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► **To cite this version:**

Monika Singh, Ganesh P. Sahu. Developing a Model for Green IS Adoption in Indian Banking and IT Industries. International Working Conference on Transfer and Diffusion of IT (TDIT), Dec 2020, Tiruchirappalli, India. pp.451-462, 10.1007/978-3-030-64849-7_40 . hal-03701783

HAL Id: hal-03701783

<https://inria.hal.science/hal-03701783>

Submitted on 22 Jun 2022

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Developing a Model for Green IS Adoption in Indian Banking and IT Industries

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ABSTRACT. Numerous studies explore that, in current era, Banking and Information Technology (IT) services sector, in various developed/developing countries, either adopted or in the phase of Green IS adoption. Since countries, round the globe, have recognized the significance of Green IS and its impact over environment, it is now vital for every industry to implement Green IS and contribute in environment sustainability. This Research-in-Progress paper observes the effective Green IS implementation through carefully consideration of different Motivational, Technological, Organizational and Environmental factors. Subsequently, in this paper 16 different factors are revealed via Literature Review and Experts opinion and a research model is developed using Technological- Organizational-Environmental (T-O-E) theory and Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) framework for effective Green IS implementation, which will be helpful for academician and practitioners in this field.

Keywords: Green IS, Environment Sustainability, Information Technology, TOE, UTAUT2

1 INTRODUCTION

According to Yang et al. [73], the increasing energy ingestion put heavy pressure on energy production at large scale that consequently enforces heavy compression on the atmosphere. This becomes a huge problem in case of cloud data center and required abrupt vigilant action by the researcher, practitioners and users in the IT field since these cloud data centers consumes high level energy due to resource scheduling mechanism to complete the task at high priority causing low server use ratio as well as due to requirement of cooling system that is on the basis of highest significant strategy causing extreme chilling supply, escalations in maneuver cost, and huge energy waste [71-73]. According to WEF Report [71-72], in the current scenario, data centers situated globally are consuming total 1.5 to 2% (two percent) of total energy and it is predicted that the consumption will rise to 140 billion kilowatt-hours per annum by 2020. Consequently, the carbon emission would be nearly 150 million metric tons yearly. Additional to this, data centers were consuming more than 1% (one percent) of the electricity in the

server dense country i.e. U.S. Their combined yearly carbon emissions of 80 metric megatons of Carbon-dioxide (CO₂) are approaching the carbon footprint of the Netherland and Argentina [3]. A computer/laptop working for over or about ten hours per day emits 1200 pounds of carbon-dioxide i.e. nearly equivalent to one tenth CO₂ emitted from an automobile yearly [10, 70]. According to Belkhir & Elmeligi [4], total number of computers/laptops worldwide is expected to increase by 5.2% and will account for huge level of CO₂ emission; it signifies the concern over IT ecological footprint is valid [42].

Table 1: Need for Research in Green IS Area

Reasons	Context	Study
Wasteful computer energy	The computer is "on" while not in use	[8, 23, 27, 29, 42, 59, 69]
Wasteful Printing	Often printing the redundant documents	[8, 42, 56]
Contamination	Emission of GHGs during manufacturing, using or disposing of electronic equipment	[8, 14, 42, 59]
Toxicity	Use of Toxic elements in manufacturing of IT equipment in mass	[8, 23, 42, 56]
High Cost	Electricity bill and other charges for using computers	[8, 29, 42, 56, 59]

Issues are enlisted in Table 1, which provides the necessity of Green IS urgently day by day. As a result, various countries agreed to noteworthy reductions in GHGs emission that are the main causes of global warming, as per Paris Agreement 2015, held at Paris in 2015, to ensure that the global warming will not exceed 1.5- 2.0°C [47, 56]. Additional factors enforcing organizations to adopt Green IS are the regulations and laws created by various countries to reduce their carbon footprints including the IT sector, customers and stakeholders' awareness towards social responsibility and competitive forces [30]. The literature review explores that research is in its initial stage and require more research in this area [4, 29, 56] for environment sustainability and reduction of carbon footprints. IT/S produces GHGs and carbon footprints, but IT/S use in green ways, i. e. Green IS provide the solution of the problem and reduces carbon and GHGs emission [71-72]. Capra and Merlo [12], had defined Green IS under three areas: 1) Power competency of IT, 2) Eco-companionable life cycle management of IT, and 3) IT as a facilitator of green governance. Dedrick [20], had categorized Green IS into four main dis-

ciplines: 1) Blueprint, 2) Development, 3) Utilization and, 4) Disposal of IT equipment e.g. PCs, servers and other associated peripheral devices to gain minimal or no impact on the environment. According to Trimi and Park [63] Green IS referring to the objective of achieving energy efficiency and reduction in carbon emissions through “Greening of IT” i.e. creating Green IS products and reuse, refurbish and through “Greening by IT” as using IT to reduce environmental impacts.

In this Research in Progress paper, 16 CSFs are investigated in order to develop a research model for Green IS adoption with the aid of T-O-E and UTAUT2 frameworks. The paper presents research strategy to investigate the key factors and an experimental scheme to validate the research model, and measurement of models’ robustness along with computing individual CSFs’ impact over behavioral intention to adopt Green IS in Indian Banking and IT sector. The Next section presents CSFs for practicing Green IS Adoption, Research Model and Methodology, Summary, Research Contribution and Paper ended with Limitation of the Study.

2 CSF(S) FOR PRACTICING GREEN IS ADOPTION

The literature review in the area of CSFs for Green IS adoption/acceptance is limited in the present scenario. From the accessible articles/reports it is explored that different authors (like [5], [7], [26], [49], [62] etc.) has worked on the alike factors, however, categories under various themes (like economic, environmental, descriptive, injunctive etc.). To conduct the research, out of total 34 studied CSFs from literature review, 16 CSFs namely: Hedonic Motivation (HM) ,Habit (HA), Interoperability (IO), Energy Efficient Technology (EET), Performance Expectancy (PE), Effort Expectancy (EE), Leadership (LA), Employee Stewardship (ES), Expert Appointment (EA), Organizational Policy (OP), Facilitating Conditions (FC), Price Value (PV), Government Regulations (GR), Incentives (IC), Competitive Pressure (CP), Social Influence (SI) and Intention to Adopt Green IS in organization’(BI) have been identified on the basis of decision made after discussion with Expert’s and Academician in the field of IT/Technology adoption as well as considering the modernization (inclusion of UTAUT2 theory constructs) and feasibility of the study. Table 2 reflects the 16 identified CSFs and their supporting study. Literature Review explored that, various authors have categorized the CSFs for Green IS effective and efficient adoption generally in four categories: Organizational factors, Economical Factors, Social-culture factors and Regulatory compliance factors. From the accessible literature review, it is explored that numerous

models on adoption of Green IS have been developed on the basis of literature review in the field of IT or technology adoption. Already in the area of Green Information Systems following models have been given by different authors:

1. Bose & Luo [9] proposed and established integrative theory for recognition of key factors for Green readiness of companies and Green IS adoption, on the basis of Technology-Organization-Environment (T-O-E), Process Virtualization (PVT), and Diffusion of Innovation (DoI) theory.

Table 2: Critical Success Factors for Green IS Adoption

Constructs/Code	Study
Hedonic Motivation (HM)	[2, 11, 15, 22, 28-29, 31-32, 34-36, 45, 54, 60, 67]
Habit (HA)	[2, 21, 22, 31, 32, 36, 57, 67]
Interoperability (IO)	[9, 13, 17, 29, 35, 38, 44, 68, 74]
Energy Efficient Technologies (EET)	[9, 13, 19, 29, 35, 38, 48]
Performance Expectancy (PE)	[2, 22, 31-33, 35-36, 48, 64, 74]
Effort Expectancy (EE)	[2, 22, 29, 31-33, 36, 48, 64, 74]
Leadership (LA)	[5, 9, 13, 19, 21, 30, 34-35, 38, 44, 48, 52]
Employee Stewardship (ES)	[13, 21, 25, 29, 33-35]
Expert Appointment (EA)	[9, 13, 17, 21, 25, 30, 33, 35, 44, 52]
Organizational Policy (OP)	[9, 17, 29, 37, 48, 74]
Facilitating Conditions (FC)	[2, 9, 13, 17, 21-22, 29-30, 31-32, 35-37, 48; 67]
Price Value (PV)	[2, 9, 13, 22, 29, 31-33, 35-36, 48, 67, 74]
Government Regulations (GR)	[5, 9, 11, 13, 21, 28, 29, 30, 34-35, 37, 40, 44, 48, 74]
Incentives (IC)	[9, 13, 29, 48]
Competitive Pressure (CP)	[11, 13, 19, 28-29, 34-35, 48, 74]
Social Influence (SI)	[2, 13, 19, 22, 29, 31-34, 36, 67, 74]

2. Chen & Chang [13] established Green IS adoption model for Taiwan' administrations on the basis of Technology-Organization-Environment (T-O-E) theory along with Perceived e-Readiness Model (PERM) and identified driving forces.
3. Thomson & Belle [62] investigated the antecedents (drivers and readiness factors) for implementation of Green IS in Higher Education Institutions (HEI) of South Africa using GITAM model established by Molla (2008)

4. Nazari & Karim [43] used both the theories T-O-E framework and DOI model together, to recognize factors inducing Green IS implementation at managerial level and advised framework that highlights three groups of factors that affect Green IS acceptance are: Invention, Organizational and Ecological Factors.
5. Molla [39] developed Green IS Adoption Model (GITAM) based on existing innovation and adoption models e.g TOE model.

To address the shortcomings of UTAUT, Venkatesh et al. [67] developed UTAUT2, including three new constructs: hedonic motivation, price value, and habit. The literature review in the area of frameworks adopted/used for research in the area of Green IS and its' adoption unearthed that T-O-E framework is the maximum used framework used by authors; however, most of the research are the qualitative research studies. Additionally, this is also unearthed that UTAUT2 is minimal times (almost not) used by any author in this area especially in the context of Indian Banking and IT industries. Consequently, this research work is based on both the theories i.e. T-O-E framework and UTAUT2 theory in order to identify the CSFs for effective and efficient adoption of Green IS in Indian services sector with special reference to Indian Banking and IT industries as well as to develop a research model for the same.

3 RESEARCH MODEL

The research model in a study creates the base-structure of the entire study [58]. The research model represents the relationship among the constructs and subsequently facilitates hypotheses development for testing. Research model developed for this study is shown in Figure 1. The relationships between the constructs are shown in the research. In the research model all the 16 factors (independent variables) are constructs and Age, Gender and Experience are roll out as the moderating variables. For model simplicity use behavior of consumers is abolished.

4 RESEARCH METHODOLOGY

Research methodology is known as systematic set of process and principles to search something. The term methodology provides set of reasonable order to researcher to attain the preset goal like facts, acumen, strategy, in-

termediation and revolutions. In this study, therefore, 16 CSFs i.e. HM ,HA, IO, EET, PE, EE, LA, ES, EA, OP, FC, PV, GR, IC, CP and SI identified, in order to develop the research model for the study. The study and developed research model would provide answers of the following research gap:

1. The current state-of-the-art of research in the area of Green IS adoption in organizations.
2. Various CSFs that influence Behavioral Intention to adopt Green Information Systems effectively and efficiently in Indian service sector with special reference to Indian Banking and IT industries
3. Validated model for Green Information Systems adoption in Indian service sector with special reference to Indian Banking and IT industries
4. Development of Policy Framework for Behavioral Intention to adopt Green Information Systems effectively and efficiently in Indian service sector with special reference to Indian Banking and IT industries.

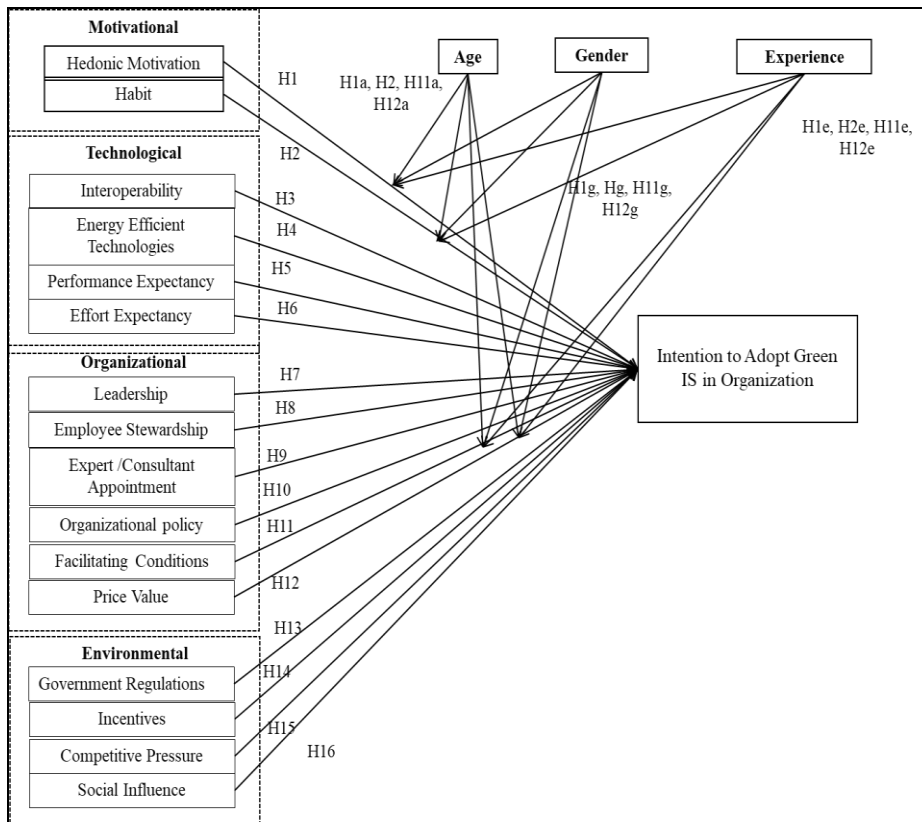


Figure 1: Proposed Research Model

To conduct the study a research framework is established, Figure 2, to perform the investigation within the preset premises in a well-planned flow. The research phases comprise: phase one of formulation of research area, phase two of literature review and exploring research gap, phase three of development of abstract framework; phase four of variables identification and developing research model with the help of Experts of academic, IT and Banking industries.

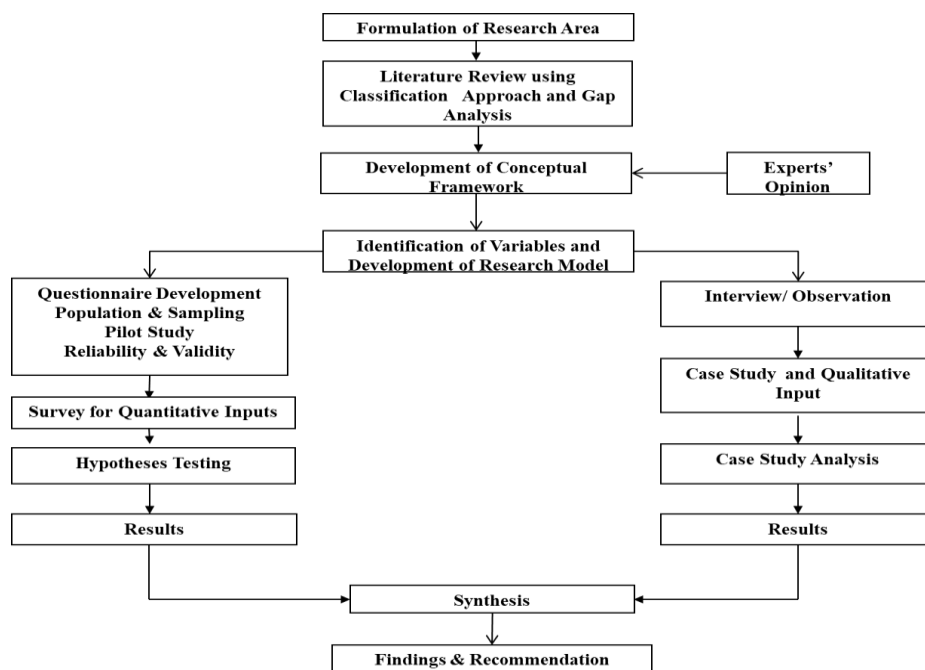


Figure 2: Research Methodology Framework

For testing research model, data/information is required to validate the framed hypotheses. After phase four the research framework divided into two different approaches - 1) Quantitative approach and 2) Qualitative approach for further research tools and analysis procedure. Both the approaches will be performed simultaneously in coordination with experts of the field. The quantitative approach comprises phase five of developing hypotheses, questionnaire development and pilot testing; Phase six of survey and data collection and phase seven of hypotheses testing. On the other

side, in qualitative approach, phase five comprises interview of experts and decision makers of IT departments and observation of the field area phase six of conducting case study and collecting information and phase seven comprises application of qualitative tools and techniques over the collected information and analysis of the output. Phase eight in both the approaches comprises results obtained by application of tools and techniques and analysis of the collected data/information. Phase nine will provide synthesis of the results obtained from qualitative and quantitative analysis and finally, the last step of the research framework is phase ten providing overall findings of the research recommendation for the researchers/practitioners in the same field for the future practices.

5 INSTRUMENT DESIGN AND VALIDATION

Following the quantitative approach, survey method would be used to collect the data from IT and Banking sector. Additionally, for qualitative analysis, interview and researcher's observation would be used for data collection. A draft copy of developed questionnaire will put in front of various experts from industry as well as academic to recognize any latent problems and check validity and reliability. For qualitative study, the main methods used are interview and researcher's observation of the experts in the organization. Convenience Sampling technique and 1000 sample size selected, based on expert's suggestions and following the recommendation provided by renowned authors. In this study Statistical Package for Social Sciences (SPSS) 21 version will be used to analyze the primary data, and Structural Equation Modeling (SEM) would be used for CFA and to validate the hypothesized model. Further, to analyze the qualitative data Interpretive Structural Modeling (ISM) technique will be used. Interpretive structural modeling (ISM) can rightly be employed under such circumstances [53].

6 SUMMARY

This paper includes the meek investigation of CSFs for Green IS adoption in Indian services sectors with special reference to Indian Banking and IT industries. The study describes the research design of the proposed investigation

with regard technology adoption using mix-method approach (qualitative as well as quantitative data analysis) and data collection techniques. This paper presents the procedures for conducting the research, which include the literature review, proposed research model and validation techniques while providing selection of model. On the basis of the research methodology research study will be conducted and empirical and non-empirical results will be provided near future.

7 PROJECTED SUPPORT TO PRACTICE, STRATEGY AND RESEARCH

As this study is research designed to perform imminent research and that will contribute the existing research in the area of Green IS adoption as well as will helpful for the practitioners to make/implement strategies for Green IS implementation in various organization at different regions. The investigated CSFs and validated research model will positively help decision makers/ practitioners and researchers in their future works. Consequently, they will be able to influence the society and organizations to adopt Green IS in daily practices, purchasing of Green Compliant products and help in environment sustainability. Additionally, as research contribution for researchers, this study will provide literature review and research gap/scope in the area of Green IS. The research also provides unique combination of T-O-E and UTAUT2 framework development. Explicit contributions and repercussions will be accessible after accomplishment of this study.

8 LIMITATIONS OF THE STUDY

Like all research work, this proposed research work will also abide by some limitations. As to conduct the study with quantitative data approach, Convenience sampling is planned to use and filling the questionnaire since: 1) The accurate population representing sample is difficult to determine.; 2) Further, due to target respondents' hectic schedule/fear from authorities, many time they avoid to fill up the questionnaire; 3) And lastly, due to expenditure problem and limitation of interviewers' (authors) of geographically approach to conduct interviews at all target offices for qualitative study. Further, the research may face problem of generalization due to non-longitudinal study.

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