

Measuring Behavioral Intention of Ministries and Government Organizations in The Kingdom of Bahrain to Adopt Green IT

Mr. Saif Mohammad Yousef Al Zubi, Senior Database programmer, Information Technology Center, University of Bahrain, Dr Minimol Anil Job, Assistant Professor, ITC Department, Faculty of Computer Studies, Arab Open University, Kingdom of Bahrain,

Abstract

This study aims at measuring the behavioral intention for adopting Green IT in ministries and government organizations in the Kingdom of Bahrain by proposing a conceptual model based on the G-readiness Model with some modifications on the original model by adding the Behavioral Intention to Adopt Green IT variable, and the Green IT Awareness variable. The research targets IT top management and high IT positions. The results showed that Attitude, governance, policy, awareness, readiness and Behavioral Intention to Adopt Green IT were significant determinants. The findings from this study will theoretically contribute to the existing knowledge of Green IT in the kingdom of Bahrain; while practically will provide useful recommendations to adopt Green IT for practitioners.

Keywords: green IT, IT governance, IT practice, IT policy, IT readiness, IT behavioral intention

1. Introduction

There are many definitions for Green IT but one of the best definitions is the one proposed by Molla et al. [1]. “Green IT is a systematic application of environmental sustainability criteria to the design, production, sourcing, use and disposal of the IT technical infrastructure as well as within the human and managerial components of the IT infrastructure in order to reduce IT, business process and supply chain related emissions and waste and improve energy efficiency.” [1]. The main objective of this study is to measure the behavioral intention for adopting Green IT in ministries and government organizations in the Kingdom of Bahrain through conducting a survey that analyzes a set of (variables) criteria which fall under awareness and readiness levels. This study is important because it measures the behavioral intention to adopt Green IT in ministries and government organizations in the Kingdom of Bahrain based on Green IT awareness and Green IT readiness which are influenced by the five variables that proposed by Molla et al. [1]. The study will pinpoint the current location of ministries and

government organizations at the Kingdom of Bahrain in the Green IT map. The findings from this study will theoretically contribute to the existing knowledge of Green IT in the kingdom of Bahrain while practically will provide useful recommendations to adopt Green IT for practitioners like Chief Information Officers (CIOs), IT managers, IT head of sections, Etc.

The limitations researchers faced are Small sample size, since the study targets specific positions in ministries and governmental organizations, Approval to distribute the survey and the following data collection process takes time and lack of prior research studies on Green IT adoption

Framework Model and Hypotheses

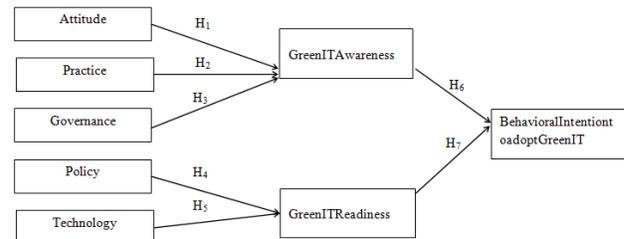


Figure 1: Research framework model

The research model used in this study is based on the G-readiness Model that comes from the work of Molla et al. [1] and is one of the first Green IT models. Modifications were made to the original model by adding the Behavioral Intention to Adopt Green IT variable, and one more variable which is Green IT Awareness that will depend on three of Molla et al. [1] variables.

2. Methodology

As part of this research, first the researchers started defining and discussing variables of Green IT Readiness and Green IT Awareness, and then the researchers defined Awareness, Readiness, Behavioral Intention, Green IT Awareness and Green IT Readiness. [5] Green IT Awareness consists of three variables: Attitude, Practice and Governance. And, Green IT

Readiness consists of two variables: Policy and Technology.

Green IT Attitude: Eagly and Chaiken [2] defined attitude (general definition) as “An attitude represents an enduring positive or negative feeling about some object or issue”. Green IT attitude defined by Molla et al.[1] as “an organization’s IT human infrastructure’s sentiment towards climate change, and refers to the extent to which IT people are aware and concerned about the impact (both positive and negative) of IT on eco-sustainability.” So we can understand from the definition of Molla et al. [1] that Green IT attitude is related to IT human’s concerns and awareness of eco-sustainability and their extent of knowledge and interest in Green IT.

Hypothesis 1: Presence of attitude affects positively to show Green IT awareness

Green IT Practice: Molla et al. [1] defined Green IT practice as “the actual application and realization of eco-sustainability considerations in IT infrastructure sourcing, operation and disposal.” Practice refers to things we perform or do habitually. There are many things employees can do to help their organization become green and to show awareness of eco-sustainability, such as turn PCs and printers off when not in use, or print on both sides of the paper (duplex printing)[3] if necessary and many more examples[4]. Thus, we can conclude the second hypothesis:

Hypothesis 2: Presence of Practice affects positively to show Green IT awareness

Green IT Governance: Governance means the act, process, or power of governing. And, Green IT governance is explained by Molla et al.[1] as “the operating model that defines the administration of Green IT initiatives and is closely related to the policy construct.” Which means all control, roles and responsibilities of IT Centers, including budget, should be assigned to the top IT management whom are aware of the impact of adopting Green IT and are also responsible for the policy construct. [7] Thus, we can conclude third hypothesis:

Hypothesis 3: Presence of governance affects positively to show Green IT awareness

Green IT Policy: The American Heritage Dictionary of the English Language defined policy in general as “A plan or course of action, as of a government, political party, or business, intended to influence and determine decisions, actions, and other matters”[3]. And, Green IT policy is defined by Molla et al. [1] as “encompasses the frameworks the organization puts in place to apply environmental criteria in IT-related activities.”

Another definition by Gartner [4]; Olson [7] defines Green IT policy as the “extent to which green issues are encapsulated in an organization’s procedures guiding the sourcing, use and disposal of the IT technical infrastructure, the activities of the IT human infrastructure and the use of IT in the wider enterprise.”

Organizations should develop and apply their own Green IT policy because having a policy shows the organization’s readiness to become green. Also, “The maturity of Green IT policy reflects the environmental considerations of the organization”. Molla et al. [1]. Taking into consideration that these policies should be aligned with the company’s overall environmental policy and initiatives, we can conclude the fourth hypothesis:

Hypothesis 4: Presence of policy affects positively to have Green IT readiness

Green IT Technology: “A key driver of Green IT Readiness success in the area of technology is to build a green technological infrastructure [8][7]. The technological dimension refers to technologies and IS for:

- Reducing the energy consumption of powering and cooling corporate IT assets (such as data centers)
- Optimizing the energy efficiency of the IT technical infrastructure
- Reducing IT induced greenhouse gas emissions
- Supplanting carbon emitting business practices
- Analyzing a business’s total environmental footprint” Molla et al. [1] Technology is all about having more environmentally effective technologies, which means to build a green technological infrastructure including the above points. Thus, we can conclude the fifth hypothesis:

Hypothesis 5: Presence of technology affects positively to have Green IT readiness

Green IT Readiness, Green IT Awareness and Behavioral Intention: After defining and discussing the components of Green IT Readiness and Green IT Awareness the researchers defined Awareness, Readiness, Behavioral Intention, Green IT Awareness and Green IT Readiness

Awareness is defined by the Oxford dictionary as “knowledge or perception of a situation or fact”. And, The American Heritage Dictionary of the English Language [12] defined Readiness as being “Prepared or available for service, action, or progress” while Behavioral Intention is defined, according to Oliver [14], as “an affirmed likelihood to engage in a certain behavior.”



As for Green IT Awareness, the researchers did not find any definition. So, from the researchers' readings about awareness the researchers defined Green IT Awareness as "Common knowledge and understanding of eco-sustainability among IT human infrastructure and management in organizations". As for Green IT Readiness, it is defined as "an organization's capability (and state of maturity) in applying environmental criteria to its IT technical infrastructure as well as within its IT human infrastructure and management across the key areas of IT sourcing, operations and disposal" Molla et al.[1]. Now, after defining Awareness, Readiness and Behavioral Intention, and understanding the meaning of Green IT Awareness and Green IT Readiness [9]we can conclude the sixth and seventh hypotheses:

Hypothesis 6: Presence of Green IT awareness affects positively to have Behavioral Intention to adopt Green IT

Hypothesis 7: Presence of Green IT readiness affects positively to have Behavioral Intention to adopt Green IT

The research model used in this study is based on the G-readiness Model that comes from the work of Molla et al. [1] and is one of the first Green IT models. [15]Modifications were made to the original model by adding the Behavioral Intention to adopt Green IT variable, and one more variable which is Green IT awareness that will depend on three of Molla et al.[1] variables[12]. The research targets top management in the IT department of the Ministries and governmental organizations since they are a decision maker in using or adopting new technologies and is responsible for establishing new procedures and policies. Add to that, they are in touch with the top management. The research also targets high IT positions that play a role in proposing new technologies, ideas, procedures or policies to the IT top management.

2.1 Population and Sampling of the Study

The study population includes only IT employees in the Ministries and governmental organizations and the sampling is restricted to the following job positions:

- Top management of the IT (Division, Centre) or Information Systems Directorate.
- High job positions in IT such as (Chief, Specialist, Senior, System Admin) or equivalent, since the job title may vary from one ministry or organization to another.

2.2 Data Collection Procedures

A survey was distributed to the respondents regarding the criteria mentioned earlier except for one ministry and two governmental organizations due to a policy for not participating in any surveys. Information about ministries and governmental organizations were collected from Bahrain e-Government portal (www.bahrain.bh). Two types of surveys were created, the first type is hard copy surveys and the second is online surveys. A total of 110 hard-copies of the survey were distributed and the researchers have had to wait for calls to collect the responses back. And, during the same period, some ministries and governmental organizations accepted to participate online, so the researcher gave those online survey links that they forwarded to their employees. 97 hard-copy surveys were collected and 47 online participations were submitted, Adding up to a total of 144 (hard-copy and online surveys) of which 119were useable and fully completed. The rest were discarded due to having incomplete/ invalid answers or since the respondent's job title didn't match the required criteria.

2.3 Instrumentation

The questionnaire survey method was used for this study. The survey consists of 40 questions divided into three parts. The first part is for the demographical variables and contains two questions that cover job title and years of experience in the current position. The second part contains 37 questions that cover three dependent variables and five independent variables, for each variable, there are three to six questions based on a 5 points Likert scale. Finally, the third part contains one question about whether the respondent is satisfied in case Green IT is adopted in their ministry or government organization; this question depends on the respondent's point of view. The survey questions are either self-developed, or derived from other survey based studies and modified to cope with the present situation of IT (Division, Centre) or Information System Directorate; especially from the aspect of management and technology. For the data entry and analysis, SPSS (Statistical Package for Social Sciences) was used.

3. Data Analysis

Demographic data analysis

1. Job position

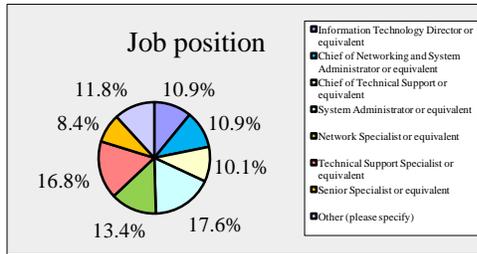


Figure 2: Job position.

Most of the survey respondents were “System Administrators or equivalent” (17.6%) followed by “Technical Support Specialists or equivalent” (16.8%), after that “Network Specialists or equivalent” (13.4%), then “Other” job positions (11.8%) distributed between (senior analyst, computer specialist, chief of system development, Database Administrator, IS specialist, head of system development, head of financial applications, IT consultant, Q A tester coordinator, IT security specialist, chief of system development, and chief of system development) then both “Information Technology Directors or equivalent” and “Chief of Networking and System Administrators or equivalent”(10.9%) followed by “Chief of Technical Support staff or equivalent” (10.1%), and finally “Senior Specialists or equivalent” (8.4%)

Table 1: Job position

Job position		
Answer Options	Response Percent	Response Count
Information Technology Director or equivalent	10.9%	13
Chief of Networking and System Administrator or equivalent	10.9%	13
Chief of Technical Support or equivalent	10.1%	12
System Administrator or equivalent	17.6%	21
Network Specialist or equivalent	13.4%	16
Technical Support Specialist or equivalent	16.8%	20
Senior Specialist or equivalent	8.4%	10
Other (please specify)	11.8%	14
Answered question		119

Years of experience in current position:

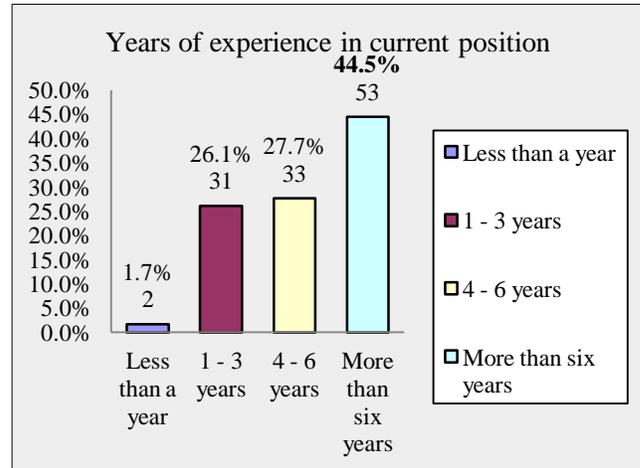


Figure 3: Years of experience in current position.

Most of the survey respondents have experience “More than six years” (44.5%) followed by four to six years of experience (27.7%) then one to three years of experience (26.1%) and finally (1.7%) have less than a year of experience

Table 2: Years of experience in current position

Years of experience in current position		
Answer Options	Response Percent	Response Count
Less than a year	1.7%	2
1 - 3 years	26.1%	31
4 - 6 years	27.7%	33
More than six years	44.5%	53
Answered question		119

Variables Descriptive Analysis

Green IT Attitude:

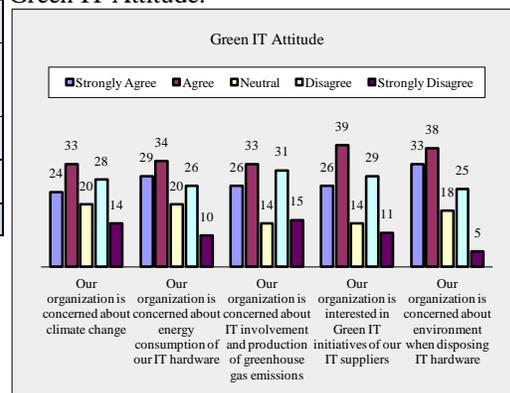


Figure 4: Green IT Attitude.

The results of Green IT attitude showed that most of the respondents' answers were "Agree" and "Strongly Agree" to all questions. In descending order of the level of agreement to the questions, the results were as follows: In question five "Our organization is concerned about environment when disposing IT hardware" (59.66%) of the respondents answered either "Strongly Agree" (27.73%) or "Agree" (31.93%), followed by (54.62%) to question four "Our

organization is interested in Green IT initiatives of our IT suppliers", then (52.94%) to question number two "Our organization is concerned about energy consumption of our IT hardware", afterwards (49.58%) to question number three "Our organization is concerned about IT involvement and production of greenhouse gas emissions" and finally (47.90%) to question number one "Our organization is concerned about climate change".

Table 3: Green IT Attitude.

Green IT Attitude						
Answer Options	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Response Count
Our organization is concerned about climate change	11.76% 14	23.53% 28	16.81% 20	27.73% 33	20.17% 24	100% 119
Our organization is concerned about energy consumption of our IT hardware	8.40% 10	21.85% 26	16.81% 20	28.57% 34	24.37% 29	100% 119
*Our organization is concerned about IT involvement and production of greenhouse gas emissions	12.61% 15	26.05% 31	11.76% 14	27.73% 33	21.85% 26	100% 119
*Our organization is interested in Green IT initiatives of our IT suppliers	9.24% 11	24.37% 29	11.76% 14	32.77% 39	21.85% 26	100% 119
*Our organization is concerned about environment when disposing IT hardware	4.20% 5	21.01% 25	15.13% 18	31.93% 38	27.73% 33	100% 119
*Removed items in Factor Analysis		Answered question				119
Mean value for items Not removed from Factor Analysis						7.78
Standard Deviation for items Not removed from Factor Analysis						2.54

Green IT Practice:

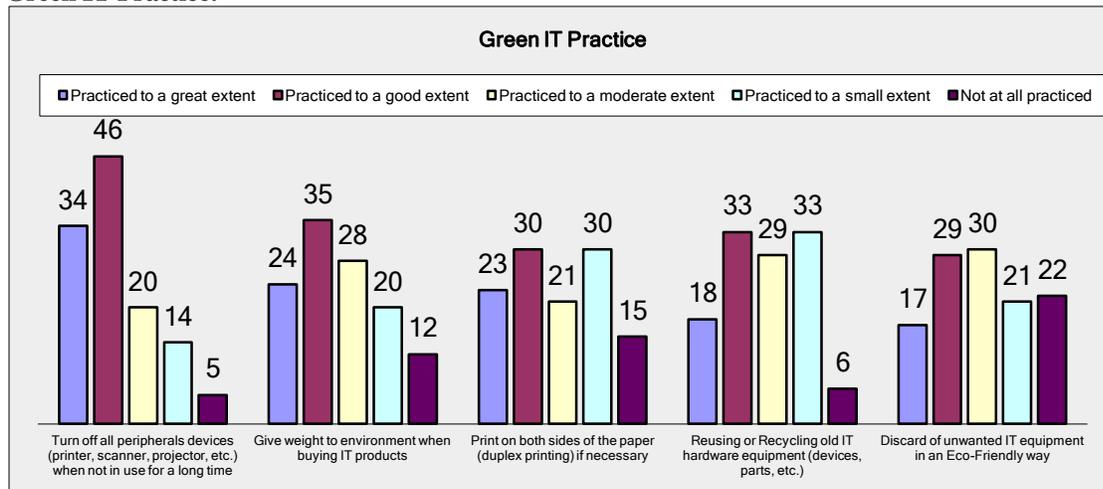


Figure 5: Job practice.

The results of Green IT practice showed that most of the respondents' answers were "Practiced to a good extent" and "Practiced to a great extent" which indicates that they have good sense of responsibility toward environment.

Furthermore, "Turning off all peripheral devices (printer, scanner, projector, etc.) when not in use for a long time" is the most widely used practice in

organizations where(67.23%) of the respondents answered either "Practiced to a great extent" (28.57%) or "Practiced to a good extent" (38.66%), on the other hand, the least widely practice in organizations was discarding of unwanted IT equipment in an Eco-Friendly way (61.35%), distributed between "not at all practiced" (18.49%), "Practiced to a small extent" (17.65%) , and "Practiced to a moderate extent" (25.21%)

Table 4: Green IT practice

Green IT Practice						
Answer Options	Not at all practiced	Practiced to a small extent	Practiced to a moderate extent	Practiced to a good extent	Practiced to a great extent	Response Count
*Turn off all peripherals devices (printer, scanner, projector, etc.) when not in use for a long time	4.20% 5	11.76% 14	16.81% 20	38.66% 46	28.57% 34	100% 119
*Give weight to environment when buying IT products	10.08% 12	16.81% 20	23.53% 28	29.41% 35	20.17% 24	100% 119
Print on both sides of the paper (duplex printing) if necessary	12.61% 15	25.21% 30	17.65% 21	25.21% 30	19.33% 23	100% 119
Reusing or Recycling old IT hardware equipment (devices, parts, etc.)	5.04% 6	27.73% 33	24.37% 29	27.73% 33	15.13% 18	100% 119
*Discard of unwanted IT equipment in an Eco-Friendly way	18.49% 22	17.65% 21	25.21% 30	24.73% 29	14.29% 17	100% 119
*Removed items in Factor Analysis					Answered question	119
Mean value for items Not removed from Factor Analysis						4.73
Standard Deviation for items Not removed from Factor Analysis						1.67

Green IT Governance:

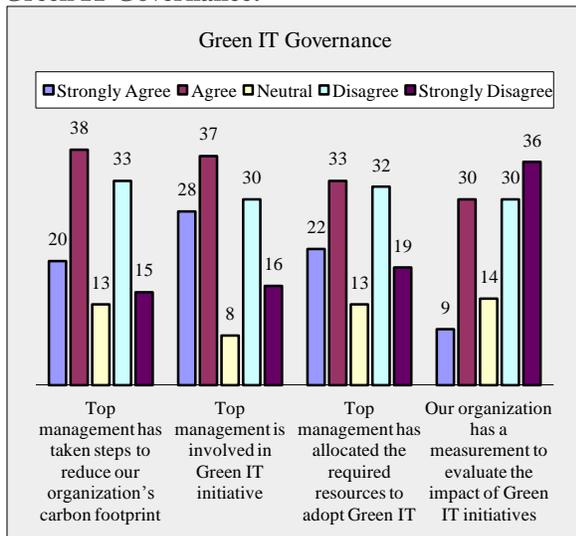


Table 5: Green IT governance.

The results of Green IT governance showed that most of the respondents' answers were "Agree" and "Strongly Agree", Additionally, most of the respondents believe that top management is involved in Green IT initiative (54.62%), On the other hand, (67.23%)of the respondents answered either "Disagree" (25.21%) or "Strongly Disagree" (30.25%) to question number four "organization has a measurement to evaluate the impact of Green IT initiatives".

Green IT Governance						
Answer Options	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Response Count
Top management has taken steps to reduce our organization’s carbon footprint	12.61% 15	27.73% 33	10.92% 13	31.93% 38	16.81% 20	100% 119
Top management is involved in Green IT initiative	13.45% 16	25.21% 30	6.72% 8	31.09% 37	23.53% 28	100% 119
Top management has allocated the required resources to adopt Green IT	15.97% 19	26.89% 32	10.92% 13	27.73% 33	18.49% 22	100% 119
Our organization has a measurement to evaluate the impact of Green IT initiatives	30.25% 36	25.21% 30	11.76% 14	25.21% 30	7.56% 9	100% 119
Answered question						119
Mean value for items Not removed from Factor Analysis						10.08
Standard Deviation for items Not removed from Factor Analysis						3.79

Green IT Policy:

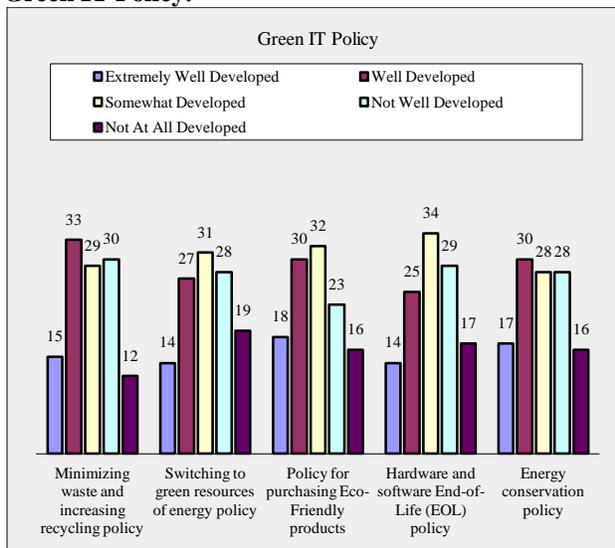


Figure 7: Green IT policy.

The results of Green IT policy showed the top relatively well developed policy is distributed between “Minimizing waste and increasing recycling policy” and “Policy for purchasing Eco-Friendly products” with (40.34%) for each question. On the other hand, the least developed policy was “Hardware and software End-of-Life (EOL) policy” with (67.23%) of the respondent answers distrusted between “Not At All Developed” (15.97%), “Not Well Developed” (23.53%) , and “Somewhat Developed” (26.05%) besides “Switching to green resources of energy policy” (65.55%) of the respondent answers distrusted between “Not At All Developed” (14.29%), “Not Well Developed” (24.37%), and “Somewhat Developed” (28.75%)

Table 6: Green IT policy

Green IT Policy						
Answer Options	Not At All Developed	Not Well Developed	Somewhat Developed	Well Developed	Extremely Well Developed	Response Count
Minimizing waste and increasing recycling policy	10.08% 12	25.21% 30	24.37% 29	27.73% 33	12.61% 15	100% 119
Switching to green resources of energy policy	15.97% 19	23.53% 28	26.05% 31	22.69% 27	11.76% 14	100% 119
Policy for purchasing Eco-Friendly products	13.45% 16	19.33% 23	26.89% 32	25.21% 30	15.13% 18	100% 119
Hardware and software End-of-Life (EOL) policy	14.29% 17	24.37% 29	28.57% 34	21.01% 25	11.76% 14	100% 119
Energy conservation policy	13.45% 16	23.53% 28	23.53% 28	25.21% 30	14.29% 17	100% 119
Answered question						119
Mean value for items Not removed from Factor Analysis						12.59
Standard Deviation for items Not removed from Factor Analysis						4.21

Green IT Technology:

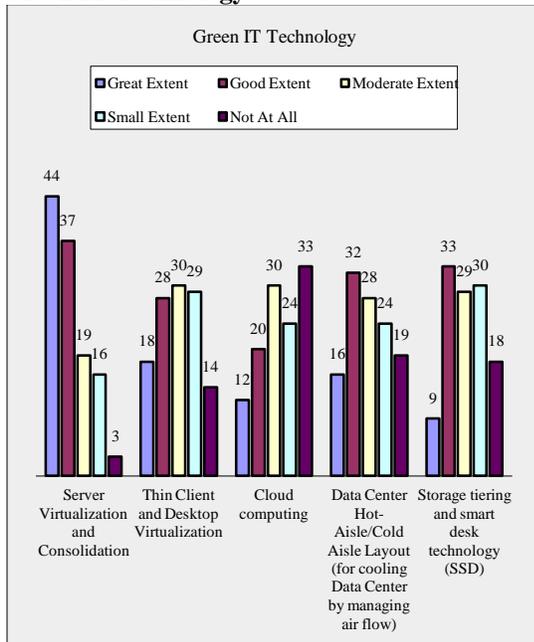


Figure 8: Green IT technology.

The results of Green IT technology showed that most of the respondents’ answered questions (Tech1, Tech2, and Tech4) either “Great Extent” or “Good Extent” also answered questions (Tech3 and Tech5) “Not At All”, “Small Extent”, or “Moderate Extent”.

Moreover “Server Virtualization and Consolidation” is the most widely implemented technology with (68.06%) of respondents’ answered either “Great Extent” (36.97%) or “Good Extent” (31.09%) and the least widely implemented technology with (73.11%) of respondents answers is “Cloud Computing” with result distributed between “Not At All”(27.73%),“Small Extent” (20.17%), and “Moderate Extent” (25.21%)

Table 7: Green IT technology.

Green IT Technology						
Answer Options	Not At All	Small Extent	Moderate Extent	Good Extent	Great Extent	Response Count
*Server Virtualization and Consolidation	2.52% 3	13.45% 16	15.97% 19	31.09% 37	36.97% 44	100% 119
*Thin Client and Desktop Virtualization	11.76% 14	24.37% 29	25.21% 30	23.53% 28	15.13% 18	100% 119
Cloud computing	27.73% 33	20.17% 24	25.21% 30	16.81% 20	10.08% 12	100% 119
Data Center Hot-Aisle/Cold Aisle Layout (for cooling Data Center by managing air flow)	15.97% 19	20.17% 24	23.53% 28	26.89% 32	13.45% 16	100% 119
Storage tiering and smart desk technology (SSD)	15.13% 18	25.21% 30	24.37% 29	27.73% 33	7.56% 9	100% 119
*Removed items in Factor Analysis		Answered question				119
Mean value for items Not removed from Factor Analysis						6.58
Standard Deviation for items Not removed from Factor Analysis						2.40

Green IT Awareness:

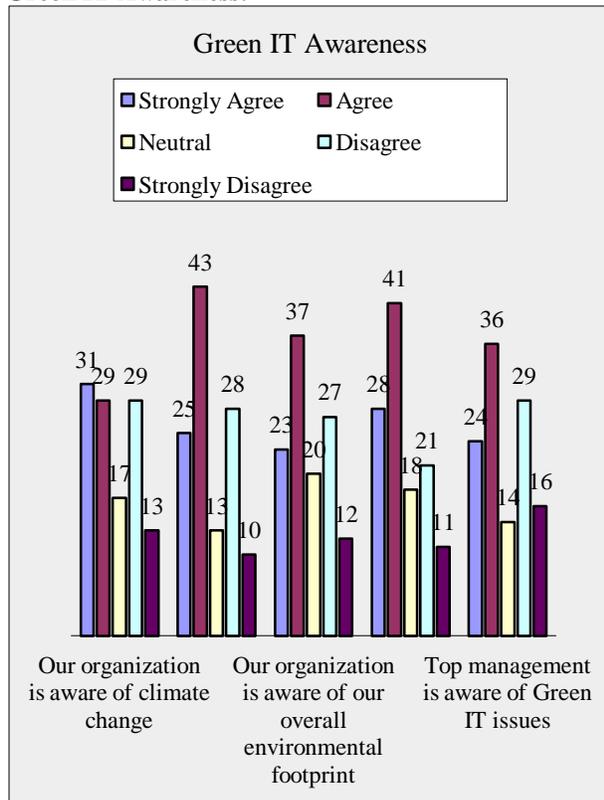


Figure 9: Green IT awareness.

The results of Green IT awareness showed that the most of the survey respondents’ answers were “Agree” and “Strongly agree” to all questions with a total of over (50%) for each question, and the result were as follows:

“Our organization is aware of its energy consumption” (57.98%), after that “our organization is aware of the environment when buying IT products” (57.14%), then distributed between “Our organization is aware of climate change”, “Our organization is aware of our overall environmental footprint”, and “Top management is aware of Green IT issues” with (50.42%) for each question,

Table 8: Green IT awareness.

Green IT Awareness						
Answer Options	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Response Count
Our organization is aware of climate change	10.92% 13	24.37% 29	14.29% 17	24.37% 29	26.05% 31	100% 119
Our organization is aware of the environment when buying IT products	8.40% 10	23.53% 28	10.92% 13	36.13% 43	21.01% 25	100% 119
Our organization is aware of our overall environmental footprint	10.08% 12	22.69% 27	16.81% 20	31.09% 37	19.33% 23	100% 119
Our organization is aware of its energy consumption	9.24% 11	17.65% 21	15.13% 18	34.45% 41	23.53% 28	100% 119
Top management is aware of Green IT issues	13.45% 16	24.37% 29	11.76% 14	30.25% 36	20.17% 24	100% 119
Answered question						119
Mean value for items Not removed from Factor Analysis						14.04
Standard Deviation for items Not removed from Factor Analysis						4.57

Green IT Readiness:

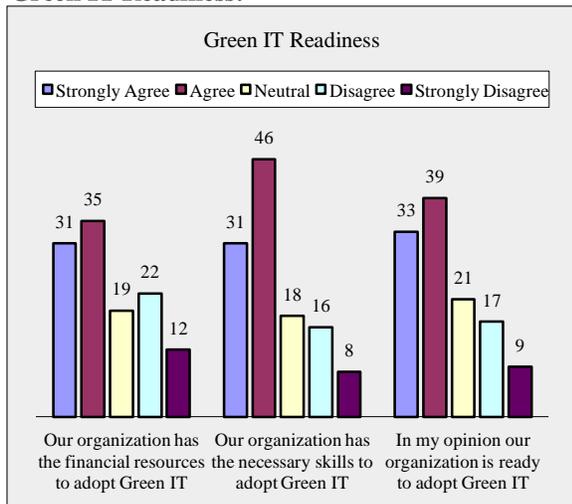


Figure 10: Green IT readiness.

The results of Green IT readiness showed that the most of the survey respondents' answers were "Agree" and "Strongly Agree" to all questions with total over (50%) for each question which shows that most of the organizations have high readiness from

both the financial aspect with (55.46%) of the respondents answered to either "Strongly Agree" (26.05%) or "Agree" (29.41%) and the skills aspect with (64.71%) of the respondents answered to either "Strongly Agree" (26.05%) or "Agree" (38.66%) also (60.50%) of the respondents believe that their organization is ready to adopt Green IT with results distributed between (27.73%) "Strongly Agree" and (32.77%) "Agree".

Table 9: Green IT readiness.

Green IT Readiness						
Answer Options	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Response Count
Our organization has the financial resources to adopt Green IT	10.08% 12	18.49% 22	15.97% 19	29.41% 35	26.05% 31	100% 119
Our organization has the necessary skills to adopt Green IT	6.72% 8	13.45% 16	15.13% 18	38.66% 46	26.05% 31	100% 119
In my opinion our organization is ready to adopt Green IT	7.56% 9	14.29% 17	17.65% 21	32.77% 39	27.73% 33	100% 119
Answered question						119
Mean value for items Not removed from Factor Analysis						8.26
Standard Deviation for items Not removed from Factor Analysis						2.52

Behavioral Intention to Adopt Green IT:

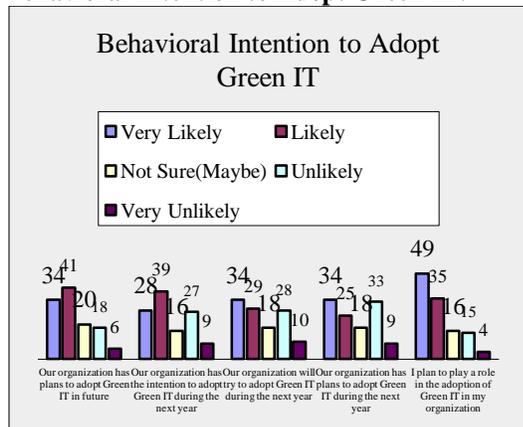


Figure 11: Behavioral Intention to Adopt Green IT.

The results of Behavioral Intention to Adopt Green IT showed that most of the respondents' answers were "Agree" and "Strongly Agree" for all questions which shows that most of the organizations have a plans to Adopt Green IT either in the future or within the next year and some of the them have the intention or they will try to Adopt Green IT within the next year. In addition, (70.59%) of the respondents answered either "Very Likely" (41.18%) or "Likely" (29.41%) when asked if they plan to play a role in the adoption of Green IT in their organization

Table 10: Behavioral Intention to Adopt Green IT.

Behavioral Intention to Adopt Green IT						
Answer Options	Very Unlikely	Unlikely	Not Sure(Maybe)	Likely	Very Likely	Response Count
Our organization has plans to adopt Green IT in future	5.04% 6	15.13% 18	16.81% 20	34.45% 41	28.57% 34	100% 119
Our organization has the intention to adopt Green IT during the next year	7.56% 9	22.69% 27	13.45% 16	32.77% 39	23.53% 28	100% 119
Our organization will try to adopt Green IT during the next year	8.40% 10	23.53% 28	15.13% 18	24.37% 29	28.57% 34	100% 119
Our organization has plans to adopt Green IT during the next year	7.56% 9	27.73% 33	15.13% 18	21.01% 25	28.57% 34	100% 119

*I plan to play a role in the adoption of Green IT in my organization	3.36% 4	12.61% 15	13.45% 16	29.41% 35	41.18% 49	100% 119
*Removed items in Factor Analysis		Answered question				119
Mean value for items Not removed from Factor Analysis						11.33
Standard Deviation for items Not removed from Factor Analysis						3.58

Respondents' level of satisfaction:

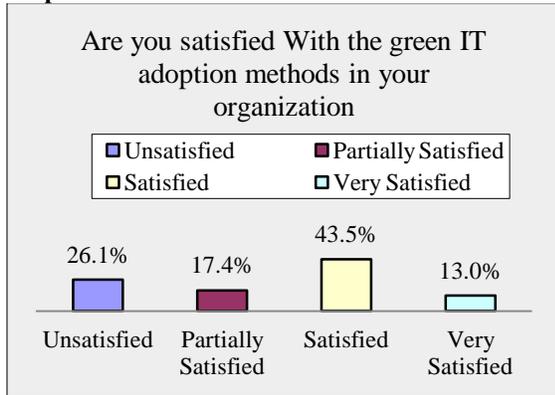


Figure 12: Respondents' level of satisfaction if adopting any Green IT methods.

Respondents' level of satisfaction question was an optional exploratory question; the goal of this question was to measure the respondents' level of satisfaction in case their ministries/governmental organizations were adopting any Green IT methods.

The results showed that only (26.1%) are "Not Satisfied" and the rest were divided between "Partially Satisfied" (17.4%), "Satisfied" (43.5%) and "Very Satisfied" (13%)

Table 11: Respondents' level of satisfaction if adopting any Green IT methods

Are you satisfied With the green IT adoption methods in your organization		
Answer Options	Response Percent	Response Count
Unsatisfied	26.1%	6
Partially Satisfied	17.4%	4
Satisfied	43.5%	10
Very Satisfied	13.0%	3
Answered question		23
Skipped question		96

Table 12: Correlations Test

	Attitude	Practice	Governance	Policy	Technology	Awareness	Readiness	Behavioral Intention
Attitude	.737*							
Practice	.252**	.627*						
Governance	.507**	.373**	.856*					
Policy	.564**	.447**	.516**	.847*				
Technology	.261**	.293**	.297**	.262**	.697*			
Awareness	.542**	.276**	.473**	.431**	.395**	.871*		
Readiness	.306**	.342**	.354**	.399**	.128	.350**	.804*	

Behavioral Intention	.576**	.306**	.512**	.482**	.301**	.642**	.436**	.870*
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* Cronbach's alpha.

** Correlation is significant at the 0.001 level (1-tailed)

Model testing

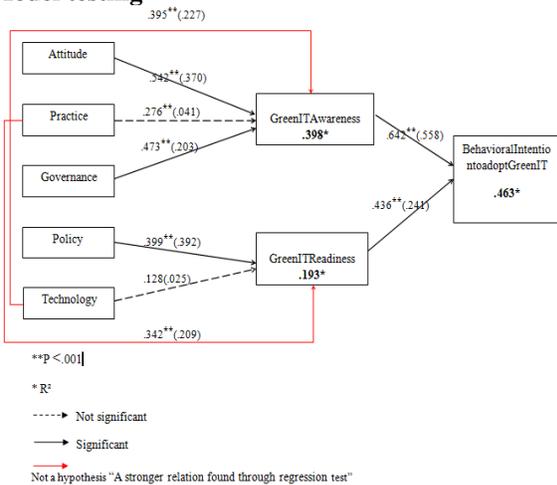


Figure 13: Model testing.

The result of the regression test shows that attitude and governance were significant determinants for Green IT Awareness with $R^2 = 0.353$ meanwhile practice was an insignificant determinant with a standardized beta value of (0.087). For the Green IT readiness, policy was a significant determinant for Green IT readiness with $R^2 = 0.159$ meanwhile technology was an insignificant determinant with a standardized beta value of (0.025). For the Behavioral Intention to adopt Green IT both Green IT readiness and Green IT awareness were significant determinants with $R^2 = 0.463$

4. Discussion

Green IT is a relatively recent field in the kingdom of Bahrain; however, we could say it's increasing rapidly, and after collecting and analyzing the results of the survey we came to conclude the following:

In term of Green IT attitude, generally organizations have a positive attitude towards Green IT and they are aware and have a high level of concern for the environment when it comes to the impact of IT, such as hardware energy consumption, production of greenhouse gas emissions and disposing of IT hardware, etc. Also, in terms of Green IT practices,

organizations are following environmentally safe practices that seem to be adopted out of a good sense of responsibility towards the environment rather than force of habit, such as turning off peripherals devices when not in use. Moreover, in terms of Green IT governance, top managements have a commitment towards the protection of the environment and they took action towards preventing green gas emission. Furthermore, IT governance plays a significant role in the adoption of Green IT. In term of Green IT policy, the results indicate that policy constructs are still in the development stage and not mature and still need a lot of concentration since policies reflect organization's intent towards Green IT and guide the use of IT in reducing organizations' carbon foot print. However, not all policies are expected to be smoothly implemented.

In terms of Green IT technology, most of the organizations didn't deploy enough Green technology that could reflect their intention to adopt Green IT or to show a high level of concern and awareness for the environment or to reduce their carbon foot print. In terms of Green IT awareness, organizations are very aware of the environment and climate changes and try their best to maintain eco-sustainability. Furthermore, in terms of Green IT readiness, most of the organizations show high readiness from both the financial and skills aspects which lead to an increase in the behavioral intention to adopt Green IT. Add to that, respondents believe that their organizations are ready to adopt Green IT which positively supports the Green IT adoption process. Finally, in terms of the behavioral intention to adopt Green IT, most of the organizations have plans to Adopt Green IT, either in the future, or within the next year. And, some of the organizations have the intention to try and adopt Green IT within the next year. However, we should differentiate between the behavioral intention to adopt Green IT and the actual adoption of Green IT, because even if organizations are concerned about the environment they have to take actions. After applying the regression analysis the results were as follows:

Table 13: Hypotheses test results.

<i>Hypothesis</i>		<i>Result</i>
<i>Hypothesis 1</i>	<i>Presence of attitude affects positively to show Green IT awareness</i>	<i>Supported</i>
<i>Hypothesis 2</i>	<i>Presence of Practice affects positively to show Green IT awareness</i>	<i>Not supported</i>
<i>Hypothesis 3</i>	<i>Presence of governance affects positively to show Green IT awareness</i>	<i>Supported</i>
<i>Hypothesis 4</i>	<i>Presence of policy affects positively to have Green IT readiness</i>	<i>Supported</i>
<i>Hypothesis 5</i>	<i>Presence of technology affects positively to have Green IT readiness</i>	<i>Not supported</i>
<i>Hypothesis 6</i>	<i>Presence of Green IT awareness affects positively to have Behavioral Intention to adopt Green IT</i>	<i>Supported</i>
<i>Hypothesis 7</i>	<i>Presence of Green IT readiness affects positively to have Behavioral Intention to adopt Green IT</i>	<i>Supported</i>

The result of the regression analysis showed that practice was an insignificant determinant with a standardized beta value of (0.087) thus; we rejected the second hypothesis “Presence of practice affects positively to show Green IT awareness”. Also, the fifth hypothesis “Presence of technology affects positively to have Green IT readiness” was rejected due to a standardized beta value of (0.025).

Moreover, the regression analysis showed that the rest of the variables were significant determinants divided as follows: Attitude and Governance were significant determinants for Green IT Awareness

with $R^2 = 0.353$, policy was a significant determinant for Green IT readiness with $R^2 = 0.159$, and Green IT Readiness and Green IT Awareness were significant determinants for Behavioral Intentions to adopt Green IT with $R^2 = 0.463$. Thus, we can conclude that hypotheses H1, H3, H4, H6, and H7 are supported.

Key findings

The key findings for the research are as follows:

- Five variables (Green IT attitude, Green IT governance, Green IT policy, Green IT readiness and Green IT awareness) were significant determinants.
- Two variables (technology, practice) were insignificant determinants.
- Another test was applied on both practice and technology variables and the results were as follows:
 - Green IT practice was a significant determinant for Green IT readiness with a standardized beta value of (0.209). Also, adding practice as an independent variable for green IT readiness increased the value of R^2 to (0.193).
 - Green IT technology was a significant determinant for Green IT awareness with a standardized beta value of (0.227). Furthermore, adding technology as an independent variable for green IT awareness increased the value of R^2 to (0.398).

Recommendations

The researchers recommend the followings:

- Implement and allocate a dedicated budget for researching and adopting new environment friendly technologies.
- Allocate a budget to train IT employees on how to choose Green IT technologies that fits their organization’s needs.
- Study the successful experiences of other organizations inside and outside the kingdom of Bahrain towards adopting and deploying Green IT.
- Adopt or create a regular assessment to evaluate the level of adopting of green IT within the organization.
- Develop and create, both, a long term and short term strategy for adopting green IT.



- Raise the awareness of IT employees about the environment through Green IT workshops on a regular basis held by experts in both IT and the environment.
- Hold regular meetings between experts in both IT and the environment to develop and issue policies to be followed by IT employees in terms of recycling, purchasing of environment friendly hardware, and energy conservation etc.

5. References

- [1] Alemayehu Molla, Siddhi Pittayachawan, Brian Corbitt, Hepu Deng, “An International Comparison of Green IT Diffusion”, *International Journal of e-Business Management*, vol. 3, no. 2, pp. 3-23, 2009
- [2] Eagly, A. and Chaiken, S. (1993) *The Psychology of Attitudes*, Harcourt Brace Jovanovich, Fort Worth, TX.
- [3] Faisal Islam, *Exploring Green IS Possibilities: Eco innovation planning for private companies*, January, 2012.
- [4] Gartner (2008) *Going Green: The CIO’s Role in Enterprisewide Environmental Sustainability*, Gartner EXP Premier, May.
- [5] Graham Vickery, “Smarter and Greener? Information Technology and the Environment: Positive or negative impacts?”, October, 2012
- [6] Kawamoto, K.; Koomey, J.G.; Nordman, B.; Brown, R.E.; Piette, M.A.. *Electricity used by office equipment and network equipment in the US. Energy. 27(3): 255–269, 2002.*
- [7] Olson, E.G. (2008) *Creating an enterprise-level ‘green strategy’*. *The Journal of Business Strategy*, 29 (2), 22–30.
- [8] Masanet, E and Horvath, A. (2006) *Enterprise Strategies for Reducing the Life-Cycle Energy Use and Greenhouse Gas Emissions of Personal Computers. Proceedings of the 2006 IEEE International Symposium on Electronics and the Environment*, pp. 21-26.
- [9] Melanie Adamson, Robert Hamilton, Kathryn Hutchison, Kaitlin Kazmierowski,

- Raise the level of positive practices towards Green IT of all employees within the organization.
- Increase the participation and involvement of the top management in the Green IT initiatives.

- Joming Lau, DeighMadejski, and Nicole MacDonald, “Environmental Impact of Computer Information Technology in an Institutional Setting: A Case Study at the University of Guelph”, 2005
- [10] Mingay S, “Green IT: A New Industry Shockwave”, December, 2007.
- [11] Mishra Alok; Yazici, Ali; Mishra, Deepti, “Green Information Technology/Information System Education: Curriculum Views”, *TTEM- Technics Technologies Education Management*; Vol. 7 Issue 2, p679, July 2012
- [12] Molla A., Cooper V. A., & Pittayachawan S. (2009). *IT and eco-sustainability: Developing and validating a Green IT readiness model*.
- [13] *The American Heritage® Dictionary of the English Language*, Fourth Edition copyright ©2000 by Houghton Mifflin Company. Updated in 2009. Published by Houghton Mifflin Company.
- [14] The Climate Group. (2008). *SMART 2020: Enabling the low carbon economy in the information age*. Paper presented at the *Global Sustainability Initiative*, Brussels, Belgium.
- [15] http://www.energystar.gov/index.cfm?c=about.ab_index , (Accessed: November 12 2013)
- [16] www.Epeat.net, *Environmental Benefits of 2008 EPEAT Purchasing: Green IT Procurement System’s Success Drives Major Environmental Benefits, 2008* , (Accessed: November 12 2013)