CHAPTER II
LITERATURE REVIEW

2.1 INTRODUCTION
As indicated in chapter 1, the overall scope of the research on hand is to model the green IT enablers and study their interrelationships empirically. The present chapter expected to explore different areas of green IT that relates to consumer purchasing behaviour. Therefore available literature pertaining to these areas were reviewed. This chapter constitutes several sections. Initially the chapter presents the overview of green IT concept followed by government green procurement procedures followed across various geographical locations. Finally, factors that are expected to have an impact on corporate consumer purchasing behaviour are identified and gathered from relevant literature are explained.

2.2 OVERVIEW OF GREEN IT CONCEPT
Green computing or Green IT is a vast and complex subject and is extremely important as we understand the role of IT can help in enabling sustainable business practices. It refers to the practice of using computing resources more efficiently while improving the overall performance. There are numerous reasons why IT departments should consider and design sustainability into their actions. The most noticeable one in being “green” is being efficient, not wasting money, resources or time. Although information and communications technology (ICT) is normally looking for facilitator and enablers of business and social purposes, it also incurs cost. This cost is not only financial but also one of the impact upon environment. The research study by Gartner in 2008 predicted that ICT industry is accountable for 2% of global carbon emissions which is approximately equal to the annual pollution generated by the aviation industry and most of these emissions rises from the use of PCs, servers, cooling requirements, fixed and mobile telephony, networks, office telecommunications and printers. The impact of ICT on the environment also extends to chemicals and waste resulting from the disposal of equipment, polluting the soil with cadmium and mercury (Simon Mingay, 2007). However the rest 98% of global carbon emissions need a solution. IT as an integral part in our daily life and across almost all the
industries plays an important role in addressing and mitigating emissions from other sectors also. The continuous increase in power consumption by IT department is proportionate to the rise in electricity cost and carbon emissions in the complete stage of IT equipment life cycle right from its production throughout its usage and disposal presenting the environmental problems. Subsequently this has resulted in other problems like huge e-waste disposals without proper recycling, global warming which is depleting the ozone layer and shortage of renewal and non-renewal resources on the planet. Hence it is clearly understood that IT is contributing to environmental problems which most of the people don’t realise.

2.3 GREEN PROCUREMENT IN GLOBAL SCENARIO

Green purchasing which is synonymous term for environmentally preferable purchasing also applicable in considering the impact on environment during the procurement of goods and services. To be more sustainable, organisations are recognising that they need to become more efficient with their utilisation of environmental, social and economic resources. Despite the green purchasing still remaining as a niche sector, the total volume of products which enter the supply chain possessing with considerable environmental benefits is quite small, but there are indications for growth in future. Green purchasing is also about improving the procurement process; for instance, consolidating multiple user orders into a single order with a given supplier will result in a single delivery and reducing shipping costs and carbon emissions. Finally, the green purchasing being a subset of sustainable procurement generally refers to the influence of product and services from an environmental, social and economic perspective. These terms are frequently used interchangeably but it is important to recognise the distinction between them. In contrast to green purchasing which focuses on environmental impacts and sustainable procurement considers the triple bottom line (social, economic and environmental benefits) which is the consequence of procurements. Despite green purchasing having many benefits, the IT organisations consider these opportunities as important driving factors in attaining sustainable strategy. The following sections highlight the developments in green purchasing across public and private sectors in Europe, North America and Asia.
2.3.1 Green Purchasing in European Union

The European Union’s green procurement considers different facets like policy framework, criteria, innovations and targets for private and government procurements. Every year European public authorities spend €2,000 billion on goods, services and works equivalent to 17% of their GDP. These include wide product groups like office IT equipment, electricity, transport, furniture, textiles and cleaning and catering services. The sixth EAP of the European Community between 2002 and 2012 has identified public procurement with considerable potential for “greening” the market by environmental performance as one of their purchase criteria. The European Commission Communication on Integrated Product Policy in 2003 called on EU member and stresses to develop action plans for greening their public procurement called National Action Plans by the end of 2006 and asked the European Commission to prepare a practical manual for use by public authorities.

While altering consumption and production patterns which are one of the primary objectives of the EU Sustainable Development Strategy (SDS) between 2001 and 2011, the adoption of the renewed SDS in 2006 supported the EU member by 2010 to try in bringing the average level of GPP in Europe. The legal decisions applicable to the public procurement and the prospects for integrating environmental considerations into procurement procedures were mentioned in the “interpretative communication” on the EU law. In 2004, the adoption of the two commands by European Council and Parliament aimed at clarifying, simplifying and modernising the existing laws on public procurement. New public procurement instructions consolidated the legal agenda of GPP. To differentiate with the former EU instructions which are guiding the procurement process followed the 2004 orders in specific references for the possibility of including environmental and social considerations in their procurement processes and procedures (Tan Mustafa, 2010).

The public authorities and contracting parties to be more practical in their GPP are suggested with “Buying Green” by the European Commission in 2004. A manual on eco friendly procurement explaining how to integrate environmental concerns at each stage of public procurement procedures and to implement best practices in EU’s GPP were passed. The Sustainable Consumption and Production and Sustainable Industrial
Policy Action Plan (SCP/SIPAP) launched by European Commission’s Communication in 2008 presents the strategy for an integrated approach for further sustainable consumption and production to promote its sustainable industrial policy. The vital reason of this action plan is to progress the energy and ecological performance of products and position their uptake by the consumers and make production fast and easy. This message set out a measure in delivering more sustainable consumption and production by improving the effectiveness of the European economy. Remarkably the improved “Sustainable Development Strategy” identified sustainable consumption and production as one of the key challenges for Europe. The following documents escorted this action plan:

- Suggestion for the extension of the Eco-design Instructions;
- Suggestion for the alteration of the Eco-label, Eco Management and Audit Scheme (EMAS) regulation;
- To communicate on Green Public Procurement;
- Proposal for the amendment of the Energy Labeling Program.

The above mentioned documents except communication are undertaken by the community regulation process and considered as updated by 2010. In 2008, the Public Procurement for a Better Environment was published by the SCP/SIPAP agenda. It advised how to overcome the main problems towards increased participation of GPP and gave directions on how to minimise the environmental influence caused by public sector consumption and how to use GPP to encourage improvement in environmental technologies for products and services. The European Commission has established objectives at EU level stating by 2010, 50% of all public tendering processes should be green. In 2008, the EU Commission has launched a web based GPP Training Toolkit whose main aim was to make it easier for member states and procurement practitioners to spread GPP through different modules (Tan Mustafa, 2010). The business to invent and make complete use of demand side policies will engage the commission to work on further improvements through public purchasing and smart guidelines and encourage eco friendly purchasing. The same has been specified in March 2010, when the European Commission established the Europe 2020 Strategy for Smart, Sustainable and Inclusive Growth. In 2008, the Energy Star Regulation
forces central governments and EU institutions to purchase IT office equipment that meets energy efficiency requirements (Tan Mustafa, 2010).

The updated EU Eco-label guidelines provides an instruction to incorporate those newly developed eco-labeled standards in the manual assisting the authorities their procurement policy. For easy identification those labels carry the flower logo. A wide variety of products with these labels were added consistently. These eco-labels standards are based on multiple criteria. Also the U.K government since 2010 made significant progress in wide spread of implementing green IT strategies across the government sector and has reached the average green IT maturity score by 2.9 in 2013 and comparatively it was 2.4 before year. The aim was to get level 3 maturity model by 2015. Therefore, necessary actions were taken in greening their IT data centers, recycling and reducing IT waste, using online submissions and reducing paper printing which reduced 760 tons of carbon emissions, decreasing business travel by leading business via video and teleconferencing (Jennifer and John Taylor, 2013).

2.3.2 Green Purchasing in North America
This section focuses on the green purchasing practices of the United States federal government which highlights the strategies on Environmentally Preferable Purchasing (EPP) and the values involved in doing such purchases. EPP benefits the federal government through “buy green” and uses the nation’s huge buying power to encourage market demand for green products and services. This kind of purchasing firstly helped the federal green purchasers and the Environmental Protection Agency (EPA) which later on helped green vendors, small and large businesses and consumers also. This explained in:

- Discovering and evaluating the information about green products and services;
- Identifying federal ecological buying requirements;
- To calculate the costs and benefits of purchasing choices; and
- Manage eco-friendly purchasing practices.
**Environmental Protection Agency’s Rules on Eco-friendly Purchasing:**
The five regulatory principles developed by EPA has provide extensive guidance for spreading EPP in the federal government setting. These principles are applicable in specific procurements depending on number of varying issues such as the type and complexity, commercial availability of the product being purchased, the type of purchasing process followed, the time frame and money of the requirement. The executive agencies with the help of these guidelines are able to identify and procure ecologically preferable products to incorporate steadily environmental preferability principles into their buying decisions (Tan Mustafa, 2010).

“Environmentally preferable” are defined with a sense to have lesser affect on mankind health and the situation when compared with conventional products or services that serve the same purpose. This assessment may consider raw materials procurement, manufacturing, packaging, operation, distribution, reuse, maintenance or discarding of the product or service. These guidelines attempted to meet the National Performance Review and Procurement Reform goals of federal purchasing which are applicable to all types of purchasings from suppliers and services to buildings and systems.

**Legislative Directives**
During acquisitions professional judgment, common sense and reasonable decision are necessary by the executive agencies to measure performance, cost and availability of products or services. On the other side for large systems acquisitions, such assessments may be suitable.

**Legislative Directive 1: Environment + Performance + Price = Eco-friendly Purchasing**
Environmental considerations have to become part of general purchasing practices and act reliably with traditional factors like product availability and safety, price and performance. Some manufacturing, usage and disposal of products may adversely influence on human health and the atmosphere whose impact puts cost together on the purchasing agencies and society as well and end up for reimbursing in one way or other. It is recommended to avoid or reduce the products which will ever increase the
disposal costs for government by both hazardous and non-hazardous material. Authorities who are considering green purchasing of products and services not only minimising environmental burdens but also reducing usage of government’s raw material, maintenance, operating and disposal cost. As the environmental preferability of the product can often have positive influence on its overall performance, most of the government’s procurement decisions are no longer limited in considering price and efficient performance instead considering the environmental performance as well. Only those vendors who can improve all the factors like price, performance, health and safety, environmental factors will capture and maintain the largest market share of government customers. The purpose of this guidance is to inspire the executive agencies to consider environmental concerns so that to make them understand it is worth paying a price premium for such purchases for better performance or quality (Tan Mustafa, 2010).

**Legislative Directive 2: Minimisation of Pollution**
The main motive for environmentally preferable purchasing is to protect the environment by minimising waste and pollution. So consideration of environmental preferability must start in early achievement process and be rooted in the ethics of pollution prevention which strives to eliminate potential risks to human health and the environment. Pollution prevention not only reduces the waste but also saves money for agencies (Tan Mustafa, 2010).

**Legislative Directive 3: View point on Life Cycle and Multiple Aspects**
Environmental benefits of a product is a function of multiple aspects from a Lifecycle standpoint. Agencies are advised to consider the following concepts in relating this directives.

**Product Life-Cycle Standpoint**
Any product has environmental influence before and even after the purchase and during its consumption. Similarly the product life cycle right from manufacturing, usage, distribution and disposal of products have different burdens on the environment. Government and private work groups should try to purchase products with less negative environmental impact on its life-cycle to a possible extent. By
practicing this way the federal government is estimated to reduce the maximum environmental impacts of products and can provide a clear indication to that government business (Tan Mustafa, 2010).

**Multiple Aspects of Environment**

Environmental benefit must include consideration of numerous environmental features such as increased energy efficiency, reduced harmfulness, reduced affect on sensitive ecosystems and other attributes from life cycle aspects (Tan Mustafa, 2010).

**Legislative Directive 4: Assessment of Environmental Influence**

Comparing the environmental impacts would involve in determining environmental friendly products preferability. While comparing environmental influences government sectors should consider the reversibility and geographic scale of the environmental impacts i.e., the amount of change among other competing products and the principal importance of protecting human health.

**Legislative Directive 5: Information on Environmental Performance**

An organisation must have complete, accurate, and significant information about the environmental performance of the products to determine whether a product or service is environmental friendly. Corporate employees are encouraged to search for the product suppliers who can provide life cycle based information about the environmental performance of products (Tan Mustafa, 2010). Disclosing the ecological information about their products and services will also stand-in competition and encourage a market driven approach to environmental development. The availability of the information to the public will help and confirm its accuracy and credibility.

**2.3.3 Green Purchasing in Asia**

Due to its incredible purchasing power government green procurement (GGP) has long been used as an important policy measure to introduce and promote the widespread of environmental friendly (“green”) goods and services. When implemented properly and successfully, the GPP practice may stimulate a new market for eco-friendly products and help lower their prices. In Asian countries, at the
government level different approaches are at different stages in implementing the green purchasing.

**Government Green Procurement in China:**
China implemented the GGP since 2005, based on the Government Procurement List on Energy Saving Products (GPLESP) that was spreaded in 2004 and government procurement list for environmental labeling products was executed in 2007. Hence it was mandated to all central government agencies and provincial level government to purchase energy saving labeled products listed in GPLESP. Currently there are over 10,000 products within 33 categories under the “energy saving label”.

In 2007, by central government agencies and regional level governments it was mandated to do preferential purchases of Type-I eco-labeled products under the GPLESP which later on extended to all levels of government in 2008. Products must have eco-label mark with some certain requirements of public purchasing before they enter into the list. Currently, more than 10,000 products from 700 manufacturers are listed in the fifth list within 24 categories under the China Environmental Labeling Program. The GGP of eco-labeled products in China amounted to more than 14 billion RMB by 2009 (Tan Mustafa, 2010).

**Government Green Procurement in the Hong Kong special Administrative Region (HKSAR):**
The HKSAR Government Logistics Department (GLD) taken proper measures to enable and implement the practice of GGP with a purpose to minimise waste generation. The Waste Reduction Framework Plan (WRFP) setup in November 1998 recognised GGP as a crucial plan for waste management initiative. GLD which is the government’s central procurement agent does the government procurements. The actual GGP efforts of HKSAR government was launched in 2000 by revising the Stores and Procurement Regulations to give consideration where financially balanced during the choice and purchase of products with high energy efficiency, recyclability, low or non toxic substances and low water consumption (Tan Mustafa, 2010).
Initially the environmental criteria included 31 product groups and later on advanced and expanded to 33 product groups including recycled office stationery and cleaning materials. During 2003-06, the pertinent products of total worth HK$180 million was purchased by GLD. In 2008 the total amount of GLD purchasing was HK$3.9 billion out of which HK$1.8 billion or approximately 45% of the total GLD procurement amount was on environmentally preferable products. Between 2005 and 2014 the HKSAR government assured to progress and adopt a green purchasing policy under Management of Municipal Solid Waste Policy which was published in December 2005. Next to a Task Force on Economic Challenges meeting in 2009 and in the policy address 2009-10, the HKSAR Chief Executive also announced the opportunity to expand the green purchasing in government sectors with an interest to make Hong Kong a green city (Tan Mustafa, 2010).

In July 2008, the HKSAR Environmental Protection Department appointed a consultancy to investigate and develop ecological conditions for particular product groups which are commonly purchased by Hong Kong government sector. It is applicable to 103 specific products in 17 broad product groups including building and construction materials, cleaning products, computer equipment, electrical appliances, fuel oil, furniture, household products, office equipment, paper and plastic products, printing and publishing equipment and supplies, stationery, telecommunications equipment and supplies, stationery, telecommunications equipment, vehicles and spare parts, textile materials and garments as well. The HKSAR government recognised these ecological specifications as mandatory requirements for the future competitive products that are available in the market (Tan Mustafa, 2010).

**Government Green Procurement in Taiwan:**
Taiwan has introduced the GGP program in May 1999 through the adoption of the green procurement article (Article 96) in its Government Green Procurement Act. In 2001, the Action Plan was circulated by the government for implementing green procurement specifying particular product groups and annual procurement goals. The action plan in Taiwan has divided the enactment into two periods:
The Promotion Period: Only the central government agencies and the
governments of the two big cities in Taiwan namely Taipei and Kaoshiung are
covered during this period from July to December 2001. Only 30% of GGP targets
were designated on product category.

The official implementation period: This was established since January 2002,
which was covered with a scope on central and first level government agencies,
government owned enterprises and other public institutions such as public schools
and hospitals. Initially in 2002, green procurement was aimed for 50% and was
increased slowly up to 85% in 2008. The government agencies every year by
February and August are required to report the GPP results to the Taiwan
Environmental Protection Administration (TEPA) as a measure of performance
tracking.

For the top priority purchasing products, the government subsidised Green Mark
Type- I eco-labeling program and such a status has gained its visibility and credibility
among the consumers. With the consistent enactment of these initiatives in 2002, the
annual GGP spending in Taiwan has increased from 2.6 billion NT dollars during the
second half of 2002 to 5.6 billion NTD in 2003 and reached 6.8 billion NTD in 2008.
Simultaneously, the number of Green Mark licensed products has also grown from
576 in 2002 to 717 in 2003 and to 876 in 2008. These figures provides a good
association between successful eco-labeling and improved GGP expenditure (Tan
Mustafa, 2010).

Government Green Procurement in India:
While there is no clear green public procurement (GPP) procedure for India, it focuses
from several views on the existing public procurement practices. In 1997, the
prohibition of azo dyes usage among textile industry, leather and food industries and
in 2000 prevention of lead as an chemical in gasoline was obligated. In 1991 India has
started its own campaign of eco-labeling system called “Eco mark” which is initially
granted for 16 product groups by meeting both environmental and quality standards.
The Bureau of Energy Efficiency (BEE), a legislative body has announced star
labeling program for energy using products (EUPs) under the Union Ministry of
Power. These labels made easy for consumers in identifying the energy efficiency
products. Similarly, the Electronic Industries Association of India (ELCINA) has been conducting awareness programs and assisting the Indian electronics industry to hold the challenge with international legislation agreements like the Restriction of Hazardous Substances (RoHS) and Waste Electrical and Electronic Equipment (WEEE) instructions of the EU, etc. A research study conducted by the Green Purchasing Network of India (GPNI) on encouraging green products purchasing and on carbon oriented Eco mark Scheme for India has got support from International Green Purchasing Network by presenting them to the Central Pollution Control Board (Tan Mustafa, 2010).

**Government Green Procurement in Japan:**
The Japanese government which accepted the Law on Promoting Green Purchasing in May 2000 has came into effect later in May 2001. The law need the Japanese central government to develop a green procurement policy and an execution plan to begin a proficient authority towards disseminating GGP rules and product standards. Since 2001, the government has selected 250 green procurement products from 19 product groups. These groups include office electronics and IT equipment, stationery, office automation equipment, lighting equipment, automobiles, construction materials and services and other general products.

In 2007, 47 regional governments all being central government ministries, 12 designated cities, and 68% of 700 local governments and cities undertook green purchasing and jointly 95% of the purchased products in the selected groups were eco friendly products. The Japanese GGP program in directing government customers towards ecological purchasing approved the products mainly from the Eco mark eco-labeling program (94%) and Energy Star (37%) (Tan Mustafa, 2010).

Furthermore, in 2007 the government has introduced “Green Contact Law” for promoting the contracts with the resolution to minimise GHG emissions by the state and other ruling bodies by instructing the public agencies and institutions in the procuring contracts for electric power, energy service company (ESCO) projects, automobiles, and building designs. Despite the Green Contract Law focusing mainly in minimising greenhouse gas (GHG) emissions from the production and supply of
specific products and services, it supplements the Law on promoting legal framework for GGP combined with the eco-labeling program and green purchasing networks has offered incentives and motivates in greatly progressing green purchasing in Japan.

The Ministry’s idea behind launching a recycling oriented society II is to set the below goals to attain by 2015.

- To create awareness among 90% of the public about waste reduction, recycling and green purchasing, so that out of which atleast 50% of public will put them in action towards waste reduction, recycle and undertake eco friendly purchases;
- Among local governments, half of the public companies who are registered on the Tokyo, Nagoya and Oaka stock exchanges and 30% of private companies with atleast 500 employees will steadily practice green procurement.

From the survey it is understood that 74% of corporate respondents had green purchasing in action, yet there is a significant low awareness among the organisations and the prices of green products were found to be the major reasons for not being able to implement green purchasing. The white paper on the environment in 2009, provides evidence that consumer awareness on GP was more at 82% and actual action to purchase recycled products was low just over 10%. The findings clearly showed a large gap between awareness and behaviour (Tan Mustafa, 2010). As there is a scope for cost reduction over the time during usage the consumers are embracing the eco-labeled system widely. The concept of “carbon foot print” has gained huge interest all over the world and Japan’s efforts in this direction are directed by the Ministry of Economy, Trade and Industry (METI). The companies have also instigated to integrate their own carbon offset activities into their products and services and promote them as part of their public relations activities.

**Government Green Procurement in Korea:**
The Korea has established Green Purchasing Law in December 2004 and executing from July 2005. Organisations are identifying “Eco-labeling Mark” and the “Good Recycle Mark” as the criteria for the green products. The Green Purchasing Law, since 2005 has tremendously improved the GGP expenditure in the Korean public

**Government Green Procurement in Thailand:**
The Pollution Control Department (PCD) and Ministry of Natural Resources and Environment (MONRE) in March 2005 established strategies for eco-friendly products and services and encouraged green purchasing for government sectors. The cabinet in January 2008 determined in endorsing the National Green Procurement Plan (NGPP) and ordered government sectors to follow the plan. The country has adopted Thai Green Label Scheme, Energy Efficiency Label and other criteria for new product standard (Tan Mustafa, 2010).

**Government Green Procurement in Malaysia:**
The Malaysian new Ministry of Water, Green Technology and Energy made efforts to promote green technology by integrating green purchasing (GP) and gained the interest of local and international as it progressed GP through supply chain management. The crucial role played by Ministry of Finance advanced the eco-friendly purchasing assisted in:

- Tuning Malaysia in realising their wider goal to strengthen market demand for eco-friendly products and services.
- Improved environmental awareness among people and industry.

**Government Green Procurement in New Zealand:**
New Zealand government within local market also strictly practicing green purchasing and supporting the national economy. The government bodies represents about 16% of GDP through their green purchasing initiatives national wide. The government strategic purchasing procedure aims with an expectation that they need sustainable goods and services to have a good impact on economic, environmental and society. Towards supporting this principle New Zealand jointly developed an agenda with Australia in executing these strategic objectives. As government bodies are responsible for majority of their purchasing actions they must be accomplished with financial management also. To integrate better sustainable concerns in the
government procurement it is important to assess the nature and difficulties of procurement.

As per the requirement of the present study, there exists no evidences from literature to understand the government green procurement pattern or green IT initiatives in Saudi Arabia. However some proofs were provided that Saudi Arabian government has allotted SR 17 billion towards water drainage and waste management covering forty three kinds of product category including electronic waste and that over 77% of all garbage in Saudi Arabia could be recycled (MOMRA, 2009).

2.4 GREEN IT ENABLERS FOR CONSUMERS’ PURCHASING BEHAVIOUR

Green IT which is primarily given importance from the corporate perspective in IT organisations (Mines and Davis 2007; Velte et al., 2008) has neglected the academic studies from consumer perspective. This is what the green marketing myopia also states that emphasising on environmental quality of a products at the cost of customer or failing to deliver green criteria in the products at cost of customers. Hence the green products must be positioned based on consumer values with an intimate understanding. As such the green IT attributes include energy consumption and e-waste disposal issues which have an influence on the buying pattern of ICT products (BITKOM, 2009). In fact the green ICT considerations are beginning to effect consumer and business buying decisions. As the holistic approach of green IT from consumer standpoint is not clear to the present IT market, this research is set with the direction to understand the corporate IT consumers’ purchasing behaviour of green IT products. Efforts were made in gathering the relevant literature on green IT and other consumer green purchasing behaviour areas extensively. Collectively fifteen factors are identified as enablers that are driving the consumers’ purchasing behaviour of green IT products.

2.4.1 Environmental Consciousness

Concern for the natural environment among business and consumers have given due consideration in their production and consumption pattern. With the growing adverse
impact on the environment it is necessary to educate the consumers in improving their level of ecological knowledge and concerns (Laroche et al., 2001, T. S. Chan, 1996, Kerr, 1990; and Donaton and Fitzgerald, 1992; Noushin Laila Ansari et al., 2010). Majority of our environmental problems like excess garbage, pollution, waste of energy and material, etc. are the consequences of consumers’ consumptive behaviour (Christopher et al., 2008) and the consumers ecological attitudes and behaviour is a positive indication in choosing products which are environmentally sound and be an initiator in solving ecological problems (Ottman, 1993; Kilkeary 1975; Arbuthnot and Lingg, 1975; Hallin 1995; McCarthy, Shrum 2001; Davis 1993 and Synodinos 1990). On the other hand there exists contradictions stating ecological knowledge exerts no significant bearing on the performance of eco-friendly acts (Arbuthnot and Lingg, 1975, Geller, 1981; Schahn and Holzer, 1990). So there exists a gap between ecological knowledge and actual behaviour. Green marketing mean not only endorsing and advertising of products with environmental characteristics but also encompasses terms like recyclable, refillable, reusable, ozone friendly and environmental friendly (Jackson, 2005) and applicable to consumer goods, industrial goods and even services also (Stern, 2006).

2.4.2 Kyoto Protocol
To attain the sustainability, government regulations in the form of carbon tax and trade scheme have been already introduced by the U.S. government and Intergovernmental Panel on Climate Change (IPCC). The vigor of the Kyoto Protocol showed a high priority to reduce IT businesses GHG emissions worldwide (Tugrul Daim, 2009; Kirk Cameron, 2010; Sania Khan et al., 2011). Most of the IT companies and IT departments are implementing this protocol in the form of corporate social responsibility to create environmental awareness for all industrial product users (Chandrasekhar Ramasastry, 2009). Most of the ICT product manufacturers are restricted by such regulations to establish green credentials in reducing their manufacturing waste or reducing its hazardous substances, so that it acts as a catalyst to the competitors in the industry to follow and gain their market share (Hugh Wareham, 2009; CGI, 2010).
2.4.3 Global Warming
While CO$_2$ is considered to be one among the four greenhouse gases like methane, nitrous oxide and fluorinated gases it is responsible for 2% of global warming with 820 million tons of emission per year from IT (Simon Mingay, 2007; Castro 2009; Paul Budde, 2010; A.O’Flynn, 2010). These emissions from IT which was 3% in 2009 is still expected to increase to 6% by 2020 (Luis Neves, 2008). Ecologically speaking this is mainly occurring due to the use of more costly hardware especially through operating systems and software upgrades which require more hardware to host it. Even with the drastic development of technology, it is now possible to handle IT and software related issues on mobile phones and still leading to generate more e-waste and is expected to enhance this problem from the hundreds of millions of units to billions with mobile phone users likely to reach five billion by 2020 (Forge et al., 2005; Blackman et al., 2007). The study on climate change and sustainable development through carbon dioxide usage in industries also states that the disposal of unwanted products on the land results in increasing the global warming effect (Sunil et al., 2013). Hence the “green energy economy” trying to capture the carbon emissions, increased energy costs and also holds companies which are more accountable for their impact on the environment (Tohmatsu, 2009).

2.4.4 Corporate Social Responsibility
Developed countries being advance in green IT embracing, consider energy efficiency, carbon pollution and disposal waste issues seriously. Among all South Korea is expected to be the world leader in green technology by strictly practicing government policies, strong executive leadership and commitment of corporate social responsibility (Castro, 2009). The first wave of green IT was emphasised on energy efficiency products and second wave focused on IT organisation’s role in CSR strategy to attain the sustainability through IT. Green initiatives addressing a broad range of business sustainability and corporate social responsibility concerns have contributed US$50 million by India towards CSR in 2008-09 and 55% of European organisations already being implemented CSR strategy in position (Nathalie and Larry, 2010; nlyte software, 2011).
2.4.5 Power Consumption

The IT products particularly in data centers are mainly power consumers which uses 123,000 GWH of electricity across the world which is approximately equal to the power consumption of a small country like Poland (Koomey 2007; Schmidt et al., 2009). Power consumption by data centers has doubled between 2000 and 2005 and again estimated to increase by 40% in 2010 which was noticed the energy cost will be higher than equipment cost by 2015 (Koomey, 2010; Forrest et al., 2008; Mckeeefry, 2008; Hamm S, 2008; Kumar, 2008 and Gartner, 2008). Electricity is a major cause of climate change because the resources like coal or oil that helps generating electricity also releases carbon dioxide, pollutants and sulphur into the atmosphere causing respiratory diseases, smog, acid rain and global climate change. It is therefore clear that increased energy consumption has positive affect on green IT product purchase to put down power consumption. Today’s data centers are big energy consumers and they are filled with high density, power hungry equipment. As reported by Gartner in 2008, the computing infrastructure like PCs and monitors accounted for 62% of total ICT energy consumption followed by enterprise communications infrastructure releasing 39% of global carbon emissions by PCs and monitors, 23% by servers, 15% by fixed telecom, 7% by LAN and telecoms and 9% by mobile telecoms. It is understood that the consumers need to be more conscious on power consumption and think purchasing of green IT products as an alternative.

2.4.6 E-Wastage Disposals

Four phases of green IT identified by Elliot defined as: design, production, operation and disposal of ICT enabled products and services are not harmful and may be beneficial to environment during the course of its whole life cycle (Elliot, 2007; Molla et al., 2009). Author Noushin Laila Ansari et al., 2010 conducted a research to study how the green IT research projects deal with mobile phone and battery disposal and recycling awareness by business and individual consumers in Bangladesh found there is a significant lack of awareness in IT professionals about the e-wastage issues. Also the U.S. Environmental Protection Agency stated, over 25 billion computers and other electronic devices sold since 1980 has created 2 million tons of e-waste where only 15% to 20% of them were recycled (Ruth, 2009; Vetter and Creech, 2008; Poniatowski, 2009). It was also found India has generated 3.3 lakh tons of e-waste in
2007 and 4.7 lakh tons by 2011 (Anand Siva Subramaniam, 2009; UNEP 2007; Pinto, 2008). U.S., New Zealand and Australian organisations found to have 80% of respondents considering e-waste management and IT energy consumption as two main environmental concerns (Molla et al., 2009). Lack of awareness on green IT among people in countries like Bangladesh and ending up most e-wastage in landfills and unofficial dumps could be controlled by respective national government in preventing such consequences by imposing strict regulations (Velte et al., 2008; Noushin Laila Ansari, 2010; Stephen Swoyer, 2006). The IT market players strive on their intelligent setup for optimised consumption, using cleaner energies and adopting green initiatives. The auditing review based on reliable metrics all through green IT projects has trained project managers and organisations for environmental regulations to be soon imposed by the governments worldwide (Nathalie and Larry, 2010).

Computers and office electronics account for 40% of lead and 70% of heavy metals including mercury and cadmium in landfills (Hobby et al., 2009). Environmental awareness is congruent with the belief that the world’s supply of natural resources is finite and the ecological balance of the environment may be in a critical disruption stage (Hayes, 1990). It was found some technology manufacturers are trying to modify their packing system with 100% recyclable material, like Acer company introducing even printers with energy star certifications and which comes in 100% recyclable packing material by reducing the use of plastic foam (CDW-G, 2009).

2.4.7 Financial Benefits

The green IT products deliver many indirect financial benefit by low operating costs, low power consumption, maximum optimisation in the long run for both producers and consumers of green IT (Clifford, 2009; Dubie, 2009; Nagata and Shoji, 2005 and Castro, 2009). By implementing green IT practices TCS provide an evidence in reducing 12.5% electricity consumption, 76MWH of solar energy generation, 1.5 cubic meters of water reuse, 28% and 67% reduction in paper and printer cartridge consumption respectively thereby leading 2% reduction in carbon footprints during 2007-08 compared to the preceding year (Anand Siva Subramaniam, 2009).
2.4.8 Eco-Labeling and Certifications

A review on sustainable IT service design states the relation between energy usage and carbon generation and the idea to reduce both has escalated IT product labeling system guiding the consumers for better choice of eco IT equipment without entering them into the waste stream prematurely (Robert Harmon et al., 2009; Hobby et al., 2009; Consumer Electronics Association, 2008). Labeling or certification programs such as TCO, Energy Star, Blue Angel and EPEAT are found to be one of the modest methods for consumers and corporate buyers to accurately determine the environmental features of ICT products and de-materialisation process like electronic invoicing can reduce carbon footprint and offers additional financial benefits such as operational efficiency and cost reduction (Christopher et al., 2008). Same time it is found environmental labeling alone does not reach the hearts and minds of consumers while doing IT purchases (Hobby et al., 2009). In United States, EPEAT product registry is a major force in green IT procurement relatively decreasing energy consumption with superior energy efficiency standards (CGI, 2010; Nordin, 2008).

Consumers buying green products depends on many factors and only very small minority of consumers are identified having very strong sustainable lifestyles while some consumers consider product environmental performance is only to be the green criteria by green consumers which shows they are not aware of other green criterion (Hobby et al., 2009). A report by the Massachusetts Department of Environmental Protection (2002) also suggests difficulty in identifying green products is one of the barriers to green product purchases. Eco-labeling, TCO, Blue Angel and EPEAT programs found to overcome this issue for environmental ICT products (Hobby et al., 2009). Therefore clear guidance through eco-label and certifications will help consumers to demand more for green products and develops their intention in making informed purchasing decision. The same was also supported by research studies that out of 252 IT decision makers, 32% says green certifications like EPEAT (Electronic Product Environmental Assessment Tool) are very important while 60% says neutral and 8% says not important (Paul Schwarz, 2008; Jerome et al., 2011).

2.4.9 Psychological Factors

The psychological factors explaining weak links between intention and actual purchase found the awareness on environmental issues, brand and price were much
more considered when comes to actual purchase decision with a better understanding of consumer’s attitude and behaviour (Tim Flannery, 2010; Roberts, 1996). There are some contradictions from few studies indicating positive attitude towards environmental issues do not necessarily lead to actual environmentally friendly purchasing behaviour (Laroche et al., 2002). The majority of consumers do not purchase products based on the environmental concern alone but depends on purchase intention, same time they will not neglect other product attributes for a better environment (Yam-Tang and chan, 1998; Ricky Y.K Chan, 2001). Consumer’s demand and preferences depend on their psychological factors as it clearly shows from their intention towards environmentally responsible behaviour which is derived from the desire to act eco-friendly and which is further derived by their attitude (Balderjahn, I. 1988). In general, empirical studies have demonstrated a significant positive relationship between ecological intention and behaviour (Maloney and Ward, 1973; Hines et al., 1987).

2.4.10 Corporate Perception
Past studies stated much research is needed to fully understand the market impact of sustainable IT services and how the customers are willing to pay for eco-friendly products (Robert Harmon et al., 2010). Also 80% of 65 corporate sustainability executives of fortune 500 companies have positive perception on green initiatives by practicing them and even same in U.S.A with 35% firms already implemented green IT initiatives (CDW-G, 2009). Besides existing economical, regulatory and ethical drivers it was found 55% of European organisations already have CSR strategy in place and 44% supporting the efforts to reduce its environmental impact through CSR. Among all cost minimisation, new business standards and opportunities, financial benefits and customer perception ranked as main drivers for going green though primarily driven by desire to reduce energy and resources cost (Molla, 2008; Anand Siva Subramaniam, 2009; San Murugesan, 2008). Market players, global warming, eco-labeling, increased power consumption, e-waste and disposals are found to be the key factors in driving consumer purchases towards green IT products (Grail Research, 2009; Tugrul Daim et al., 2009). Even with lower quality consumers are ready to buy green products but will look for environmental information on labels. Green consumers purchasing intention and usefulness of ecological product labels
assists the business strategies in gaining market visibility, on the other hand they are also driven by efficiency and performance oriented consumers (D’Souza et al., 2006; Schmidt et al., 2010; Hugh Wareham, 2009; CGI, 2010).

2.4.11 Performance
Most common green criteria for electronic product purchasing found to be product environmental performance with greater energy efficiency, product durability, energy rating and water consumption while manufacturing (William et al., 2010). A corporate research study on green IT products states that new technologies are improving the IT operative performance (Hobby et al., 2009). Also by using green IT products can reduce power usage up to 75%, lowers cost by 73%, reduces carbon footprints by 56% and improved performance by 55%, office space saving by 47% and it is proved practically that a thin client uses only one fifth of the power of a desktop (Murugesan, 2008). These findings are also supported by 89.3% of respondents with a positive perception on product performance for consumer electronic goods that incorporated green features (Tim Flannery, 2010). The data center efficiency can also be achieved by metrics in power, productivity and server performance (Tugrul Daim, 2009).

2.4.12 Consumer Demand and Preferences
Consumers expect green products to be superior or at least similar with conventional products and look forward to the companies to communicate through the right channels. But it is noticed most green product purchases done based on their impulse and curiosity. Especially for green electronic products the present demand found to be 47% and it will grow to 88% of purchases in future with organisations delivering products in line with customer demands (Grail Research, 2009). Therefore this is the driving factors for vendors to sell their products while consumer outlook, policies, practices, green IT technology and green IT governance constitutes the five dimensions of green IT readiness among the organisations and business (Molla et al., 2009).
2.4.13 Market Players
Schmidt et al., (2010) found the potential market share for PC with green attributes would be 26.6% offering the opportunity in paying attention and attracting new customers and gain extra revenues. Global IT suppliers like Dell, HP, Sun, Wipro and IBM who are meeting regulatory requirements for European markets, North America and Asia created a competition among IT product manufacturers towards green initiatives in marketing their products (CGI, 2010). Past studies also revealed green IT services market is expected to grow from $500 million to nearly $5 billion in 2013 (Brodkin J., 2008). HP, CISCO have eco-label and take back programs for obsolete products to recycle and so far had reduced 25% of its GHG emissions by 2012 (Grail Research, 2009).

2.4.14 Sustainable Strategy
The U.S EPA reports energy usage of data centers has been increasing and doubled between 2000 and 2006. Costs incurred for public and private sectors was $7.4 billion for their yearly electricity bills by 2011 and it will represent 44% of total IT budget for most companies. Therefore, private and public sector organisations are incorporating sustainability into their operations through CSR strategies and a clear driver of green purchasing will develop sustainability with a good impact on regular operations (nlyte software, 2011; Hugh Wareham, 2009).

2.4.15 Green Purchasing Behaviour
Past research findings for other electronic household green products found environmental awareness, environmental related factors, attitude and regulatory actions influenced the green purchasing behaviour and that now the consumers are no longer thinking green products as inferior (Tim Flannery, 2010; Hugh Wareham, 2009; Ishaswini and Saroj, 2011). Companies adopting green initiatives and the financial recession situation in the past have changed two-third of consumers to consider green purchases (Grail research, 2009). This is also true with the general green products where environmental attitude has a high degree of coefficient towards green purchasing, recycled products and other ozone friendly aerosols. Further ecological knowledge, ecological effect, an attitude towards green purchases, green
purchase intention have positive association towards green purchasing behaviour (Ricky Chan, 2001).

The literature suggests these enabling factors drive the corporate consumers towards green IT purchasing. Also looking at the traditional IT procurement procedures with conventional IT products, there exists some drawbacks in not meeting the expectations of the business organisations. The IT products with green attributes found to overcome these problems and are able to address the business needs more confidently matching with their sustainable goals. Therefore with no evidence of the authentic empirical studies, some research questions were raised.

- **Whether these green IT enabling factors actually drive the consumers towards green IT purchasing or there is a skepticism by greenwashing?**
- **If they are truly driving, how are their statistical relationships?**
### 2.5 ENCAPSULATED TABULAR FORM OF GREEN IT LITERATURE

Some of the important literature on green IT incorporated in a tabular form as presented in the below Table 2.1.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Author and Paper Title</th>
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<th>Issues</th>
<th>Design/Methodology/Approach</th>
<th>Findings</th>
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| 1       | Chandrasekar Ramasastry, (2009) Green IT Matters at Wipro LTD | To present the company's initiatives towards Green IT strategic implementation | Green IT drivers, strategic role, global warming, CSR, green IT initiatives, regulatory steps, e-wastage disposal. | Case Study | 1. 23 green initiative areas are classified under 4 broad categories.  
2. Green IT initiatives are supported by top management.  
3. Wipro IT in 2006 has launched 16 collection centers for take back of obsolete IT products.  
4. Greenware was introduced by an Indian IT industry for the first time. |
| 2       | C. Hobby, N, Rydell, E. Sjogren, W. Williams (2009) IT Products-Going Beyond | To discuss the recent standards review process conducted by TCO and industry. To reconcile consumer demand for high performance products and latest technology, while simultaneously influencing product development towards greater sustainability. | Environmental aspects, E-wastage, CO₂ emission, CSR, eco-labeling, TCO process, product design and development, buying pattern. | Survey Method | 1. There was significant demand for green products from past 5 years in North America.  
2. Environmental factors influenced 62% of consumers in their purchasing decisions and 25% are now considering more about being green than in 2008.  
3. Females consider more about green than men.  
4. 53% of consumers agree concern for environment, 23% concern energy consumption, 40% concern environmental issues while buying, |
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<td>3</td>
<td>D. Castro, (2009) Learning from the Korean Green IT Strategy</td>
<td>To highlight the South Korean green IT initiatives and inspire other countries in green IT implementations.</td>
<td>Green Initiatives in South Korea, eco-labeling, government role.</td>
<td>Executive Summary</td>
<td>1. In July 2009, South Korean committee announced a 5 year plan to add on a total of $87.7 billion in green investment which is equal to 2% of South Korea's GDP. 2. South Korea has taken initiatives with RFID technology in identifying greenhouse gases in forest. 3. South Korea should be ideal for other countries like U.S if they want to implement green IT initiatives.</td>
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<td>4</td>
<td>CGI Group, (2010) Emerging trends in Green IT</td>
<td>To present summary of emerging green IT concepts, approaches and provide overview of key areas where IT organisations can achieve savings and provide leadership in sustainable business practices.</td>
<td>Economy, Green programs and practices, Green Procurement.</td>
<td>Company White Paper</td>
<td>1. Green Initiatives make sound economic sense and generate substantial savings. 2. Raising energy demand, hazardous waste, increased e-waste, commuting costs leading retention issues, increasing real estate costs, rising airline tickets cost, stronger regulatory climate at federal states and local level are identified.</td>
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<td>5</td>
<td>Simon Mingay, (2007) Gartner Estimates ICT Industry Accounts for 2% of Global CO2 Emissions</td>
<td>To examine ICT industry influence on the environment and suggest the steps for the industry to practice green initiatives.</td>
<td>Environmental, GHG, power cost.</td>
<td>Executive Summary</td>
<td>1. ICT Industry is responsible in generating 2% of global CO₂ emissions.</td>
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3. Green IT practices offers the double win of reducing costs while demonstrating a positive environmental commitment.

4. On base of 20,000 work stations, annual saving for lower end devices 60 watt can save $900,000 yearly and higher end devices up to $2.4 million by power management policies, approx. saving per PC $30-80

5. Business with 20,000 desktops working 24X7 consuming 35 million KWH annually costing $0.855 per KWH, would cost business $3 million in utility charges annually.
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<td>6</td>
<td>Dr. Paul Schwarz - HANSA GCR, (2008) Green Tech Plus 2008</td>
<td>To address the important aspects and barriers of green purchasing attributes.</td>
<td>Green technology spending prioritise, drivers and barriers, industry leadership and decision makings.</td>
<td>Online web survey, statistical tools for calculation.</td>
<td>1. 77% are male and most of them are part of a team in purchasing decision making. 2. Four green pillars are identified viz., commitment on environmental stewardship, resources conservation and recycling, offering environmentally conscious products and reduces carbon footprint. 3. It was found being green is not so simple and companies should focus of being green before it conveys to its consumers to be green. 4. Greenwash, cost issues, product lacking functionality, leadership in purchasing decision making are found to be major barriers to consider green IT purchasing. 5. Totally 14 industry types are identified in which services industry has maximum response of green initiatives.</td>
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<td>7</td>
<td>Hugh Wareham, (2009)</td>
<td>To establish a baseline for the status of organisational green purchasing in Australia including the drivers, barriers</td>
<td>Green purchasing benefits, drivers, barriers, consumer</td>
<td>Content Analysis, Interview and questionnaire.</td>
<td>1. Green purchase provides benefits like reduced energy consumption, water consumption, improve resource usage efficiency, reduce waste, reduced pollution, and provide markets for new environmentally preferable products, viability of</td>
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<td>Sr. No.</td>
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|         | Green Purchasing in Australia | and the opportunities for progress. | and organisational approach, policy and regulations, eco labeling. | | recycling.  
2. Consumers fall into 4 groups: Leaders, leaning, learners and laggards.  
3. Consumer market for natural, healthy and sustainable products and services in Australia has grown over 25% to $15 billion in 2008 and reaching $22 billion by 2010.  
4. Major barriers for green purchasing found to be changing behaviour patterns, decentralized purchasing systems, budget constraints and need for ongoing support and education. |
| 8      | Kirk W. Cameron, (2010) Trading in Green IT | To convey message that by using green IT techniques can significantly reduce an organisation’s and ultimately a country’s- carbon footprint. | Carbon footprint, Trade and carbon credits, | Survey | 1. 1000 computers with green criteria could save 25% of their power consumption and avoid 350 metric tons of CO2. |
| 9      | S. Murugesan, (2008) Harnessing Green IT: | To convey a message that adopting a holistic approach to greening IT is our responsibility towards | Environmental and GHG problems, Factors of green IT initiatives and | Survey | 1. Green IT benefits the environment by improving energy efficiency, lowering GHG emissions, using less harmful materials and encouraging reuse and recycling process.  
2. Environmental legislation, rising cost of waste |
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<th>Sr. No.</th>
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<td></td>
<td>Principles and Practices</td>
<td>creating a more sustaining environment.</td>
<td>benefits, holistic approach of green IT.</td>
<td>Qualitative methodology, interview, thematic data analysis technique.</td>
<td>disposal, corporate image, public perception are major factors for green IT initiatives. 3. Each PC in use generates about a ton of carbon dioxide every year. 4. Reducing electricity consumption is a crucial to reduce carbon dioxide emissions and their impact on our environment and global warming. 5. Using green IT can reduce power usage up to 75%, cost by 73%, lower GHG, CO2 56%, and improve performance 55%, space saving 47%. 6. A thin client consumes only 1/5th of power of a desktop.</td>
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<td>10</td>
<td>Noushin Laila Ansari, Dr. Md. Mahfuz Ashraf, Bushra Tahseen Malik, Helena Grunfeld (2010)</td>
<td>To present findings from a green IT research project, dealing with mobile phone, battery disposal and recycling by businesses and individuals.</td>
<td>E-Wastage disposal, recycling, awareness level of green practices.</td>
<td>1. There is lack of awareness on mobile and battery disposals in Bangladesh. 2. People expect convenience when dealing with environmental issues.</td>
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<td>Green IT awareness and practices</td>
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| 11      | Paul Budde (2010) ICT solutions for Global warming and Energy saving | To convey message that ICT solutions are for global warming and energy saving. | Global warming, energy saving | Article | 1. Customers will be looking for more products and services that will allow them to maintain lifestyle that fall within their budget.  
2. India and China are found to be the biggest investors in alternative energy sources like solar and bio fuel.  
3. Next 5 years and beyond, ICT industry will take a leadership role in environmental programs. |
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<td>12</td>
<td>Robert R., Harmon, Noura Auseklis (2009) Sustainable IT services: Assessing the Impact of Green Computing Practices</td>
<td>To review the current literature on green computing and its influence on sustainable IT services with an idea to identify critical issues and leverage points in improving customer value, business value and societal value.</td>
<td>Driving factors adopting green computing, energy cost, implementing strategies, latest technology, green IT metrics.</td>
<td>Literature Review approach</td>
<td>1. Presents a review on current thinking and suggested driving factors that should be considered for a sustainable IT strategy. 2. Rapid growth of internet, increased equipment, power density, increasing cooling requirements, energy cost, restriction on energy supply, growing awareness of IT's impact on environment are major driving factors for green IT. 3. Data center infrastructure, power and workload management, Thermal load management, product design, cloud computing, virtualisation are considered to be green IT implementation strategies. 4. An integrated corporate wide sustainability strategy is necessary for IT services to be truly sustainable so that all departments act in an integrated fashion.</td>
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<td>13</td>
<td>Sania Khan, Krishna Kumar Veluri, Abdul Razak Honnutagi (2011) Prioritisation of Green IT parameters for Indian IT Industry: Using AHP</td>
<td>To focus and explore awareness levels, selecting the best suitable criteria and prioritise and rank them among the multiple criteria available with green IT practices in Indian IT industry.</td>
<td>Internal organisation, innovation and Learning, customer awareness, environmental effect and financial aspects.</td>
<td>Content Analysis, questionnaire survey, Balance score card, Analytical Hierarchical Process (AHP)</td>
<td>1. Internal organisation is ranked with high priority and financial perspective has been ranked last. 2. Among sub-criterion government policy and regulations, CSR are ranked with more weightage and infrastructure and automation has received last priority. 3. Study has identified maximum number of factors for green IT adoption.</td>
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<td>14</td>
<td>Schmidt Nils-Holger, Schmiditchen Timo, Erek Koray, Kolbe Lutz M., Zarnekow Ruediger (2010)</td>
<td>To evaluate the influence of green IT attributes of PCs on buying behaviour of consumers.</td>
<td>Potential market share of green PCs, measures for successful marketing, marketing mix, energy and disposal attributes of PCs</td>
<td>Online questionnaire survey, conjoint Analysis, Cluster Analysis, Discriminant Analysis.</td>
<td>1. PCs with green attributes will have 26.6% market share. 2. Collective importance of green IT attributes is 40.4% which is less than an average. 3. Green IT attributes possess below average importance to consumers. 4. Green attributes must be emphasised on PC development and improvement. 5. To place green IT attributed PCs in upper</td>
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<td>Influence of Green IT on Consumers Buying Behaviour of personal Computers: Implications from a Conjoint Analysis</td>
<td>To present the unresolved problems of green IT, does telecommuting makes difference or difficult to manage? And to study if cloud computing reduces number of data centers and reduces e-wastage.</td>
<td>Power consumption, cost reduction and waste elimination, logistic reduction, GHG emission, cloud computing, Metrics</td>
<td>Executive Summary</td>
<td>price segment. 6. Young, old and female consumers are targeted for green IT PCs selling.</td>
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<td>15</td>
<td>S. Ruth (2009) Green IT- More than a Three Percent Solution?</td>
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<td>1. Green computing idea started in 1992 when U.S EPA launched Energy Star. 2. IT related electronic wastage sold in 1980, generates 2 million tons of unwanted electronic devices in 2005 with only 10% to 20% being recycled. 3. Data centers with associated servers, A.C, fans, pumps, UPS etc., use 100 times energy per square foot of an office building. 4. CO₂ emission estimates in 2008 from operations was 1.442 million, manufacturing 3.5 million, product transport 1.8 million, employee business travel 425,000 tons.</td>
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<td>16</td>
<td>Tim Flannery (2010)</td>
<td>To understand what drives consumers towards eco-friendly and why not purchase behaviour match the consumer's attitude towards environmental conscious purchase intentions.</td>
<td>Factors influencing environmentally thoughtful purchase, environmentally aware and concern, environmental locus of control, Environmental consequences and individual</td>
<td>Online questionnaire survey</td>
<td>5. McAfee report shows spam emails also generates carbon emission, 62 trillion spam messages in 2008 generated 0.3 grams of CO₂, annual spam energy use 33 billion KWH equal to 2.4 million homes power consumption every year. 6. Cloud computing can reduces data center size serving large no. of clients efficiently with less cost comparatively.</td>
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1. 75.6% of respondents were aware of and concerned about environmental issues 2. About 91.2% believe their own pro-environmental behaviour can make a difference. 3. 89.3% of respondents had a positive perception on product performance for consumer electronic goods that incorporated green features. 4. Low response with 55.4% of consumers are aware of eco featured products and brands. |
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<tr>
<td>17</td>
<td>Tugrul Daim, Jay Justice, Mark Krampits, Matthew Letts, Ganesh Subramanian, Mukundan Thirumalai (2009) Data Center Metrics An energy efficiency model for IT Managers</td>
<td>To identify energy efficiency metrics that can be used by IT managers to measure and maintain the implementation of cost savings and green initiatives in data centers.</td>
<td>Reasons for energy savings in data center, strength and weakness of data center metrics are examined.</td>
<td>Questionnaire design, survey method</td>
<td>1. Data center efficiency is achieved by metrics in power, productivity and server performance.</td>
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<tr>
<td>CDW-G (2009) Implementing Green IT</td>
<td>To provide actionable tips from technology manufacturers themselves to help reach green goals and produce measurable results.</td>
<td>Power consumption, cost reduction and waste elimination</td>
<td>Executive Summary.</td>
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<tr>
<td>1. Shutting down of unused PC can save $15 to $20 yearly.</td>
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<td>2. 62% people buy low wattage and low power processors, 52% buy energy star 4.0 qualifying devices, 50% train their staff to shut down idle computers, 48% implement server consolidation and optimisation, 41% make full use of power management tools.</td>
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<td>3. An average office work uses 10,000 sheets of paper per year.</td>
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<td>4. One ton of recycled paper from fibers is equal to 17 to 31 trees.</td>
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<td>5. Screen savers consumes and waste power.</td>
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<td>6. Desktop uses 60 to 80 watt during normal use and 10 watts when idle, notebooks use 10 to 30 watts in normal use and 6 watts while idle.</td>
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<td>7. Hibernation mode consumes zero watts and sleep mode consume 0.2 watts.</td>
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<td>8. Recycled plastics account for 83% of the printer's total plastic weight and uses ink cartridges molded from recycled plastic resins.</td>
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<td>9. Some technology manufacturers like Acer are trying to make their packaging 100% recyclable.</td>
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| 10. Among government agencies in U.S 35% already implemented green IT, 26% will implement in next two years and 39% has no
plans for next two years.
11. Green IT strategies have multiple aspect benefits and good ROI.
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| 19      | Nlyte software (2011)   | To present trends in energy cost, IT data center management, and focusing on drivers, benefits of Green IT initiatives | Drivers, Benefits and technology enablers of Green IT, Trends in Energy cost, data center, IT role in CSR | Executive Summary | 1. Most data center managers lack visibility into energy use and costs.  
2. Controlling data center assets, staffs and monitoring them are key indicators of green IT initiatives.  
3. 85% of 65 corporate executives of fortune 500 companies says they will increase funds for green initiatives.  
4. 55% of European organisations have a CSR strategy and 44% says green IT will extremely support organisation's effort to reduce environmental impact and supports CSR.  
5. Data centers power usage was doubled from 2000 to 2006 and still doubles by 2011.  
6. Corporate energy cost represents up to 44% of total IT budget for many companies. |
<p>| 20      | Nathalie Bachour and Larry Chasteen (2010) | To focus on standards and factors for green IT within organisations and propose models for green IT project management and to evaluate | Internal driver, External drivers, e-wastage, technology and performance, power | Literature Review, Balanced Scorecard Method, modelling | 1. Conducting audit reviews based on reliable metrics in green IT project, proactively prepare project managers and organisations for environmental regulations may soon executed by government worldwide. |</p>
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<td></td>
<td>Optimising the Value of Green IT Projects within Organisations</td>
<td>organisational project achievements.</td>
<td>consumption, green IT reasons and success models.</td>
<td>methods and quality process used for developing models with a sustainability perspective.</td>
<td>1. By green IT practices TCS has reduced 12.5% reduction in electricity consumption, 76MWH of solar energy generation, 1.5 cubic meter of water reuse, 28% and 67% reduction in paper and printer cartridge consumption, leading 2% reduction in carbon footprint in 2007-08 compared to prior year. 2. Cost reduction, new business opportunities, CSR, regulation, incentives and standards, public and customer perception are considered to be drivers of green business. 3. Found India is generating 3.3 lakh tons of e-waste in 2007 expecting 4.7 lakh tons in 2011.</td>
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<td>21</td>
<td>Prof. Anand Siva Subramaniam (2008) Making IT Green -The TCS way</td>
<td>To present the views on green IT together with business opportunities and services that were undertaken externally for clients and internally within TCS.</td>
<td>Green business drivers, holistic view of green IT, environmental and e-waste issues.</td>
<td>Case Study</td>
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<td>22</td>
<td>William Young, Kamji Hwang, Seonaidh McDonald, Caroline J. Oates (2009) Sustainable Consumption: Green Consumer Behaviour when purchasing products</td>
<td>To investigate the micro purchasing decision process for green consumers in relation to consumer technology products in UK.</td>
<td>Eco-labels, barriers and enabling factors for green purchasing</td>
<td>In-depth interview data collection, snowballing technique for initial contact.</td>
<td>1. Educating consumers on environment aspects, time of purchase, experience in using or buying other products, lifestyle, life stage, living arrangements, work patterns were identified as major driving factors of green buyers while buying green products. 2. Lack of time to think more on green products, decision making regarding high price, lack of information on eco-friendly products, social performance of products and manufacturers, non-green criteria (habit and desire) were found to be major barriers for purchasing greener products. 3. Here the product environmental performance is only considered to be green criteria by green consumers, which shows they are not aware of other green criterion. 4. Only few considered green products, green manufacturers and green retailers for their choice of technology based products. 5. Only very small minority of consumers are</td>
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1. Consumers are ready to buy green products even if they are lower in quality in comparison to alternative products but will look for environmental information on labels.  
2. There is a relationship between price sensitivity and constant reading of labels indicating a sufficient information on product labels to make informed purchasing decisions.  
3. Inferences are given to suggest the business needs to provide a clear, accurate and easily readable label design to encourage perfect communication.  
4. There was good understanding from eco-labeled products leading to significant consumers green purchase intention.  
5. 69.7% indicated they would purchase environmentally safe products even if they were more expensive than alternative products, 51.7%
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<td>24</td>
<td>Alemayehu Molla, Vanessa Cooper, Siddhi Pittayachawan (2009) IT and Eco-sustainability: Developing &amp; validating a Green IT readiness Model</td>
<td>To develop a green IT readiness model, identify its key dimensions and develop a reliable and valid instrument to operationalise it.</td>
<td>Green IT capability constructs.</td>
<td>SEM, Online data collection method, convergent validity, discriminant validity, factorial validity.</td>
<td>1. Only 11% of total effective response rate is identified with 16% in Australia, 16% New Zealand, 5% in USA. 2. Most of the enterprises are medium size among them 21% are manufacturing companies and 41% are operating less than 50 servers. 3. Study is based on 5 dimensions namely attitude, practices, policies, green IT technology and green IT governance.</td>
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<td>25</td>
<td>Alemayehu Molla, (2008) GITAM: A Model for the Adoption of Green IT</td>
<td>To propose a theoretical model for green IT adoption from four distinct interrelated perspectives to predict the intention, breadth and depth of green IT adoption.</td>
<td>Green IT from technology, supply chain and strategic perspective.</td>
<td>Content Analysis of past literatures.</td>
<td>1. Depth insight into green IT can allow a complete understanding of green IT adoption among business. 2. Economical, regulatory and ethical drivers are identified for green IT adoption. 3. Perceived value network, green IT readiness referred to the readiness of the firm's suppliers, competitors, investors, partners and customers</td>
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|         |                        |         |        |                             | for green IT.  
|         |                        |         |        |                             | 4. Green IT is attracting a huge interest among IT vendors and consulting services mainly due to the increasing demand of power in data centers.  
|         |                        |         |        |                             | 5. IT plays a vital role in handling 98% of global CO₂ emissions apart from reducing its own 2% of emissions. |
2.6 RESEARCH GAPS FOUND FROM LITERATURE AND ROADMAP FOR THE STUDY

Based on the extensive review of literature on green IT, many research gaps were identified and however this study intends to address a few gaps out of the list shown below:

1. Green IT studies are envisaged from corporate view where the consumer studies found to be neglected. A major gap exists between green IT product development and consumer purchasing behaviour which is also termed as green marketing myopia.

2. Most of the green IT studies discussed many driving factors for green IT adoption but could not model the underlying green IT enabling or barring factors affecting the consumer purchasing behaviour.

3. The studies neither addressed potential relationships between each enabler nor the best predictor of consumer purchasing behaviour.

4. Only the issues related to green IT metrics, implementation, strategies were discussed with a little emphasize on environmental, economic and societal ethics with no proper outline explaining how these ethics will lead in building sustainable organisations.

5. There is also a gap in understanding the priority as well as weightages of various enablers relating to green IT on consumer purchasing behaviour.

6. The attempts were made to know the market share of the personal computers and laptops with green attributes which may not be applicable for different green IT product groups particularly from corporate outlook. However there is no consistent approach in suggesting the best strategy to grab the green IT consumers.

7. There is no clarity for policy makers and government on green IT enablers as the behaviour of these enablers on consumer purchasing is dynamic in nature since it changes from time to time.

8. The green IT literature presents possible benefits that can be delivered to its customers but could not provide comprehensive approaches for cost-benefit analysis of green IT products.
The research on hand aims to address few of the gaps listed in the preceding section and approach to research, as follows:

- One of the major gaps existing between green IT product development and consumer purchasing behavior, the researcher has attempted to carry out an extensive literature review with a view to compile all possible enablers influencing the consumers’ green IT products purchasing. In the published literature it was observed that the collective influence of all these enablers were not attempted and hence the present study focuses on creating an understanding on the relationships among all enablers. For this, an established strategic approach named interpretive structural modelling (ISM) shall be used for linking these enablers together based on the feedback obtained from experts and practitioners in the field of green IT.

- In order to extract the expert feedback and consensus amongst the experts, Delphi approach has been proposed. This feedback shall be used as the basic input for ISM and the outcome of this approach shall be a strategic relationship model connecting all the enablers providing scope for further analysis. This essentially becomes the research framework for the study on hand.

- In order to systematically analyse the proposed research model, a questionnaire instrument shall be developed and a pilot study could be conducted for its internal validity. The final questionnaire instrument shall be administered to the corporate respondents who are from IT background, IT product purchasing and C-level executives. This attempt is basically to obtain the data for understanding and analysis of various enablers connected in the model.

- In order to interpret the empirical interrelationships among identified enablers, structural equation modelling (SEM) approach is used as it serves the same purpose similar to other methods but in a more powerful way. The SEM is popularly used in handling the complex relationships of the elements in a system with multiple dependent and mediating factors which is most appropriate for the proposed ISM model in this study.
2.7 CHAPTER SUMMARY

Present chapter provided a review of relevant literature for the various constructs that form a part of this study. The constructs discussed in the present chapter are used for proposing a ISM based hierarchical model that explains corporate consumers’ green purchasing behaviour for green IT products. The overall green IT and green consumer studies are presented in an encapsulated tabular form to help in understanding the literature in a short preview. The development of proposed conceptual model and the hypothesised relationship between the various constructs are discussed in chapter 3 and chapter 4.