainability practices by ITSPs in each stage of the ITSVC is associated with a number of expected outcomes for client organizations, leading to positive impacts on the triple - economic, social and environmental (Elkington 1998) bottom line. We briefly describe some of them below.
At the **Planning and Design** stage, use of collaborative platforms results in improved performance of servers and storage and in reduced travel, leading respectively to decreased energy consumption and decreased travel costs. For the **Development** stage code efficiency leads to reduced processing and designing parsimonious forms leads to reduced paper consumption. At the **Sourcing** stage, conformance to energy certifications in procurement leads to use of environmental-friendly hardware and a reduced carbon footprint for client organizations. While initial costs of procuring certified hardware may be higher, eventual energy consumption is expected to be lower. In the **Production stage**, efficient provisioning decreases duplication and increases utilization of hardware, leading to reduced energy consumption. Advanced technologies such as cloud computing would also yield similar benefits; we found their application to sustainability in the nascent stages with significant future potential. At the **Delivery** stage sustainability practices in DC management such as virtualization, space utilization and automated switching control, result in efficient use of multiple aspects of the infrastructure - technology, physical facilities/floor space and power. They lead to reduced energy consumption and processing. The **Disposal** stage activities such as recycling and reduction in landfill disposal lead to environmental benefits for client organizations. There is some potential to realize economics benefits, however detailed cost analysis not available in our data, may be required to support substantive conclusions.

To summarize, ITSPs play a central role in all aspects of the SITSVC and can enable sustainable IT related outcomes at client organizations. Further, as firms focus more on their core competences it increases their dependence on external organizations for IT resources and capabilities. In line with the resource dependence perspective this increase dependence may enable ITSP’s delivery of the SITSVC to increase adoption of sustainable IT practices at client organizations. Our research thus indicates that there is significant potential to realize environmental, economic and social benefits by clients, from delivery of the SITSVC by ITSPs.

**Outcome 2: Increased cognizance of IT-related sustainability**

In consonance with the knowledge sharing perspective, we find that ITSPs delivery of the SITSVC, client education and exemplification of self-sustainability efforts lead to enhanced knowledge and awareness of IT-related sustainability in client organizations. To the extent that a particular ITSP incorporates sustainability practices at each stage of the ITSVC, the corresponding customer engagement interactions for the stages would provide insight to client organizations about IT sustainability. We also found that exemplification initiatives strengthened the ITSPs own knowledge about IT sustainability practices and helped increase client awareness as well. For instance, one of our respondents at VD mentioned, “**We ourselves have a huge IT infrastructure and so we started doing many things internally to address our own transformation. We showed clients what we were doing and they said why don’t you do it for us. What started as an internal initiative has now become part of our services. There is constant feedback between what we do and what we offer to clients.**”

**CONTRIBUTIONS, LIMITATIONS AND FURTHER RESEARCH**

The primary theoretical contribution of this paper is in introducing the perspective of the ITSP in driving or enabling adoption of IT sustainability by organizations. By mapping the SITSVC, we find that ITSPs can indeed influence the adoption of IT sustainability by delivering IT services that incorporate sustainability practices, an important finding, given their global reach and wide scope of operations. The inter-organizational knowledge sharing perspective, a second contribution is in highlighting the role of ITSPs in increasing sustainability cognizance of organizations. Sustainability research has so far focused primarily on data centers as the major IT service delivery related area for reducing energy consumption. This paper, in examining the entire spread of IT services from a supply chain perspective shows that there are a number of stages and activities in IT services delivery that should form the focus of sustainability practices.

In terms of managerial contribution, this paper provides a starting point for developing a checklist for organizations that can help evaluate the sustainability readiness of an ITSP, and be used as a decision criterion for ITSP selection. For ITSPs, it provides guidelines for the foundation to develop a framework which can help in developing and differentiating their sustainability offerings. Organizations may initially be interested in economic benefits from sustainability, since they lead to cost savings. Therefore those stages of the SITSVC that are associated with economic outcomes could be the initial focus of sustainable IT services delivery. Also, from the findings it is clear that all firms are not equally aware of or interested in acquiring sustainable IT services; from our preliminary findings it seems that firms in those sectors where environmental legislation is stringent are more willing to do so. ITSPs could thus direct their sustainability offerings at these firms.
This paper presents a starting point to develop a framework for understanding the role of the ITSP in driving sustainable IT adoption. There are limits to the generalizability of the findings, given the relatively small number of respondents and study sites. However, given the leading industry positions of the selected firms, we believe we have been able to reasonably capture state-of-the-art sustainability related thinking and practice representative of larger ITSPs. Future research could build on our work and address questions that reveal further mechanisms and roles associated with ITSPs in driving IT sustainability, as well as their differential effectiveness for different industries and firms. Such an effort may extend our work to jointly incorporate the perspectives of ITSPs and client organizations in building an integrated framework.

REFERENCES