

# Green IS in Education Industry: A Case Study

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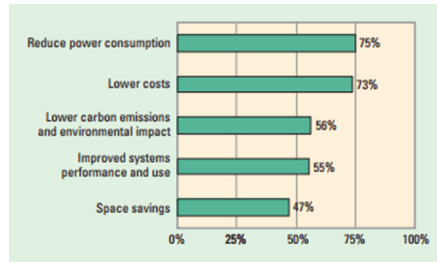
**Abstract.** Green IS relates to environmentally sustainable Information Technology practices in order to reduce business cost and lower environmental impact. Currently, much of the discussion of Green IS is focused on businesses, but the same practices can be applied to education or to anywhere IT or IS related. It is viewed as needed in both business and education because it considers the long term impacts of technology. This study conducts several interviews with employees work in an American university to explore motivations behind Green IS adoption. The results are in line with work of Jenkin et al. (2011a, b) showing that Organizations are still in the infancy stage of awareness and Green IS adoption. In addition, we found Green IS education is one critical factor current universities need to focus on in their process of Green IS adoption. We also suggest that standardization and a rating system of Green IS are necessary to encourage universities in adopting Green IS.

**Keywords:** Green IS · ERP · Education · Adoption

## 1 Introduction

Technology and information systems specifically, were not known to be environmentally friendly. In recent years, that has changed and information systems that is environmentally conscious is known as ‘Green Information System’ (Green IS). Due to the concerns of global warming, most of society and many businesses are becoming eco-friendlier and adopting sustainable products and solutions. Technology is constantly evolving and due to our consumeristic society, the impulse of buying the latest gadget to replace two-year-old electronic devices, has had a huge negative impact on the environment (Jenkin et al. 2010). More electronic devices are consuming electricity, companies and even universities need more and more hardware devices and software to store huge amounts of data, analyze, and summarize the data to improve business processes, thereby increasing the need for more data centers and both IT and IS.

Green Information System or Green IS is the effort of reducing the first hand environmental impacts of Information Technology (IT) by making computing more energy efficient. According to Murugsan (2008), Green IS is defined as “the study and practice of designing, manufacturing, using and disposing of computer, servers and associated subsystems ... efficiently and effectively with minimal or no impact on the environment” This can be applied to any level or scale and therefore, is applicable to anything from smartphones to large data centers (Fig. 1).



**Fig. 1.** Green IS by Murugesan (2008)

Green IS is able to reduce IT costs in the long run, which makes it a stronger incentive for its adoption according to a survey conducted by Dedrick (2010) (Communications of the Association for Information Systems). The author points out, however, that businesses are more apt to adopt Green IS if it makes financial sense. He also states that IS managers are beginning to become more interested in the positive impacts of Green IS practices due to the many positive benefits that can be gained from its adoption.

Green IS has many parts such as virtualization of servers and storage, storage consolidation and environmentally friendly IT actions (ex. double-sided printing). Electronic waste management, also known as e-waste management is also necessary in order lower the environmental impact of Information Technology and Information Systems (Jenkin et al. 2011a, b). There has been an increase in remote group collaboration such as teleconferencing and using software such as SharePoint and Office 365.

Prior to the increase of green sustainability among businesses, the design of its information systems and company culture were not environmentally friendly. Inefficient components of their information systems contributed to high electricity costs (especially in data centers), single-side printing resulting in paper waste, not recycling ink toners, and not recycling old electronics (computers, printers, etc.). Data centers, especially, used excessive energy to cool the servers. Instead of businesses having their own data centers, they could switch over to virtual servers, thereby reducing energy costs and decreasing their carbon footprint. One of the main reasons for companies to adopt Green IS practices was to reduce costs (Molla et al. 2009). Adopting Green IS is not just limited to businesses, but to universities as well. Universities such as Florida Gulf Coast University, have implemented environmental sustainability practices on campus.

One example of poor IS design that could be improved with Green IS practices is the traditional data center cooling approach. The traditional approach includes air cooled computer rooms; this has many problems such as wasted energy due to the way that air convection works. There is wasted electricity from constantly running fans, and there is still heat created that dissipates but is not being used in any way (Li and Kandlikar 2015).

Yet another reason for the necessity of Green IS is to respond to pollution caused by population growth. Due to the use of fossil fuels and of fossil fuels being unsustainable (Santoyo-Castelazo and Azapagic 2014), renewable power alternatives such as

solar or wind power would provide more environmentally friendly IS. Fossil fuel resources are limited and cause pollution which affects the entire planet. The amount of fossil fuel resources needed in the manufacturing processes of IT infrastructure components such as Dynamic Random Access Memory (DRAM) are so high that IS practices with less infrastructure use will greatly reduce the overall environmental impact of a company or university (Williams 2011). Power consumption from a university's IT infrastructure is contributing to these environmental problems. Thus, changing the source of power is a major factor in adopting Green IS (Blaabjerg and Ionel 2015).

As The Climate Group (2008) announced that Green IS/IT could potentially reduce global emissions by 15 %. In most of the previous studies, Green IS/IT are always mentioned together. However, they are different. Green IT addresses the direct impact from technology perspectives, such as energy consumption and waste associated with the applications of hardware and software, toward upon the environment. Green IS focuses on how to adopt a Green system to support other business initiatives to reduce the negative environmental impacts, therefore it has more indirect impact on the environment. Most organizations are willing to change part of their IT and turn it to Green (Jenin et al. 2011), but update IS to green is more difficult and complicated. In this paper, we focus the study on Green IS.

According to Brooks et al. (2010), there were several stages organizations completed in the past toward Green IS, from recognizing the Green IS, to realizing the importance of Green IS, and eventually willing to accept and adopt Green IS. However, even organizations realize the importance of Green IS and are ready for the Green IS, many of the organizations do not necessarily begin Green IS adoption. Even though studies to date explores some issue of Green IS adoptions, such as using TAM to study the intention of Green IS adoption, few study looks at the motivations in pushing organizations to eventually adopt Green IS. Moreover, we find no study focuses on the Green IS adoption in educational industry. Therefore, we decided to study the motivational drivers of adopting Green IS in universities.

## 2 Literature Reviews

Green IS adopts Information Systems as one solution to environmental issues and problems (Dedrick 2010). Ryoo and Koo (2013) propose a Green IS framework to reveal the current concerns of environmental sustainability (ES). There are five stages in the model: there should be some ES motivating forces first, such as new laws, or social norms to push the concerns to the organizations; then, environmental strategies and technologies start to initiate the ES projects; organizational internal factors, such as attitudes or intentions from different level of management or groups in the organization, should also be considered after the ES initiation; ES alignment emphasizes the coordination between Green IS and other systems in the organization; the last stage evaluate the impact on environment.

To be more empirical, Grauler et al. (2013) develop a belief-action-outcome research model to demonstrate consumers' attitude and actions toward Green IS adoption. The results indicate that a sophisticated sustainability report that satisfies

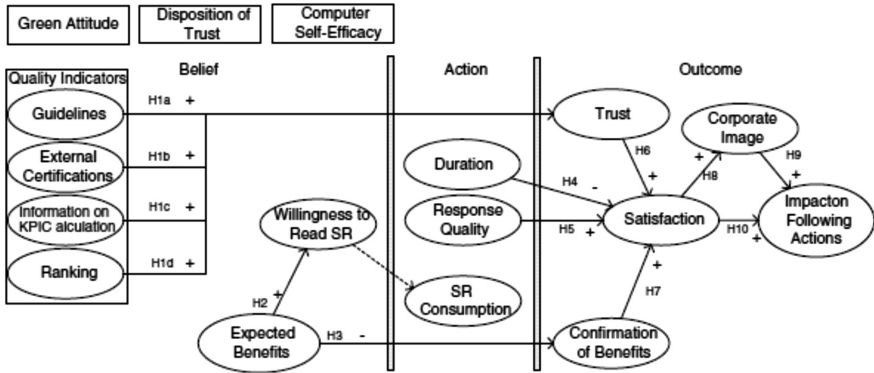


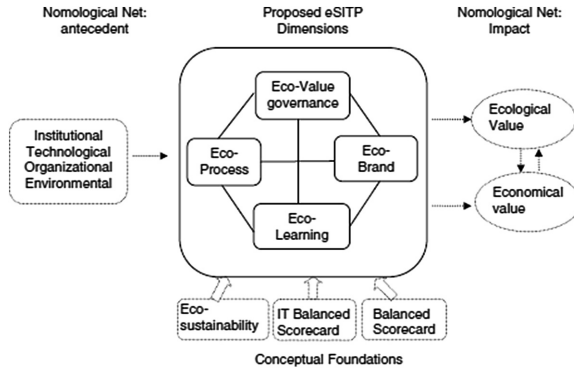
Fig. 2. Research model from Grauler et al. (2013)

consumers' Green expectations could significantly impact/change the organization's reputation and consumers' purchase actions (Fig. 2).

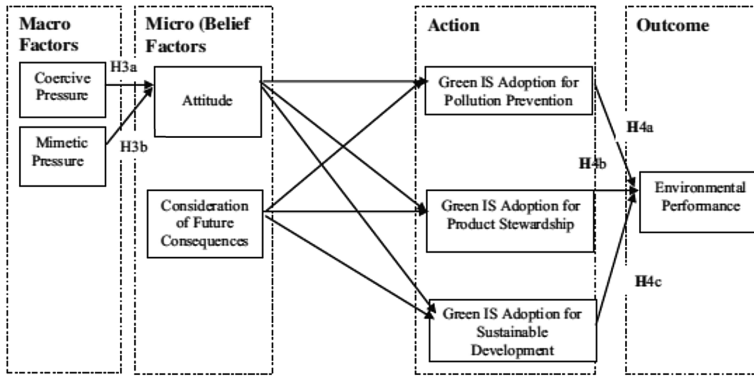
Jenkin et al. (2010) provides exemplary evidence for Green IS/IT. The authors state one of the issues of adopting green information systems and technology, are that most businesses do not put sustainability as a priority. It only becomes a priority if there it is financially driven, meaning if the business will end up saving more money in the long run by adopting sustainability practices. Electronic devices used in organizations such as laptops, desktop computers, printers, and cellphones (company issued) have short lifespans. When businesses replace legacy systems and hardware, it also contributes negatively to the environment. The electronic waste or e-waste is not biodegradable and over time when the metals deteriorate, it may seep into the ground. The authors also point out that IS and IT can also be used to alleviate the negative impacts on the environment and electronic/IT companies such as Apple and IBM, are addressing the issue. IBM's consulting division, Green Sigma, was created to provide green sustainability consulting services to companies (Jenkins et al. 2010).

Even some organizations adopted green IS, their performances may vary. Molla (2013) develops a conceptual framework to identify the sustainability performance indicators of Green IS. He proposed four elements in the framework: Eco-Value governance with measurability of both tangible and intangible Green IS benefits, Eco-Process with embedded environmental criteria design in IS products and services, Eco-Brand with customers' perspectives of the balanced scorecard, and Eco-Learning with ability to educate employees' sustainability behaviors (Fig. 3).

To further study the Green IS and get a full picture of the sustainability performance, researchers have different focus groups from different angle to explain organizational intentions toward Green IS adoptions. Gholami et al. (2013) propose a Green IS adoption model based on belief-action-outcome framework. Through a survey of 405 organizations, the findings indicate that two macro factors in their model shows different results. Coercive pressure is supported to positively relate to attitude whereas mimetic pressure does not (Fig. 4).



**Fig. 3.** Sustainability performance framework by Molla (2013)



**Fig. 4.** Green IS adoption model by Gholami et al. (2013)

From employees' perspectives, Jenkin et al. (2011a, b) identify four types of gaps in Green IS adoption based on their proposed research model and the interview results (See Fig. 5).

1. Knowledge gaps: employees are not aware of Green IS adoption in organizations;
2. Practice gaps: organizations doesn't follow their intentions in adopting Green IS;
3. Opportunity gaps: after being aware of organizations' environmental issues, employees identify additional areas that organizations could improve;
4. Knowing-doing gaps: even employees recognize an environmental issue and know the benefits of Green IS, they do not change their behaviors toward Green IS.

Jenkin et al. (2011a, b) also emphasize that they believe organizations are still in the infancy stage of awareness and adoption of Green IS. Therefore, our research is trying to understand a little bit more toward the motivations behind the Green IS adoption in education industry.

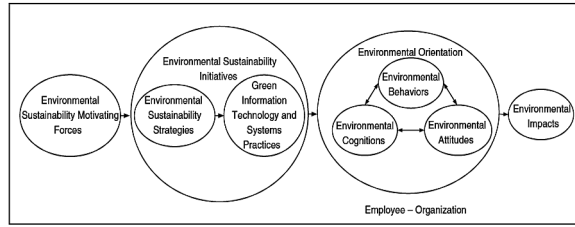


Fig. 5. Green IS research framework from Jenkin et al. (2011a, b)

### 3 Case Study

This research adopts case study method to study the research question. We conducted several interviews with several IT related employees in one American university. Florida Gulf Coast University's use of Banner by Ellucian, it is hosted at the University of South Florida. The specific name of where it is hosted is the CFRDC or the Central Florida Regional Data Center, which is an entity of its own. CFRDC and USF also currently host this ERP system for a number of other schools in the state of Florida such as University of West Florida, University of North Florida and the State College of Florida. Before implementing Banner, there was a short time the PeopleSoft was used as the university's ERP system. Currently, staff at FGCU in Business Technology Services work very closely with staff at USF in order to report issues with Banner and deploy updates. There are no specialists in Banner at FGCU although there are specialists for Banner, Oracle Database Administrators and IT staff at USF that work directly on Banner, manage updates and troubleshoot problems. The build of all Banner modules at FGCU are based off of a duplicate of the ones in use at USF.

ERP systems for a universities and other higher education institutions are an increasing trend. "Several IS education programs have adopted the hands-on use of ERP systems for instructional purposes with successful results" (Scholtz et al. 2013). This is used for academic purposes compared to business purposes that a traditional organization ERP is used for. Some of the functions that these systems are able to handle include accounting, student class registration, financial aid services, health services and payroll. As with business, there are different sized higher education ERP systems to fit the size of a university.

The primary interview was conducted with the IT director of Applications Group who deal with the use of Banner and other systems in use by FGCU. The second interview was conducted with a Systems Team Specialist at FGCU's Business Technology Services (BTS), he has full access to Banner. The third interview was done with an Analyst and Computer Programmer in the Information Systems part of FGCU's BTS. A fourth interview was conducted with a Banner end user, a Patron Account Manager at the FGCU Library in order to get a different perspective.

## 4 Discussion and Conclusion

We summarize some of the question answers from our interviews in Table 1. According to the knowledge of Green IS, the interview results show that IT director understands the Green IS best, system specialist are close to the IT director, Business analyst gets less understanding toward Green IS, and Banner end user only knows the term Green IS. Therefore, to show an interesting results, we draw a diagram to compare the knowledge of Green IS Vs. Confidence of Green of current system among the four employees. The graphic (see Fig. 6) shows that the more knowledge of Green IS, the less confidence one employee will have toward current system in the university. This seems to be in line with the work of Jenkin et al. (2011a, b) that current organizations need to educate employees about Green IS. This should be the initial step toward the process of Green IS adoption.

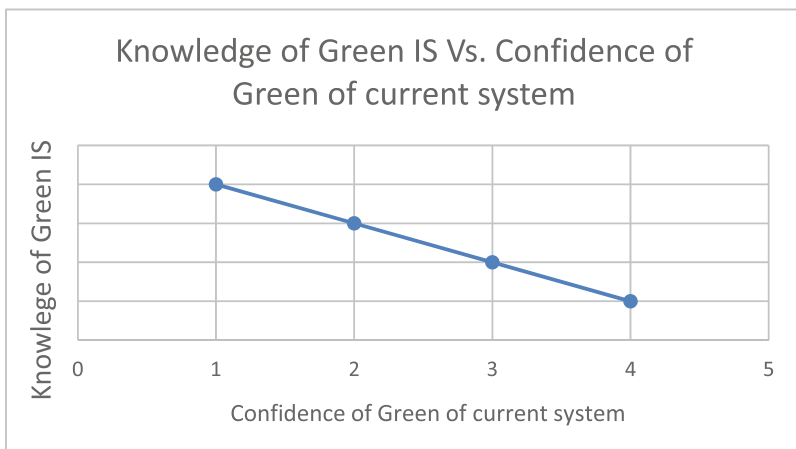
**Table 1.** Summary of several interview questions and answers

Participant	Do you find Green IS to be important?	Do you think FGCU follows Green IS practices?	Do you think hosting Banner (an ERP system) in a centralized location is a green IS practice?	Additional information
IT Director	Yes	We follow all legally and budget allowed practices	Our current practice is the best we can support	We try our hardest, but there can be budget restraints for getting what could possibly be the best technology
System Specialist	Personally, Yes	We follow all legally and budget allowed practices	There is definitely economics of scale by the way we manage one server compared to multiple servers for running databases	
Business Analyst	Absolutely	Yes, though they could be better if it weren't for legal and budget issues	It's green to have it hosted there	

(Continued)

**Table 1.** (Continued)

Participant	Do you find Green IS to be important?	Do you think FGCU follows Green IS practices?	Do you think hosting Banner (an ERP system) in a centralized location is a green IS practice?	Additional information
Banner User	Absolutely	Yes	Yes	I have not given any in depth thought about the possible environmental impact of the technology that I use at the university

**Fig. 6.** Knowledge of Green IS Vs. Confidence of Green of current system

Additionally, in the current priority of IS/IT, Green IS is not ranked on the top. That is the reason the IT director emphasized “There may also be more environmentally friendly ways of disposing of some equipment, but because of the requirements such as that all equipment must be completely wiped before disposal. Due to the cost of these legal requirements, it can be difficult to become more sustainable.” We believe the four types of gaps summarized by Jenkin et al. (2011a, b) are the main reason.

Another interesting finding is that FGCU ranks top five among colleges and universities in the U.S for its sustainable initiatives according to a student blog website (2014). However, the university and employees focus on the sustainable issues more toward on direct impact factors of environment, such as green grass area, adopting



more renewable energy source, recycling policies, and so on. From this view of point, universities need to consider more upon Green IS while they spent most on direct environmental issues.

Throughout all the literatures, we rarely find any standard of Green IS. We argue that this is one reason why it is difficult to educate employees about Green IS. Therefore, the last suggestion we propose is that standardization and a rating system of Green IS are necessary to encourage universities in adopting Green IS.

Future trends of Green IS appear to be moving to a cloud based model for implementation. Cloud computing rents out computing resources which includes infrastructure making it more efficient. In the United Kingdom, environmental factors are one of the reasons for organizational decision makers to adopt cloud computing (Gutierrez et al. 2015). Further supporting that this is a new trend is that much of the literature about this topic was made recently in only the last five years. “Green IT is again one of the most important issues for future development” (Nowak 2011). As discussed earlier, a reduction of IT infrastructure is an example of a Green IS practice, cloud based ERP systems use less infrastructure so they help meet this requirement.

In data centers and other IT rooms where there are large amounts of power usage and heat, different cooling methods are being explored to reduce cost. These include liquid cooled plates which are able to effectively dissipate heat. The way that data cooling systems are being engineered are keeping energy conservation as a concern. The wasted heat from these systems can be repurposed in order to provide building and water heating in order to help other conservation efforts not directly related to the IS practices of a company or university (Li and Kandlikar 2015).

Some limitations that we found were a lack of discussion on Green ERP for universities or other higher education institutions. ERP systems in business have been studied more thoroughly than ERP systems for education. The topic of green IS and IT has become more discussed in recent years, but there has been little that looks at the difference of environmental impact of ERP systems in a university. Authors would not usually mention specific costs of an ERP implementation at a university. They would provide some information such as how much was budgeted to a region’s education system, but only a little information about how much was specifically spent on an ERP implementation.

Another limitation that we encountered was the lack of research in the comparison of having higher education ERP systems hosted in a centralized location instead of hosting ERP systems individual at each institution. Due to the lack of research, we have no way of knowing how often the centralized implementation model is used and the potential environmental and cost savings that could be derived from its use.

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