SUSTAINABLE IT

REDUCING CARBON FOOTPRINT AND MATERIALS WASTE IN THE IT ENVIRONMENT

LECTURE FIVE

ROADMAP AND SUCCESS OF SUSTAINABLE IT

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The Natural Edge Project (TNEP) is an independent non-profit Sustainability Think-Tank based in Australia, administratively hosted by Griffith University and the Australian National University. TNEP operates as a partnership for education, research and policy development on innovation for sustainable development. Driven by a team of early career Australians, the Project receives mentoring and support from a range of experts and leading organisations in Australia and internationally, through a generational exchange model. TNEP's initiatives are not-for-profit. All support and revenue raised is invested directly into existing initiatives and development of future initiatives.

EDUCATIONAL AIMS OF LECTURES

Lecture 1: Drivers and Benefits of Sustainable IT

The aim of this lecture is to discuss the drivers and benefits of *Sustainable IT*, particularly for the customer. Drivers and benefits range through business, economic, environmental and legislative domains.

Lecture 2: Product Service Systems and the Product Cycle

The aim of this lecture is to discuss *product service systems*, their barriers and lessons from past implementations, as well as the opportunities to reduce energy and materials consumption in packaging and equipment through end-of-life processing.

Lecture 3: Client Equipment

The aim of this lecture is to discuss a four-step process for reducing energy consumption, materials consumption and materials toxicity in client equipment.

Lecture 4: Data Centres and HP Case Study

The aim of this lecture is to discuss a seven-step process for reducing energy consumption in data centres and to present a *Sustainable IT* case study of IT vendor HP.

Lecture 5: Roadmap and Success of Sustainable IT

The aim of this lecture is to discuss the strategies, activities and actions upon which customers and vendors should focus in order to successfully transition to, maintain and promote their *Sustainable IT* solutions at the organisation and industry level.

Sustainable IT

Lecture 5: Roadmap and Success of Sustainable IT

Educational Aim

The aim of this lecture is to discuss the strategies, activities and actions upon which customers and vendors should focus in order to successfully transition to, maintain and promote their *Sustainable IT* solutions at the organisation and industry level.

Required Reading

Reference	Page
Degher, A. (2002) 'HP's worldwide take back and recycling programs: lessons on improving program implementation', *Electronics and the Environment*, 2002 IEEE International Symposium on 6-9 May 2002, pp. 224-227.	pp 224-227
Hochstein, A., Zarnekow, R. and Brenner, W. (2005) 'Evaluation of service-oriented IT management in practice', *International Conference on Services Systems and Services Management*, pt.1, vol. 1, pp. 80-84.	pp 80-84
Vassiliadis, B., Stefani, A., Tsaknakis, J. and Tsakalidis, A. (2006) 'From application service provision to service-oriented computing: A study of the IT outsourcing evolution', *Telematics and Informatics*, vol. 23, no. 4, November 2006, pp. 271-293.	pp 271-293

Learning Points

Roadmap to Sustainable IT

1. For customers, the successful transition to *Sustainable IT* relies largely upon three key activities:
    - *Establish appropriate internal culture:* Customers will need to establish appropriate internal culture, which includes: developing an understanding of the environmental impacts of IT;[1] committing to sustainability in, at least, the IT business function; developing a good understanding of *product service systems* concepts;[2] and committing to the *Sustainable IT* solutions' success. A corporate commitment to sustainability provides support for the IT business function to maximise all benefits of *Sustainable IT*.
    - *IT asset management and IT asset replacement strategy:* Comprehensive *IT asset management* relies on assessing user profiles, maintaining accurate asset registers and

[1] Cabinet Office (n.d.), p. 7.
[2] Hochstein, A., Zarnekow, R. and Brenner, W. (2005); Vassiliadis, B. *et al* (2006); Brezet J.C., Bijma, A. and Silvester, S. (2000).

establishing predictable usage patterns. In addition, software asset management involves managing media and licenses. A comprehensive *IT asset replacement strategy* incorporates options for product reuse, trade-in and recycling. The impact of capital and operating costs on asset selection as part of the *IT asset replacement strategy* is a key consideration in optimising *product service systems*.

Product service systems are comprised of several well-defined, modular product and service offerings that exhibit varying levels of advancement towards complete *product service systems*. While each offering will enhance performance and reduce total costs, *product service systems* that synergistically integrate all offerings will provide the greatest benefits per dollar invested.

- *Data centre and business continuity considerations:* Most *Sustainable IT* solutions for large enterprises incorporate a data centre. Critical factors affecting energy efficiency are floor design, intelligent building components, and server power consumption. Compact server technology has lead to higher server density and processing power density in data centres, but has also resulted in energy and cooling challenges.[3] These challenges can be minimise by reducing energy consumption.

2. For vendors, the successful transition to *Sustainable IT* relies largely on two key activities:

   - *Establish appropriate support and structure*: Vendors will need clear governance, strong support from upper management, well defined solutions models, and operations that align at least loosely with provided services.[4] Vendors must also develop the capacity to deliver customised solutions.[5]

   - *Develop product end-of-life processing activities and infrastructure in Australia*: In Australia, the least developed component of *product service systems* is product end-of-life management. A long term solution is to develop the processing infrastructure domestically, which, for hardware products (equipment), could be costly and will require many years.[6] Meanwhile, there are a number of necessary activities that can be immediately cost-effective domestically.[7]

Success of Sustainable IT

3. The successful maintenance of *Sustainable IT* relies largely on three key actions:

   - *Develop understanding and acceptance*: Poor understanding of the concepts and expected performance of *product service systems* often compromises success.[8] Poor understanding manifests as misunderstandings[9] and unrealistic expectations.[10] Compromised success can be minimised through comprehensive training for employees.[11] Training should address not only *product service systems* concepts and operation, but motivations for common customer resistances and fears.

[3] IDC (2006), p 4.
[4] HP Services (n.d).
[5] Vosicky, J.J. (1992).
[6] Degher, A. (2002).
[7] Degher, A. (2002).
[8] Hochstein, A., Zarnekow, R. and Brenner, W. (2005); Vassiliadis, B. *et al* (2006).
[9] Vosicky, J.J. (1992); Lewis, E. (2000).
[10] Vassiliadis, B. *et al* (2006).
[11] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).

- *Engage in support activities*: Several support activities include:[12] acquiring the support of upper management; forming project trams to manage new activities and IT lifecycle impacts, risks and costs through all stages of the product service system; and striving for continuous improvement.
- *Contribute to continuous improvement*: Customers are encouraged to partner with vendors to collect and release performance information for reporting and case study development.[13] Customers are also encouraged to re-invest cost savings from initial *Sustainable IT* activities in order to progress the solution.

4. The successful promotion of a *Sustainable IT* as a business solution relies largely on three key actions:
   - *Engage in awareness activities and report successes*: *Sustainable IT* can be marketed to customers[14] and should be supported by a series of best practice case studies.[15] It is important to highlight the short-term successes.[16]
   - *Provide economic incentives*: Economic incentives make *product service systems* more attractive and less risky.
   - *Support legislation and regulations that encourage Sustainable IT*: Customers and vendors should consider supporting legislation and regulations that encourage cost-effective *Sustainable IT*. Customers and vendors could also initiate voluntary self-regulation activities.

[12] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).
[13] Vassiliadis, B. *et al* (2006).
[14] Vassiliadis, B. *et al* (2006).
[15] Vassiliadis, B. *et al* (2006).
[16] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).

Brief Background Information

Roadmap to Sustainable IT

A successful transition to *Sustainable IT* relies largely on addressing the barriers identified and learning the lessons of past and new implementation attempts. There are a few particularly important steps for both customers and vendors.

Activities for Customers

For customers, the successful transition to *Sustainable IT* relies largely upon three key activities. These activities streamline the transition to *Sustainable IT* through planning and minimising uncertainties.

1. *Establish appropriate internal culture*: Customers will need to establish appropriate internal culture, which includes: developing an understanding of the environmental impacts of IT;[17] committing to sustainability in, at least, the IT business function; developing a good understanding of *product service systems* concepts;[18] and committing to the *Sustainable IT* solution's success.

   A corporate commitment to sustainability provides support for the IT business function to maximise all benefits of *Sustainable IT* by facilitating the activities that are critical to optimising *product service systems*. These activities include:

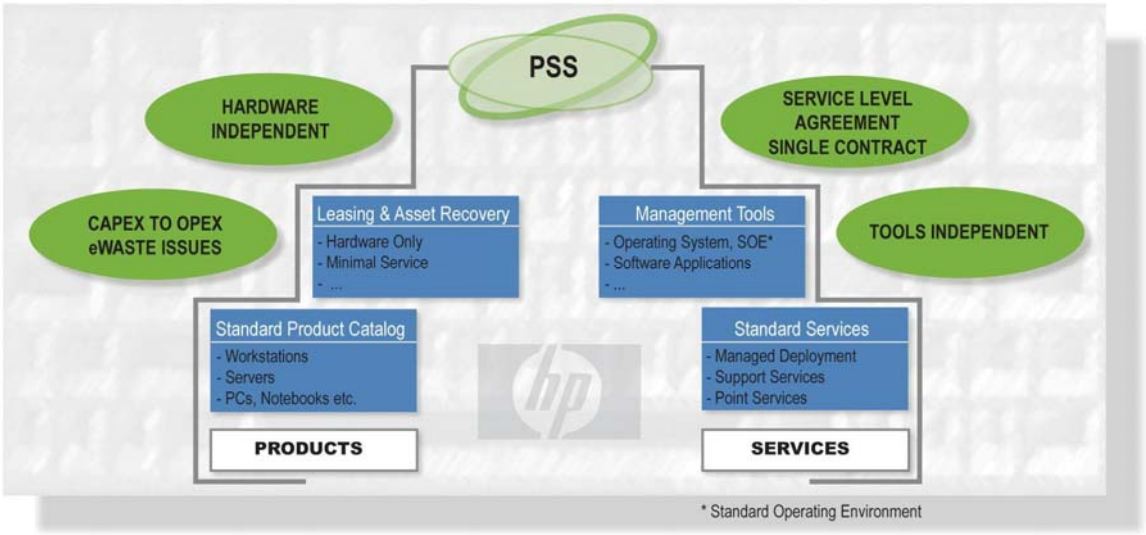
   - defining and monitoring key sustainability indicators[19] and targets;
   - making management responsible for ensuring that the lifecycle environmental impacts of decisions are fully evaluated;[20]
   - developing employee guidelines and policies for sustainable use and disposal of IT assets;
   - developing marketing messages that demonstrate the IT business function's commitment to sustainability; and
   - communicating with other business functions about sustainability related issues.

2. *IT asset management and IT asset replacement strategy*: *IT asset management* creates opportunities for optimising *product service systems*. Comprehensive *IT asset management* relies on assessing user profiles, maintaining accurate asset registers and establishing predictable usage patterns. In addition, software asset management involves managing media and licenses. For example, compared to hard media licensing, online licensing is easier to track and does not require collection or disposal at product end-of-life, and thus should be favoured.

   The *IT asset replacement strategy* should complement *IT asset management*. A comprehensive *IT asset replacement strategy* incorporates options for product reuse, trade-in and recycling. The impact of capital and operating costs on asset selection as part of the *IT asset replacement strategy* is a key consideration in optimising *product service systems*.

[17] Cabinet Office (n.d.), p. 7.
[18] Hochstein, A., Zarnekow, R. and Brenner, W. (2005); Vassiliadis, B. *et al* (2006); Brezet J.C., Bijma, A. and Silvester, S. (2000).
[19] Brezet J.C., Bijma, A. and Silvester, S. (2000); Taylor, P.W. (2008), p. 14.
[20] Cabinet Office (n.d.), p. 7.

Figure 5.1 is an example of a roadmap to *product service systems* whereby customers can identify the components that they have already implemented, if any, and then identify the best sequence in which to implement the remaining components to ultimately build their customised *product service systems*.



*SOE: Standard Operating Environment, which includes the operating system and all desktop software applications.

Figure 5.1. HP Roadmap to Product Service Systems

Source: Adapted from HP internal document, *The HP roadmap to sustainable IT*, by TNEP

Product service systems are comprised of several well-defined, modular product and service offerings that exhibit varying levels of advancement towards complete *product service systems*. While each offering will enhance performance and reduce total costs, *product service systems* that synergistically integrate all offerings will provide the greatest benefits per dollar invested. The modular structure permits customers to make either a rapid or gradual transition to *product service systems* by engaging offerings strategically and sequentially. Using the *Roadmap to Product Service Systems*, customers can first identify which offerings they have already deployed and then construct the subsequent phases of the transition to a *product service system* such that they meet their performance and investment expectations.

In developing the phases of the transition, it is useful to use checklists that assist *IT asset management, IT asset replacement strategy* and alternative employment models.[21] A conservative transition would initially seek to implement all no-cost improvements to the existing IT system and propose a series of improvements with high return on investment.

3. *Data centre and business continuity considerations*: Most *Sustainable IT* solutions for large enterprises incorporate a data centre. Critical factors affecting energy efficiency are floor design, intelligent building components, and server power consumption.

[21] Department of Finance and Deregulation (2005); Department of Finance and Deregulation (2007) *Better Practice Checklist - 24: ICT Asset Management*; Department of Finance and Deregulation (2007) *Better Practice Checklist - 25: Managing the environmental impact of information and communications technology (ICT)*.

Compact server technology has lead to higher server density and processing power density in data centres, but has also resulted in energy and cooling challenges:[22]

- Higher server density increases energy consumption. Many data centres now require more energy than can be supplied.
- Higher energy consumption increases heat load, while higher server density restricts cooling airflow. Modern data centre cooling systems rely on a relatively complex integration of control systems and cooling technology.

These challenges can be minimise by reducing energy consumption (see Lecture 4).

When reducing energy consumption in data centres, business continuity should also be considered. For example, while operating part of a data centre on cold standby will reduce energy consumption, business requirements may include a fast response in getting those resources back online, in which case hot standby would be favourable. Other examples where energy consumption and business continuity intersect arise when managing shared resources in a data centre.

Activities for Vendors

For vendors, the successful transition to *Sustainable IT* relies largely on two key activities. These activities ensure the processes and infrastructure are available to comprehensively deliver the components of *Sustainable IT*.

1. *Establish appropriate support and structure*: A successful transition to *Sustainable IT* requires that vendors have clear governance, strong support from upper management, well defined solutions models, and operations that align at least loosely with provided services.[23] Vendors must also develop the capacity to deliver customised solutions, so they must be:[24]
   - Flexible: respond to unexpected customer requests and offer creative financing solutions
   - Stable: demonstrate strong financial status and business experience
   - Valuable: provide value-adding services specific to the customer's operations
   - Knowledgeable: have appropriate expertise and communicate in the customer's language
2. *Develop product end-of-life processing activities and infrastructure in Australia*: In Australia, the least developed component of *product service systems* is product end-of-life management. For example, in the product end-of-life programs in which one IT vendor currently participates, cost-effectiveness is maintained by transporting hardware products (equipment) and components to centralised processing facilities, some of which are overseas.[25] Currently, only end-of-life print consumables are processed entirely in Australia.[26] A long term alternative is to develop the processing infrastructure domestically, which could be costly and will require many years.[27]

[22] IDC (2006), p 4.
[23] HP Services (n.d).
[24] Vosicky, J.J. (1992).
[25] Hewlett-Packard Development Company (2006) *2006/7 Global Citizenship Report: HP's contribution to the Australian community, environment and employees*, p 10.
[26] Hewlett-Packard Development Company (2006) *2006/7 Global Citizenship Report: HP's contribution to the Australian community, environment and employees*, pp 3,9.
[27] Degher, A. (2002).

Meanwhile, there are a number of necessary activities that can be immediately cost-effective domestically:[28]

- Classify materials under national and local waste regulatory criteria.
- Develop return transportation infrastructure, which may include using envelopes, bulk boxes, bulk collection and shipment systems.
- Develop systems for customer service and distributing return transportation materials, which may include a web page, toll free number or drop-off system.
- Design a sorting procedure for returned items since a small quantity of non-compliant equipment, such as warranty returns and non-IT equipment, can be expected.
- Acquire a central location for receiving, stockpiling, sorting, and transporting returned equipment.
- Analyse Customs, finance, and environmental health issues associated with international transportation.
- Develop processes for transporting returned equipment to processing facilities.

Successful Sustainable IT

A successful maintenance and promotion of *Sustainable IT* relies largely on addressing the barriers identified and learning the lessons of past and new implementation attempts (see Lecture 2). There are a few particularly important actions.

Success at the Organisation Level

The successful maintenance of *Sustainable IT* relies largely on three key actions:

1. *Develop understanding and acceptance*: Poor understanding of the concepts and expected performance of *product service systems* often compromises success.[29]

   Misunderstandings arise from ambiguous definitions, inconsistent language, generalised language, and unspoken agreements, which can lead to costly disputes and performance under-achievement.[30] Customers can develop unrealistic expectations because of misguiding information, excessively ambitious technology objectives, and focussing on technology rather than on business issues.[31] Customers will need to involve representatives from accounting, legal, operations, treasury and top management.[32]

   Customers will also need to partner with vendors to provide comprehensive training for employees.[33] Training should address not only *product service systems* concepts and operation, but motivations for common customer resistances and fears:

[28] Degher, A. (2002).
[29] Hochstein, A., Zarnekow, R. and Brenner, W. (2005); Vassiliadis, B. *et al* (2006).
[30] Vosicky, J.J. (1992); Lewis, E. (2000).
[31] Vassiliadis, B. *et al* (2006).
[32] Vosicky, J.J. (1992).
[33] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).

- Training should explain *product service systems* concepts and justify the benefits as there is often resistance to changing internal processes[34] and shifting from a product ownership model to a product service model.[35] A study of six large companies suggests that the primary barrier to *product service systems* is poor understanding, which led to employees misinterpreting the solutions as management's response to poor personal performance and which consequently led to poor acceptance.[36]

  > *…the greatest challenge in implementing and establishing a service-oriented IT management was the lack of acceptance and missing understanding of the necessity for introducing 'new' processes. Employees were convinced that they were doing a good job and because of that misinterpreted new initiatives as a personal affront to their work. However, only with the support of employees and an understanding for service-oriented processes can such an initiative be successful. In final analysis that is why it was crucial for success to implement initiatives that promote acceptance and understanding in an effective way…*[37]

  Training on the *product service systems* concepts also prevents customers from inadvertently negating the benefits by behaving as if they still own some products and components.[38] For example, a performance review of a *product service system* at the International Rice Research Institute (IRRI)[39] identified as the primary barrier the cultural change away from product ownership and towards performance management and service delivery. Before the solution was implemented and understood, IRRI employees and groups would often purchase additional and replacement components for computers, and then remove the components when the computers were replaced with newer models. As a result, the IRRI's IT employees would have to maintain a wider variety of hardware and software configurations, and then commit time to repairing the old computers before donating them to schools.

- Where there is fear of high risk in changing from a reliable and working IT system,[40] the training should explain the *Roadmap to Product Service Systems*, and the options to deploy *product service systems* in manageable and cost-effective phases. Phased deployment allows the performance of each offering to be analysed before progressing. This fear is exacerbated by the prospect of having to rely on multiple vendors.[41] Thus, the training should also explain that a complete solution from a single vendor, even if some components are subcontracted to other vendors, eliminates the need for multiple vendors and can improve cost-competitiveness.[42]

- Where there is fear of forfeiting control of critical and security processes,[43] the training should explain the transparent communication processes and shared management processes in managing critical and security processes, and the cost savings from avoiding the difficultly and cost of integrating the *product service systems* with the customer's legacy processes.[44]

[34] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).
[35] IDC (2006), pp 15-16; Ness, D. *et al* (2005).
[36] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).
[37] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).
[38] Ness, D. *et al* (2005).
[39] IDC (2006), pp 15-16.
[40] Vassiliadis, B. *et al* (2006).
[41] Vassiliadis, B. *et al* (2006).
[42] Vosicky, J.J. (1992).
[43] Vosicky, J.J. (1992).
[44] Vassiliadis, B. *et al* (2006).

2. *Engage in support activities*: Support activities include:[45]
   - acquiring the support of upper management to facilitate changes;
   - forming project teams to manage and develop the new activities;
   - forming project teams to analyse and manage the IT lifecycle impacts, risks and costs through all stages of the product service system;
   - using short-term successes to demonstrate the effectiveness of *Sustainable IT*; and
   - striving for continuous improvement.
3. *Contribute to continuous improvement*: New *Sustainable IT* solution deployments in Australia will offer lessons towards customisation for the Australian market. Customers are encouraged to partner with vendors to collect and release performance information for reporting and case study development.[46] Customers are also encouraged to allocate a portion of the IT budget, particularly cost savings from initial *Sustainable IT* activities, on IT innovation, such as expansion or progression, rather than on maintenance.

Success at the Industry Level

The successful promotion of a *Sustainable IT* as a business solution relies largely on three key actions:

1. *Engage in awareness activities and report successes*: *Sustainable IT* can be marketed to customers through seminars,[47] and promotional reports. For greatest impact, the seminars and reports should be supported by a series of best practice case studies,[48] particularly those that demonstrate success in the customer's industry. *Sustainable IT* can also be marketed through popular media campaigns. Once commenced, the *Sustainable IT* can be further marketed to both the customer and to prospective customers by highlighting short-term successes.[49]
2. *Provide economic incentives*: Economic incentives are a good means of attracting customer attention. A number of incentives, such as financing with depreciating interest, energy credit rebates and product discounts make *product service systems* more attractive and less risky.
3. *Support legislation and regulations that encourage Sustainable IT*: Legislations and regulations impose a threat of economic loss, operation delays or even closure on non-complying customers and vendors. Customers and vendors should consider supporting legislation and regulations that encourage cost-effective *Sustainable IT* introduced by governments, the various IT industry associations and community groups. Customers and vendors could also initiate voluntary self-regulation activities that encourage both themselves and the industry as a whole to stay ahead of regulations and thus avoid receiving non-compliance penalties.

[45] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).
[46] Vassiliadis, B. *et al* (2006).
[47] Vassiliadis, B. *et al* (2006).
[48] Vassiliadis, B. *et al* (2006).
[49] Hochstein, A., Zarnekow, R. and Brenner, W. (2005).

Optional Reading

1. Brezet J.C., Bijma, A. and Silvester, S. (2000). 'Innovative electronics as an opportunity for Eco-efficient Services', *Proceedings of Electronics Goes Green conference,* September 11-13, 2000, Berlin, Germany, pp. 859-865.
2. Vosicky, J.J. (1992) 'Capturing the benefits of high-tech leasing', *Financial Executive*, July-August. Available at http://www.allbusiness.com/technology/computer-software-management/332405-1.html. Accessed 10 June 2008.

Key Words for Searching Online

Sustainable IT, product service systems, service culture, IT asset management, IT asset replacement, business continuity, product end-of-life processing, continuous improvement, economic incentives.