International Journal of Business Analytics
Volume 6 • Issue 4 • October-December 2019

An Evaluation on Carbon Footprint Indicators in Turkey Located Banks and Worldwide Banks

Özlem Yurtsever, Department of Industrial Engineering Department, Marmara University, Istanbul, Turkey
Seniye Umit Firat, Department of Industrial Engineering Department, Marmara University, Istanbul, Turkey
https://orcid.org/0000-0002-0271-5865

ABSTRACT

Global warming has become one of the most critical issues in the recent years. There is a great debate, centered on greenhouse gas emissions of countries, companies, and institutions. Not only the manufacturing sector but also service sector has begun to be questioned in terms of the need for controlling greenhouse gases. Thus, banks deserve an attention on the basis of sustainability and environmental impact. Besides the operational activities of this enormous sector, its investing and lending choices have considerable influence on sustainability. The carbon footprint measurement indicators have to be standardized in order to estimate the contributions of the banks in the global climate change precisely. In this study, carbon footprint measurement indicators, extracted from the sustainability reports and/or websites of the banks in Turkey are examined. The findings have been comparatively discussed with the measurements used by the international banks and addressed in the literature.

KEYWORDS

Banking Sector, Carbon Emissions, Carbon Footprint, Carbon Footprint Indicators, Service Sector

INTRODUCTION

The rays of the sun pass through the atmosphere and then heat Earth. The atmosphere stands like a greenhouse. Most of the thermal radiation reaching Earth from the Sun, are reflected. The atmosphere is composed of several gases mostly nitrogen and oxygen. Some gases in the atmosphere block the reflecting thermal radiation. Carbon dioxide, methane, nitrous oxide, water vapor and ozone are the main gases considered as greenhouse gases (GHGs) in the Earth's atmosphere (IPCC, 2007). The rate of greenhouse gases in the atmosphere began to increase after the industrial revolution in the early 1800s. The consumption of natural resources has increased to a point that mankind consumes resources of Earth faster than Earth can regenerate (Wackernagel et al., 2002). Quick growth of greenhouse gas emissions in the world is one of the result of this overconsumption (Arto, Genty, Rueda-Cantuche, Villanueva, & Andreoni, 2012) Rapid increase of the greenhouse gases in the atmosphere causes climate system change leading to potential negative effects on the ecosystem (Butchart et al., 2010). The term "global warming" is used to describe an ongoing increase in the average temperature of the Earth's atmosphere and its oceans. According to Intergovernmental Panel on Climate Change, IPCC (2007), the main cause of global climate change is the greenhouse gas emissions created by human activities in the atmosphere which lead to the rise in global average temperatures. Deforestation and

DOI: 10.4018/IJBAN.2019100106

Copyright © 2019, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

excessive use of fossil fuels are regarded as the main reasons of the increasing concentrations of GHGs in the atmosphere.

According to the United Nations Framework Convention on Climate Change, developed countries are mostly responsible for the current high levels of GHG emissions as a result of their industrial activities in the last century (United Nations, 1994). Future generations may face some difficulties due to the radical climate change. Strict environmental considerations should be taken in to account in order to avoid such catastrophic events.

The global risks classified risks that threaten the world as; Economic Risks, Environmental Risks, Geopolitical Risks, Social Risks and Technical Risks. Environmental risks include risks such as extreme weather events, natural disasters, human-induced environmental disasters, and failure to reduce climate change (Oktay Fırat, Yurtsever, İleri & Kıvılcım, 2017). The supply chain has become increasingly important in the business sector, both in manufacturing and service. Additionally, sustainable supply chain has become one of the important subjects in the supply chain management system (Er Kara, Yurtsever & Oktay Fırat, 2016; Er Kara & Oktay Fırat, 2016). From this aspect, carbon footprint calculations are becoming increasingly important in terms of reducing environmental risks and sustainable supply chain management.

According to the World Commission on Environment and Development Report (Brundtland, 1987) also known as Brundtland Report, sustainable development is the cooperation between today and the future. For sustainable development, the progress must satisfy the current demands without risking the future generations' ability to meet their own needs. As the climate change and global warming issues attract more and more attention, sustainability has become one of the most important topics of concern and research. Sustainable growth and sustainable development is based on environmental, social and economic perspectives. Morelli (2011) has defined environmental sustainability as a balance between preserving the ecosystem and biological diversity while allowing generations to satisfy their needs.

Environmental impact should be evaluated carefully for sustainable development. Consequently, sustainable solution strategies should be determined in order to preserve natural resources. Kyoto Meeting is the one of the most important international achievements to fight against global warming by reducing greenhouse gas concentrations. The famous protocol aimed to reduce the greenhouse gas emissions caused by human activities. The most important outcome of the protocol was determining a baseline for GHG emissions and limitation commitments of countries. In order to sustain GHG emissions according to the proposed commitments, each country must carry out detailed evaluations. Emission evaluations must be surveyed through each level of organizations from top to bottom. Generally, greenhouse gas emissions are calculated in terms of CO_2 equivalency.

As a good starting point, Kyoto Protocol brought awareness on global warming, but the Protocol targets mostly have not been met. On the basis of unsatisfactory outcomes of Kyoto Protocol; in 2015, COP21, also known as 2015 Paris Climate Conference took place with the participation of 195 countries. Realization of a new worldwide consensus regarding the reduction of the global warming has been the main reason for organizing 2015 Paris Climate Conference. Most of the participant countries agreed to give commitment on climate goals and report their progress regularly for the first time. This global climate agreement, ended with the acceptance of the Paris Agreement which will be put into force in 2020 (United Nations, 2015). The main objective of the agreement is limiting global average temperature increase 2°C according to the pre-industrial levels. Countries also agreed to limit this increase to 1.5 °C as a long term objective.

"Common but differentiated responsibilities" are considered in the agreement in regard to capacities and economic situations of the countries which are related with their carbon emission potential. While developed countries are obliged to contribute financially, developing countries are accepted to contribute on a voluntary basis (COP 21, 2015). To reach a common goal and set more ambitious targets in line with scientific facts, countries have agreed to meet every five years. Furthermore, in order to achieve transparency and monitoring, countries agreed on to share their progress.

There are some governmental, inter-governmental and non-governmental organizations (NGOs) which draw attention on climate change and guide countries and corporates. They provide scientific, technical and socio-economic information for the evaluation and prevention of the climate change. Moreover, these organizations support activities by forming guidelines for preventing the climate change and measurement of carbon emissions. There are also some NGO's that analyze some major banks for carbon emissions and provide guidelines. Some of the organizations abovementioned are summarized in Table 1.

Additionally, some standard criteria have been formed by different organizations like International Organization for Standardization (ISO) and British Standard Institution (BSI).

All countries should accept the significance of the global warming since it has become one of the most critical issues in the recent years. There is a great debate centered on greenhouse gas emissions of countries, companies, institutions. The energy consumption in the world is highly depended on fossil fuels. Hence, the energy related sectors have the highest share of global CO_2 emissions. Likewise, energy sector in Turkey had the highest share in CO_2 emission by 70% in 2012 (Oktay Fırat, Yurtsever, & Bilsel, 2015). Besides the energy sector, service sector especially the banking sector, deserves attention on the basis of sustainability and environmental impact. In addition to operational activities of this enormous sector, its investing and lending choices have considerable influence on environmental sustainability. Hence, greenhouse gases (GHG) emission measurement of banks is an important step to control and reduce the carbon footprint. Since banking has been one of the largest and most critical sectors in the global economy, it may be an imitable model for benchmarking.

The aim of the study is to examine carbon footprint measurement indicators of selected Turkish banks and comparatively investigate the indicators with international banks and literature studies. The carbon measurement indicators are extracted from the sustainability reports and/or websites of the related banks.

This study addresses the following research questions;

1. Do Turkish banks calculate their CO_2 emissions and publicly share the results?
2. Which indicators are used to calculate CO_2 emissions in the banking sector?
3. What are the similarities and gaps between banks located in Turkey and worldwide in the sense of carbon emission measurement indicators?
4. Are the indicators to measure carbon emissions standardized?

The paper is organized as follows: Section 1 addresses an analysis of carbon footprint indicators in terms of sustainable and green banking by reviewing literature and sustainability reports of selected banks. Then, in Section 2, a similarities and gaps between Turkish banks and worldwide banks are determined in terms of carbon footprint indicators. Section 3 contains obtained results and conclusions.

Table 1. Some major organizations and non-governmental organizations related to climate change

Major Organizations	Environmental NGOs	NGO's Specifically Analyze the Major Banks
• The Intergovernmental Panel on Climate Change (IPCC) • The United Nations (UN) • United States Environmental Protection Agency (EPA) • International Energy Agency (IEA)	• Global Reporting Initiative (GRI) • Carbon Disclosure Project (CDP) • World Resources Institute (WRI) • World Business Council for Sustainable Development (WBCSD)	• Banktrack • Rainforest Action Network (RAN) • Carbon Tracker

SUSTAINABLE AND GREEN BANKING: A COMPARATIVE ANALYSIS OF CARBON FOOTPRINT INDICATORS

The two most important elements of the climate movement are the reduction of greenhouse gas emissions and energy management. As a result of human activities, the amount of greenhouse gases in the atmosphere has increased, especially since the industrial revolution. Increasing concentrations of greenhouse gases in the atmosphere are regarded as the main cause of global warming. The trigger for climate change is the greenhouse gases, which can lead to more frequent or more extreme weather events in the future thus their concentrations need to be under environmental control (Oktay Fırat, Yurtsever, İleri & Kıvılcım, 2017).

Banking sector is a focused market since the business deregulated. Clients' demand for some services in banking sector led to an increase in the number of branches to serve a geologically scattered client base. (Cao, Leggio & Schniederjans, 2012) Therefore, the increase in number of branches also contributes to the increase in carbon footprint of the bank.

Biswas (2016) states that one of the major economic agents of change is financial institutions. Banking sector is a major component in the financial system and a key element of the economic development. The assets of banks are widely distributed across markets. Daily operations of a bank, in terms of use of paper, electricity, lighting, air conditioning, electronic equipment etc. all cause carbon emissions (Islam, Sharmeen, & Rahman, 2014). In addition to their own operational activities, lending and financing projects in various sectors can affect the carbon emissions of the banks. Thus, in addition to their direct effects, banks are indirectly involved in carbon emissions. In this manner, banks may play a major role in supporting sustainability by funding the socially and environmentally responsible investment projects. As implementers of innovation and technology, banks can apply green practices and thereby lead the path in this worldwide initiative. In this manner, new terms such as "ethical bank", "sustainable bank" or "green bank" are introduced to the literature. The role of financial institutions in sustainable development is guided by the United Nation Environmental Program Finance Initiative (UNEP-FI). According to the UNEP-FI (United Nations Environment Programme Finance Initiative, 2007), a sustainable bank considers the influences of its own operations, products and services for the current and future generation. In order to promote the reduction of the carbon emission, the banks should motivate and finance the environmentally friendly technologies and projects.

Green is becoming a symbol of eco-awareness in the world. Green bank considers all the social, ecological and environmental factors. By green banking, technological improvements, operational improvements and changing client habits are taken into account (Biswas, 2011). Additionally, promoting eco-friendly practices and reducing the carbon footprint are also important in green banking activities (Jha & Bhome, 2013). Banks should adopt environmentally friendly practices within their banking organizations and also they should consider the environmental impact of the projects while funding them and investing in them. It can be concluded that green banking approach involves environmentally friendly practices at every level of its activities.

Meena (2013) identified four benefits of green banking.

1. Green banking avoids paper work. Green banks reduce the paper usage by introducing online and SMS banking services. Thus, green banking helps reducing deforestation and commits less contribution to global warming.
2. Environmental awareness among employees and customers are created by green banking. The author emphasized that, green banking contribute to the positive image among the stakeholders.
3. Green banking aims to provide loans at lower interest rates to environmentally friendly projects such as fuel efficient vehicles and green building projects. By this action, green banks encourage businesses to be more environmentally friendly.

4. Green banks introduce environmental standards for lending which lead the business owners to change their businesses in to a more environmentally friendly establishment.

Some of the following components can be taken into account for going green in banking (Jha & Bhome, 2013; Rahman, Ahsan, Hossain, & Hoq, 2013)

- Financing the green projects
- Green funds
- Online banking services
- Mobile banking
- Green credit cards
- Use of green checking accounts
- Minimizing plastic consumption
- Use of power saving equipment
- Reducing air pollution
- Minimizing their carbon footprint
- Organizing environmental campaigns
- Use of renewable energies
- Saving paper

Green banking is a global initiative and the eco-friendly policies play a very special role for developing countries. Green banking involves the environmental and social responsibility of banks through their operations, financial products and services. Banks should reduce the paperwork and transform to online transactions for going green. From this point of view, promoting the mobile banking is an important step to minimize carbon footprint of banking sector (Nisha, 2016).

Besides the management actions, the approach of employees is also important. If employees become integrated into the organization culture and sustainability awareness, this is a positive component for sustainability in long term (Wolf & Mujtaba, 2011). Creating sustainability awareness is reflected in employees' perceptions, attitudes and behavior. Employees can reduce their wastage activities that cause greenhouse gas emissions such as reducing paper wastage, electricity wastage. Being the part of the organization's sustainability culture, employees can contribute to the bank's overall carbon footprint reduction targets.

Literature on sustainable and green banking is reviewed and a brief summary is given in Table 2.

It can be seen from Table 2 that green banking topic is a worldwide issue since the studies are done for different countries. In the reviewed literature, all the authors suggest banks to consider the environmental issues and be more sustainable. Some of the authors identified ways for banks to fight climate change. Some of the literatures have identified common green banking practices. Some authors have suggestions to the banks while going in green like funding environmentally friendly projects. Also, some of them have identified key elements for carbon emissions and have focused to reduce their GHG emissions. Besides, the awareness of customers for green banking products and environmental issues are studied widely in the literature.

Since the carbon footprint measurement in banks is a recent topic, there are a limited number of studies carried out regarding this matter.

According to Bimha and Nhamo (2013) banking activities can be examined in two categories such as internal and external operations. Internal operations of banks are the work inputs that directly affect the environment. Some of these internal operations are business travel, use of electricity, paper usage, renting and owning of office space or buildings, other equipment and resources. On the other hand, the external operations is considered as banking products and services which may affect the natural environment indirectly when used by the banking customers. Bimha and Nhamo (2013) analyzed carbon footprint models for South African banks by a conceptualized benchmark model.

Table 2. Literature on sustainable and green banking

Author(s)	Research Topic	Findings / Results / Conclusions
Goyal and Joshi (2011)	Underlined social and ethical issues such as social banking, ethical banking, green banking, rural banking etc. which assists the accomplishment of sustainable development of banking and finance.	• Customers have become aware of different environmental issues • Banks can be social and ethically oriented organizations by giving the loans to organizations which concern about environment rather than thinking only the profitability.
Sharma, Sarika, and Gopal (2014)	Awareness of customers and bank employees in regard to green banking concept in public and private sector banks in India	Customers are not aware of green banking initiatives even though few green banking strategies are initiated by the banks.
Bihari (2011)	Studied Indian Banking Industry's green banking initiatives	• Before considering of financing a project, banks, as part of the society, should clarify the project if it is environmentally friendly or not and if it has any future implications on environment or not.
Islam and Das (2013)	Conducted a study which is mainly based on secondary data and which highlights the mobile banking, online banking, green banking and green financing	• Although Bangladesh is one of the most climate change vulnerable countries in the world, green banking practices in Bangladesh are not satisfactory enough. • Banks should consider the environmental issues and the government should encourage the green banking practices.
Ganda and Ngwakwe (2014)	Find out if South African banks are engaged in sustainable development practices by analyzing energy and carbon reduction practices of the banks. 11 South African banks have been selected regarding the case study they conducted.	• The operations of 11 banks are functioned with energy efficiency and carbon reduction practices. • On the other hand, some banks still need to establish their sustainability or green departments.
Bahl (2012)	Find out the most significant green banking strategies in India	• Top priority in green banking strategies is carbon footprint reduction by green building. • Green banking financial products have had also an outstanding weightage. • Giving loans in projects which reduces pollution or uses green technology is important
Bimha and Nhamo (2013)	Specified banking operations as internal and external operations and compare them in the sense of GHG emissions.	Internal operations are cleaner and free from radical amounts of GHG than external operations
Ditz, Institute, and Ranganathan (1997)	Identified four key elements of corporate environmental performance related to carbon emissions	Key elements of corporate environmental performance related to carbon emissions are material use, energy consumption, non-product output and pollutant releases
Mortimer, Ashley, Moody, Rix, and Moss (1998)	Carbon dioxide savings in the commercial building sector	Carbon reductions were possible with the adaptation of cost-effective energy, installation and operation of energy-saving building services and plants.
Imeson and Sim (2010)	Identified three ways that banks are using to fight against climate change	Identified three ways that banks are using to fight against climate change • climate proof • climate friendly • climate profitability
Chang, Kuo, and Chen (2013)	Measured changes in corporate sustainability performance over numerous industries by using Data Envelopment Analysis (DEA)	Identified important components of corporate sustainability using the key elements of sustainability (economic, social, and environmental) as eco-efficiency (environmental performance), environmental policy and management, and environmental reporting
Aranda, Ferreira, Mainar-Toledo, Scarpellini, and Sastresa (2012)	Used regression analysis to analyze energy consumption in the Spanish banking sector	• Authors did not pursue to link energy savings for reduced carbon emissions however for the service industry; they validated important variables for reducing carbon emission. • They identified a correlation between some variables like number of employees, office surface area and annual energy consumption. They found out that firm's employee number was highly correlated to the rest of the variables.
Shaumya & Arulrajah, A. A. (2016)	Identified and discovered the green banking practices of selected private banks in Sri Lanka by using the secondary sources mainly from the annual reports of the banks in Sri Lanka	• 67 green banking activities were identified. • The common green banking practices that are found in this study are: ○ Implementation of social and environmental management system ○ Installation of energy saving equipment ○ E-waste management
Sahoo, B. P., Singh, A., & Jain, M. N. (2016)	Focused on examining the relationship between different age groups of customers and adoption of green banking products. ANOVA and post hoc tests are applied for analyzing.	• Across various age groups, there is an important difference in the usage of green banking products • Young generation customers are more motivated towards green banking products then middle age and senior age groups. • Awareness of green banking for middle age and senior age customers are lower than young generations.
Ada, A. A., & Kılıç, Z. (2014)	Examine and compare the contributions of the banks operating in the European Union (EU) and Turkey to sustainable development	• The banks in Turkey have begun to support sustainable development like the banks in the EU. • In the light of decisions and policies, the funds allocated to renewable energy by banks have been increased in Turkey. • However existence of banks operating in the EU countries with an understanding of ethical banking and the funds allocated for sustainable development by many commercial banks are considerably higher than those of Turkey.
Dayan, V. (2015)	By banks reports and studies, Canadian and Turkish banks are compared in terms of sustainable banking. Eight of 28 domestic Canadian banks and eight of 32 domestic Turkish banks are selected.	• In terms of environmental sustainability, both Turkish and Canadian banks are found to show similar characteristics: ○ Renewable energy investment is given priority. ○ Energy and climate friendly processes within the organizations are considered ○ Recycling projects are considered • Sustainability practices of Canadian banks especially outside the bank building stands out Turkish banks. • In terms of footprint measurement, Canadian Banks have more efficient practices.

They found that banks have detailed carbon footprints of their internal operations rather than their external operations. Based on this finding, a conceptual framework that includes both internal and external banking systems is recommended in order to have an integrative approach in measuring the carbon emissions.

Bimha (2014) studied the carbon reduction efficiency in the banking sector and used Data Envelopment Analysis (DEA) to measure the carbon reduction efficiency of the major South African banks. As a result, Bimha (2014) found out that the company with the best practices is the one that is the most efficient in reducing carbon emissions.

Seattle office of Sustainability and Environment (2008), performed a case study on Home Street Bank. In the case study, they determined that energy use and commute travel were the main resources for the carbon emissions of the bank. They tried to find out the strategies for carbon reduction which maximize opportunities for improvement and minimize business impacts. Furthermore, by cutting computer servers and runtime hours on desktop, Home Street Bank was able to reduce its electricity consumption.

Indicators to measure carbon footprint used by the last three above-mentioned studies can be summarized in the Table 3.

As discussed above, some methods like Data Envelopment Analysis (DEA), or benchmarking is used to analyze the carbon reduction and environmental performance. To calculate CO_2 emissions most critical variables are material use, energy consumption, traveling, number of employees and

Table 3. Carbon measurement indicators in related studies

Name of the Article / Report	Carbon Measurement Indicators in Related Studies		
Conceptual framework for carbon foot printing in the South African banking sector	• Energy sources o Electricity consumption ■ Data centers ■ Heating ■ Cooling o Natural Gas o Energy from primary fuel sources ■ Diesel generator ■ Kerosene ■ Light oil ■ Heavy oil ■ LPG ■ Gas o Energy from renewable sources	• Travel o Business Air Travel ■ International travel ■ Domestic travel ■ Short haul air travel ■ Medium haul travel ■ Long haul travel ■ Hotel stay (nights) o Business fleet travel ■ Company owned/leased vehicles ■ Hotel stays ■ Taxis o Employee commuting/work travel ■ Public rail system ■ Public bus system ■ Employee personnel car	• Waste o Waste to landfill o Waste recycled • Paper usage o Paper used o Paper recycled
HomeStreetBank: A Carbon Footprint Measurement Case Study	• Energy Use o Electricity o Natural Gas	• Travel o Business Travel ■ Air ■ Ground • Bus • Car • Truck • Train • Ferry o Employee commuting	• Paper Use • Waste/Garbage • Recycling o Cans o Bottles o Paper
The Internal Carbon Emissions Reduction Efficiency of the South African Banking Sector-A Data Envelopment Analysis	• Paper usage • Electricity usage • Business travel		

non-product outputs such as wastes and pollutant releases. It is apparent that the companies which are the most efficient in reducing carbon emissions will have the spectacular success in this manner.

In addition to the literature mentioned above, it is important to understand the situation of the banks located in Turkey. Finansbank ranking in the 8th place according to total assets has a total asset of 87,354 million TL which is less than half of the total assets of Vakıflar Bank.'s that ranks in the 7th place. Since this is a turning point, the top seven banks of Turkey will be examined in this study. Asset size, foundation year, numbers of branches, employees and ATMs of the top seven list according to the report of the Banks Association of Turkey by March 2017 is given in Table 4 (Türkiye Bankalar Birliği, 2016a).

All of these banks publish their yearly sustainability reports that are available in their web sites. Some highlights on Environmental Sustainability of the banks from their sustainability reports are also given in Table 5 (Akbank, 2016; Türkiye Cumhuriyeti Ziraat Bankası, 2015; Türkiye Garanti Bankası, 2016; Türkiye Halk Bankası, 2016; Türkiye İş Bankası, 2016; Türkiye Vakıflar Bankası, 2016; Yapı ve Kredi Bankası, 2016.)

From the sustainability reports of the top 7 banks in Turkey above mentioned, factors which have been used by each bank to measure carbon footprint can be summarized as in Table 6.

It is clear that almost all the top seven Turkish banks calculate their carbon footprint in three main categories that are energy usage, travel and paper usage. Nevertheless, from Table 6, it is clear that not all the banks use the same indicators under these main categories to measure carbon footprint. Some banks have more indicators of energy usage or travel than the others. Carbon measurement indicators used by the top seven Turkish Banks are summarized in the cross table (Table 7).

For calculating carbon emissions from energy usage, only Akbank did not mention about natural gas consumption. Likewise, out of these seven banks, only Vakıf Bank did not mention about electricity consumption. Burning of coal and lignite emit more carbon dioxide with respect to the energy content than burning of natural gas. Despite this fact, only Garanti Bank and Halk Bank have calculated coal consumption and only Vakıf Bank has calculated lignite consumption.

On the other hand, for the travel category in order to calculate carbon footprint, only Ziraat Bank, İş Bank and Garanti Bank made a breakdown of vehicles by fuel usage; as diesel and gasoline vehicle. Only Akbank, Halk Bank and Vakıf Bank made a breakdown of the emissions from travel usage by personnel commuting, staff shuttle and company vehicles or official cars. Vakıf Bank and Garanti Bank were the two banks that mention about emissions from air travel. Out of the 7 banks only Ziraat Bank did not measure their paper usage.

Table 4. Profiles of Top 7 Turkish banks

#	Name of the Bank	Total Assets (Million TL) by March 2017	Foundation Year	Number of Branch by March 2017	Number of Employee by March 2017	Number of ATM by February 2016
1	Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	384,695	1863	1,818	25,008	6,532
2	Türkiye İş Bankası A.Ş.	333,449	1924	1,373	24,753	6,515
3	Türkiye Garanti Bankası A.Ş.	300,420	1946	965	19,506	4,476
4	Akbank T.A.Ş.	282,980	1948	839	13,826	4,203
5	Yapı ve Kredi Bankası A.Ş.	262,133	1944	931	18,371	4,272
6	Türkiye Halk Bankası A.Ş.	247,830	1938	966	17,762	1,818
7	Türkiye Vakıflar Bankası T.A.O.	221,012	1954	924	15,678	3,400

Table 5. Some Highlights of Turkish banks on environmental sustainability

Name of the Bank	Highlights
Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	The bank published its first sustainability report in 2013-2014, measured carbon footprint and shared with public
Türkiye İş Bankası A.Ş.	The bank provided a loan of 625 million US dollars to 983 renewable energy projects with settled power capacity of 874 MW in 2016. The bank had its first carbon emission measurement in 2011, involving 14 spots including head office and branches
Türkiye Garanti Bankası A.Ş.	The total amount of funding provided from 2006 to present on renewable energy investments exceeded 4 billion US dollars. The bank has awarded "CDP Turkey Climate Disclosure Leader" in 2015. It was the first Turkish bank to be member on "Caring for Climate" (C4C) in Turkey. The bank has been calculating its carbon footprint since 2009. In addition, it had an A performance band from CDP (Carbon Disclosure Project) two years in a row by 2016. Garanti Bank is one of the four banks in Turkey that signs the UNEP-FI statement.
Akbank T.A.Ş.	The bank has joined in CDP climate change program for the first time in 2009. It drew attention to environmental transparency by supporting the implementation of Carbon Disclosure Project in Turkey. In order to create a new road map for fighting against global climate change, the bank signed a statement at COP21 Conference of the Parties in Paris which calls the parties to fight against climate change
Yapı ve Kredi Bankası A.Ş.	The certification process in ISO 14064 has started in 2011. From the greenhouse gas calculations, in the head office and banking centers, about 637 tons of CO_2e reductions have been achieved in 2016 compared to 2015. Yapı Kredi Bank is one of the four banks in Turkey that signs the UNEP-FI statement.
Türkiye Halk Bankası A.Ş.	The bank has been calculating carbon footprint and developing reduction strategies since 2013. The bank also shares the CDP report, which is generated yearly, and carbon footprint with its shareholders
Türkiye Vakıflar Bankası T.A.O.	The bank provides financial source for the country as well as sourcing projects evaluated for environmental and social effects through carrying out credit practices with international financial foundations such as World Bank, European Bank for Reconstruction and Development, European Investment Bank. They gained reduction of 192.430 ton/year of carbon emission and 747.480 MWh/year primary energy savings as a result of 119 million US dollars of credit usage provided as part of Turkey Sustainable Energy Financing Program (TurSEFF) which has been conducted since 2010. The bank got 91 points out of 100 in C performance band

According to the banks' sustainability reports, the change of carbon emission amounts compared to the previous year is summarized in Table 8. Four banks reduced their carbon emissions in one year. Ziraat Bank has the highest increase with 12,3% whereas İş Bank has the lowest increase by 1,4% in one year. The best bank which has decreased its carbon emissions in one year was Vakıfbank with 13,0% decrease.

Apart from the banks located in Turkey, it is important to examine some worldwide banks as well. Within the list of the top 30 banks ranked by their assets in March 2016 (Statista, 2016), banks belonging to 11 different countries were taken into consideration in the sense of carbon footprint. The first bank from each of the 11 countries was determined according to its worldwide assets ranking and included in the research study. In order to evaluate the worldwide picture of GHGs, it is essential to know the total carbon dioxide emissions of the related countries and their rankings in the world. The names and rankings of these banks, and their countries with total CO_2 emissions are given in Table 9 (Worldbank, 2017).

Table 6. Carbon measurement indicators of selected 7 Turkish banks

#	Name of the Bank	Carbon Measurement Indicators in Related Banks	
1	Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	• Naturalgas (m^3) • Gasoline (liter)	• Diesel (liter) o number of diesel vehicles • Purchased electricity (kWh)
2	Türkiye İş Bankası A.Ş.	• Electricity consumption (kWh) • Natural gas consumption (m^3)	• Fleet (gasoline and diesel) • Staff shuttle • Paper usage
3	Türkiye Garanti Bankası A.Ş.	• Electricity consumption (MWh) • Natural gas consumption (m^3) • Diesel fuel consumption (m^3) • Coal consumption (tonnes) • Fuel Oil consumption (liter)	• Diesel consumption from usage of generator Business travel – air traveel • Fleet (gasoline and diesel) • Funded Energy Projects • Paper usage
4	Akbank T.A.Ş.	• Emissions from Electricity consumption o Headquarters o District offices o Branches o ATMs	• Emissions from fuel used for heating purposes • Personnel commuting o Staff shuttle o Official car • Paper usage
5	Yapı ve Kredi Bankası A.Ş.	• Calculations in head office and branches o Electricity consumption o Natural gas consumption o Diesel consumption from usage of generator	• Staff shuttle • Paper usage
6	Türkiye Halk Bankası A.Ş.	• Electricity consumption (kWh) o Headquarters o Branches o ATMs • Natural gas consumption (m^3) o Headquarters o Branches • Fuel Oil Consumption (tons)	• Coal Consumption (tons) • Diesel fuel consumption (liter) o Generators o Headquarters o Branches • Fleet (gasoline and diesel) o Staff shuttle o Company vehicles • Paper usage
7	Türkiye Vakıflar Bankası T.A.O.	• Types of fuels used o Lignite o Natural gas o Heating oil o Gasoline o Diesel	• Personnel commuting • Business travel – air travel • Paper usage

In 2012, China shares 23,6% of total carbon emissions of the world and ranks in the first place. USA which shares 12,0% of total carbon emissions of the world, ranks in the second place. Japan, Canada and Germany rank in the 6th, 7th and 8th place, and shares 2,8%, 1,9% and 1,8% of total carbon emissions of the world, respectively. Rest of the above-mentioned countries have a share of 1,1% and less in total.

As Table 8 shows, the carbon emission values of the top seven banks in Turkey vary in a large range between 22 to 85 kton CO_2e per year according to the measurements performed last year. Energy consumption rates of developed countries are higher than the other countries. Since energy consumption rate increases with the level of development, there is a strong positive correlation between carbon emission levels and GDPs of countries (Durmuşoğlu, Selam, & Fırat, 2017). Based on this result, it is possible to assume that there is a positive correlation between carbon emissions level and

Table 7. Breakdown of the carbon measurement indicators of the top seven Turkish banks

	Ziraat Bank	İş Bank	Garanti Bank	Akbank	Yapı Kredi Bank	Halk Bank	Vakıf Bank
ENERGY	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Natural gas consumption	x	x	x		x	x	x
Electricity consumption	x	x	x	x	x	x	
Coal Consumption			x			x	
Fuel Oil Consumption			x			x	
Heating oil							x
Diesel	x		x			x	x
Diesel consumption from usage of generator			x		x	x	
Lignite							x
Emissions from fuel used for heating purposes				x			
TRAVEL	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Diesel vehicles	x	x	x				
Gasoline vehicles	x	x	x				
Staff shuttle		x		x	x	x	
Company vehicles/official cars				x		x	
Air travel			x				x
Personnel commuting							x
PAPER		**x**	**x**	**x**	**x**	**x**	**x**

Table 8. Carbon emission amount of the top seven Turkish banks

Name of the bank	Year of start to Carbon measurement	Amount of carbon measured in last year (eq. of CO_2)	Amount of carbon measured in the previous year (eq. of CO_2)	Change compared to previous year (%)
Ziraat Bank	2013	**2015**: 53.069 tons	**2014**: 47.264 tons	+ 12,3
İş Bank .	2011	**2016**: 23.549 tons	**2015**: 23.230 tons	+ 1,4
Garanti Bank	2009	**2016**: 71.364 tons	**2015**: 78.333 tons	**- 8,9**
Akbank	2009	**2016**: 51.358 tons	**2015**: 54.996 tons	**- 6,6**
Yapı ve Kredi Bank	N/A	**2016**: 84.600 tons	**2015**: 86.863 tons	**- 2,6**
Halk Bank	2013	**2016**: 77.278 tons	**2015**: 71.737 tons	+ 7,7
Vakıflar Bank	N/A	**2016**: 22.683 tons	**2015**: 26.070 tons	**- 13,0**

asset size of banks. However, such a comparison cannot be made since carbon emission amounts are evaluated via using different indicators and methodologies different indicators and methodologies by the banks in Turkey and even worldwide.

Table 9. Ranking of worldwide banks by assets and total CO_2 emissions of respective countries

Country	Total CO_2 Emission (kiloton, CO_2 eq.)	CO_2 Emission Ranking in the World – 2012	Name of the Bank	Ranking by Assets, March 2016
China	12.454.711	1	Industrial & Commercial Bank of China	1
USA	6.343.841	2	JPMorgan Chase & Co	7
Japan	1.478.859	6	Mitsubishi UFJ Financial Group	3
Canada	1.027.064	7	Royal Bank of Canada	30
Germany	951.717	8	Deutsche Bank	10
UK	585.780	15	HSBC Holdings	6
France	499.147	20	BNP Paribas	8
Italy	482.634	22	UniCredit S.p.A.,	26
Spain	348.257	32	Banco Santander	20
Netherlands	195.873	41	ING Group NV	28
Switzerland	54.108	92	UBS AG	27

Source: World Bank Statistics

From the sustainability reports of the banks mentioned in Table 9 (Banco Santander, 2015; BNP Paribas, 2015; Deutsche Bank, 2015; HSBC, 2015; ICBC, 2015; ING Group, 2015; JP Morgan Chase, 2015; Mitsubishi UFJ, 2015; Royal Bank of Canada, 2015; UBS, 2016; UniCredit, 2015), factors which have been used by each bank to measure carbon footprint can be summarized as in Table 10.

It is clear that all banks calculate carbon emissions in three main categories that are energy usage, travel and paper usage. However, from Table 9, it is obvious that not all the banks use the same indicators to measure the carbon footprint. Some banks have more breakdowns of energy or travel than the others. Carbon measurement indicators used by the 11 worldwide banks are summarized in the cross table (Table 11)

From the sustainability reports of these eleven banks, HSBC Bank and UniCredit S.p.A did not breakdown their energy usage. Remaining all other banks used electricity consumption as one of the indicators for energy usage. In addition, out of the nine banks, six banks directly mentioned about natural gas. On the other hand, Deutsche Bank claims that they have calculated emissions from liquid fossil fuels, Royal Bank of Canada mentioned about heating fuel and Mitsubishi UFJ mentioned about city gas. Liquid fossil fuels, heating fuels and city gas can be a substitution of natural gas. Mitsubishi UFJ is the only bank that has a detailed breakdown of fuel usage as city gas, LPG, kerosene, light oil, heavy oil, and gasoline.

Royal Bank of Canada and UniCredit S.p.A did not breakdown travel indicator. Industrial & Commercial Bank of China is the only bank out of the nine banks which did not consider air travel. Only Deutsche Bank has calculated the emissions from taxis and rented vehicles. On the other hand, for the emissions from rail travel, only 4 banks have calculated carbon footprint and these banks are HSBC Holding, BNP Paribas, Deutsche Bank and UBS AG. Banco Santander and UBS AG are the two banks which measures the paper usage.

Table 10. Carbon measurement indicators of selected 11 worldwide banks

Bank	Rank by Assets, March 2016	Report Year	Carbon Measurement Indicators in Related Banks	
Industrial & Commercial Bank of China	1	2015	• Electricity • Natural Gas	• Fleet fuel • Paper
Mitsubishi UFJ Financial Group	4	2016	• Energy o City gas o LPG o Kerosene o Light oil o Heavy oil o Steam/hot water o Gasoline o Electricity	• Employee Travel and transportation o Overseas o Company automobiles
HSBC Holdings	6	2015	• Energy	• Travel o Air o Rail o Road
JPMorgan Chase & Co	7	2015	• Energy consumption o Electricity o Steam o Chilled water o Natural gas o Propane o Fuel oil o Chiller plants (fugitive emissions) o Jet fuel • Air travel	
BNP Paribas	8	2015	• Traveling o Air travel o Road travel o Train travel	• Energy o Fuel oil o Natural Gas o Renewable electricity o Standard electricity
Deutsche Bank	10	2015	• Scope 1, direct GHG emissions from; o natural gas consumption o liquid fossil fuels o HFCs o owned/leased vehicles o Electricity from renewables	• Scope 2, indirect GHG emissions o Market based emissions from; ■ electricity consumption ■ steam, district heating and cooling • Scope 3, indirect GHG emissions from; o air travel o rented vehicles and taxis o rail travel
Banco Santander	20	2015	• Energy Use o Normal electricity consumption o Green electricity consumption o Natural gas consumption o Diesel consumption • Paper usage	• Indirect emissions from displacement of employees o private car o group transport o by train, o business travel of employees when travelling in plane or by car.
UniCredit S.p.A.,	26	2015	• Fleet • Energy	
UBS AG	27	2015	• Total direct energy consumption o natural gas o heating oil o fuels (petrol, diesel, gas) o Renewable energy • Total business travel o rail o road o air • Total paper consumption	• Total intermediate energy purchased o electricity o electricity from gas-fired power stations o electricity from oil-fired power stations o electricity from coal-fired power stations o electricity from nuclear power stations o electricity from hydroelectric power stations o electricity from other renewable resources
ING Group NV	28	2015	• Energy consumption o natural gas o fuel oil; o electricity o renewable electricity o district heating;	• Business travel o by air o car
Royal Bank of Canada	30	2015	• Heating fuel use • Electricity use and steam	• Employee travel • Green power purchase

Source: Sustainability Reports of Relevant Banks

Table 11. Carbon measurement indicators breakdown for selected worldwide banks

	Industrial & Commercial Bank of China	Mitsubishi UFJ Financial Group	HSBC Holdings	JPMorgan Chase & Co	BNP Paribas	Deutsche Bank	Banco Santander	UniCredit S.p.A.,	UBS AG	ING Group NV	Royal Bank of Canada
ENERGY	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Electricity	x	x		x	x	x	x		x	x	x
Renewable electricity					x	x	x		x	x	
Natural Gas	x			x	x		x		x	x	
City gas		x									
LPG		x									
Kerosene		x									
Light oil		x									
Heavy oil		x									
Steam/hot water		x		x							x
Diesel							x		x		
Gasoline		x									
Chilled water				x							
Propane				x							
Chiller plants (fugitive emissions)				x							
Jet fuel				x							
Liquid fossil fuels						x					
HFC						x					
Heating fuel											x
Fuel oil					x					x	
TRAVEL	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Fleet/ Company automobiles	x	x					x			x	
Overseas		x									
Air			x	x	x	x	x		x	x	
Rail			x		x	x			x		
Road			x		x		x		x		
Rented vehicles						x					
Taxis						x					
PAPER							**x**		**x**		

COMPARATIVE RESULTS AND DISCUSSION

Similarities and gaps between Turkish banks and worldwide banks are determined by comparing the carbon emission measurement indicators from the banks' published sustainability reports. In the second stage, 18 banks' applications and literature findings are compared in this manner. The brief comparison of carbon measurement indicators is given in Table 12.

The common indicators for the emissions of energy usage are electricity consumption, natural gas consumption, diesel, fossil fuel, heating fuel and fuel oil around the banks located in Turkey and worldwide. Consumption of LPG, kerosene, light oil, heavy oil, gasoline, chilled water, chiller plants (fugitive emissions), jet fuel, propane and hydroflorocarbon are not measured in Turkey and for the

Table 12. Comparison of carbon measurement indicators

Indicators	Banks in Turkey (7)	Worldwide Banks (11)	Articles/ Reports (3)	Indicators	Banks in Turkey (7)	Worldwide Banks (11)	Articles/ Reports (3)
ENERGY	7/7	11/11	3/3	TRAVEL	7/7	11/11	3/3
Electricity	6/7	9/11	3/3	Fleet/Company automobiles/Rented cars	2/7	4/11	1/3
Renewable electricity	None	5/11	1/3	Diesel vehicles	3/7	None	None
Natural Gas	6/7	6/11	2/3	Rail	None	4/11	2/3
City gas	None	1/11	1/3	Ferry	None	None	1/3
LPG	None	1/11	1/3	Air travel/Overseas	2/7	8/11	2/3
Kerosene	None	1/11	1/3	Road	None	4/11	2/3
Light oil	None	1/11	1/3	Taxis	None	1/11	1/3
Heavy oil	None	1/11	1/3	Staff shuttle	4/7	None	None
Steam/hot water	None	3/11	None	Personnel car	None	None	1/3
Diesel	4/7	2/11	None	Personnel commuting	1/7	None	2/3
Diesel consumption from usage of generator	3/7	None	1/3	Hotel stay	None	None	1/3
Gasoline	None	1/11	None	PAPER	6/7	2/11	3/3
Chilled water	None	1/11	None	WASTE	None	None	2/3
Propane	None	1/11	None	RECYCLED WASTE	None	None	2/3
Chiller plants (fugitive emissions)	None	1/11	None				
Jet fuel	None	1/11	None				
Liquid fossil fuels	None	1/11	None				
HFC	None	1/11	None				
Heating fuel/ oil	1/7	1/11	None				
Fuel oil	3/7	2/11	None				
Coal Consumption	2/7	None	None				
Lignite	1/7	None	None				

worldwide banks only one bank has measured these consumptions. Renewable electricity is measured in almost all banks worldwide, but Turkey located banks do not mentioned about renewable energy. Coal usage and lignite usage is measured only in three Turkey located banks however worldwide banks did not mentioned about these.

Fleet/company automobiles, air travel and road travel are the common indicators for the emissions of travel category around the banks located in Turkey and worldwide. Rail transportation is measured out of four banks in worldwide but none of the banks that are located in Turkey mentioned about this type of transportation. Rented vehicles and taxis are not common around world since only one bank calculates the emissions and the banks located in Turkey did not calculate carbon emissions from rented vehicles and/or taxis. Around the Turkey located banks only three banks made a breakdown of their vehicles by fuel usage, as diesel and gasoline vehicles whereas none of the worldwide banks made this breakdown.

Out of the seven banks located in Turkey, 6 banks measured their paper usage. When considering the worldwide banks, only 2 banks out of the 11 banks, measured paper usage.

From the results abovementioned, it is clear that not all the banks use or state the same indicators to measure carbon footprint in their sustainability reports.

The real-life applications were compared with official reports and literature mentioned in Section 1 in order to find out gaps and similarities between them.

Energy usage category for carbon emission measurement is included in all of the reports/journal papers covered in this study. All the banks analyzed in this research study, have calculated carbon emissions by energy usage category. However only one report/journal paper did not breakdown the energy usage category. The rest three used electricity and natural gas consumption as common indicators for this category. All banks (worldwide and Turkish combined) breakdown their energy usage category. Only 2 banks did not use electricity and natural gas indicator for the energy usage. Data centers of banks consume big amount of energy and they are very important in the sense of being carbon emissions source. Despite this fact, only two out of four reports/journal papers and one bank, which is Royal Bank of Canada, have calculated carbon footprint of data center units.

All of the reports/ journal papers mentioned about travel category to measure the carbon footprint. Travel category for calculating carbon emissions is included in almost all the banks analyzed in this study. Only 1 out of 4 journal papers and 2 out of 18 banks did not breakdown the travel category. Road travel and air travel are the only common indicators of this category for literature, Turkey and worldwide banks. Rail travel indicators are common for literature and worldwide banks. Only one literature study has made a breakdown the air travel and they even included hotel stay nights.

Ten out of 18 banks have not mentioned about the paper usage and all of the reports/articles measure their paper usage. three out of four report/article declared waste/garbage whereas none of the banks reported about waste and garbage.

The industrial revolution has led to more intensive use of IT technologies and faster adoption of innovation processes. On the other hand, development in the innovation and IT technologies can lead to extensive usage of sources and thus can create threat to sustainability. In terms of both internal and external operations, the banking sector is one of the most affected sector by this transformation. While lean thinking and lean management approach is based on reducing waste sources, it leads the reduction in carbon footprint based on sustainability (Oktay Fırat, Ağlan, Kalender, Ülkü, Bayram & Erdem, 2016; Er Kara & Oktay Fırat, 2016).

CONCLUSION

The role of the banks in the economic system, in general, is to supply funds through the acceptance of deposits from customers and loans to be granted to customers who are in need of these funds. From this perspective, it gives the impression that banks are not involved in the environmental activities. However, the financial system, especially the banking sector, is a driver of economic growth and development. The financial organization that manages the flow of funds plays an important role on the determination of international policy and ensuring macro-economic stability can affect the whole humanity. Banks, indirectly, might give either an important contribution or even harm to human rights

and social justice level. Therefore, the financial system affects and leads all the other sectors while applying a sustainable development plan.

Banks are taking some actions for fighting against threats to the environmental sustainability. Out of top seven Turkey located bank, all of them are publishing the sustainability reports and measure their carbon footprint. Most of them stated that they provide loans for renewable energy projects and green projects. More than half of these seven banks, they joined in Carbon Disclosure Project. Some of them started a certification process in ISO standard series for carbon emissions and footprints. According to their sustainability reports only three banks have an increase on the carbon emission amount compared to previous year. The highest increase was 12,3% whereas the highest decrease was 13,0%.

Many companies and organizations are calculating carbon footprints to estimate their effects on global climate change. However, as it has been noticed, banks which are in service sector, uses different indicators for calculating the carbon footprint. Also, there are several differences from the literature and applications in the banks. From this aspect, it is important to standardize the categories and indicators, so that banks' effects to global climate change can be estimated precisely. Banks can use the guidance of Greenhouse Gas Protocol standard or ISO 14064 standard which is about Greenhouse Gases for using more accurate and standardized categories and indicators.

Energy and transportation are the main categories of carbon emission calculations in the real life applications and in the scientific publications. On the other hand, distinct indicators are not presented in these categories. To calculate and manage carbon emissions from energy usage and travel accurately, distinctions between those categories should be clearly made.

Among the real-life applications and literature, most common energy usage indicators are electricity and natural gas consumption. In spite of the fact that, renewable energy is an important breakdown in reducing the carbon emissions, it was mentioned in none of the Turkish banks reports, five out of 11 global banks reports and one out of 3 scientific studies. If a bank uses renewable energy sources, bank should definitely calculate and report the reduction in its carbon footprint. Although the ratio is low, city gas, LPG, kerosene, light oil, heavy oil is considered in worldwide banks and literature, but not in Turkey located banks. If used, these fuels should be taken into account to calculate the carbon emissions more accurately. Likewise, heating fuel/oil and fuel oil does not appear in any literature, although real life applications mentioned them even if the banks which considered them were in small ratio. Coal consumption and lignite usage is another important carbon source. These sources are not presented in the reports of worldwide banks and in scientific literature, but few Turkish banks considered about these sources in their report. The reason for this can be that the world is transforming their energy usage habits and they stopped coal or lignite consumption since they are not environmentally friendly

Most common indicators in the travel category are fleet/company automobiles/rented cars and air travel/overseas among the real-life applications and literature. Vehicles should be considered by their fuel type as diesel and gasoline since carbon emissions are different. Some banks in Turkey considered this issue in their reports but none of the literature or worldwide banks stated about it. Commuting is also an important component and a bank should know how their personnel come to work. Hence, they should calculate the emissions from fleet, staff shuttle, public transportation (buses, ferries, trains, taxis etc.) and personnel's private car. This breakdown is not considered in any banks in Turkey except the staff shuttle. The rest of the transportation indicators are taken into account in the reports of the worldwide banks and in literature. Especially top management has lots of business travels, so air travel and accommodation should be considered in calculation. From this aspect, air travel indicator is mostly considered in real life applications and in the literature, yet accommodation is only mentioned in one literature.

Waste, paper consumption and recycling activities of the banks should also be considered. Paper consumption is another common indicator seen in literature and real world applications; however none of the real world applications mentioned other wastes or recycling activities.

Due to the reason that calculating carbon footprint in service sector, especially in banking sector, is a very recent topic, there is a limited number of studies carried out regarding this matter in the banking environment. This is why this study gives a perspective of indicators used to measure carbon footprint for the banks and contributes to the literature.

As a future work, in the case of standardization of measurement methods and indicators for all banking sector in order to calculate carbon footprints, then it is possible to perform a correlation analysis between banks' carbon emission amount and their asset sizes.

ACKNOWLEDGMENT

This study is a part of Ozlem Yurtsever's PhD thesis that is supported by Marmara University Scientific Research Project Coordination Unit (BAPKO), Istanbul, Turkey, Project No. FEN-C-DRP-090217-006
The authors declare no conflict of interest.

REFERENCES

Ada, A. A., & Kılıç, Z. (2014). Sürdürülebilir Kalkınma ve Sürdürülebilir Bankacılık: AB ve Türkiye'deki Uygulamalar. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, 42.

Akbank. (2016). 2016 Sustainability Report. Retrieved from http://www.akbank.com/tr-tr/Yatirimci-iliskileri/Documents/2016-Akbank-Surdurulebilirlik-Raporu.pdf

Aranda, A., Ferreira, G., Mainar-Toledo, M., Scarpellini, S., & Sastresa, E. L. (2012). Multiple regression models to predict the annual energy consumption in the Spanish banking sector. *Energy and Building*, *49*, 380–387. doi:10.1016/j.enbuild.2012.02.040

Arto, I., Genty, A., Rueda-Cantuche, J., Villanueva, A., & Andreoni, V. (2012). Global resources use and pollution: vol. I, production, consumption and trade (1995–2008). European Commission Joint Research Centre (IPTS), Luxembourg.

Bahl, S. (2012). Green banking-The new strategic imperative. *Asian Journal of Research in Business Economics and Management*, *2*(2), 176–185.

Banco Santander. (2015). Sustainability Report. Retrieved from http://www.santander.com/csgs/StaticBS?blobcol=urldata&blobheadername1=content-type&blobheadername2=Content- Disposition&blobheadername3=appID&blobheadervalue1=application%2Fpdf&blobheadervalue2=inline %3Bfilename%3D305%5C990%5CSustainability+report.pdf&blobheadervalue3=santander.wc.CFWCSancomQP01&blobkey=id&blobtable=MungoBlobs&blobwhere=1278719350925&ssbinary=true

Bihari, S. C. (2011). Green Banking–Socially Responsible Banking in India. *The India Banker*, 6(1).

Bimha, A. (2014). The Internal Carbon Emissions Reduction Efficiency Of The South African Banking Sector: A Data Envelopment Analysis. *The International Business & Economics Research Journal (Online)*, *13*(1), 69.

Bimha, A., & Nhamo, G. (2013). Conceptual framework for carbon footprinting in the South African banking sector.

Biswas, D. (2016). A Study of Conceptual Framework on Green Banking. *Journal of Commerce and Management Thought*, *7*(1), 39. doi:10.5958/0976-478X.2016.00003.3

Biswas, N. (2011). Sustainable green banking approach: The need of the hour. *Business Spectrum*, *1*(1), 32–38.

Brundtland, G. H. (1987). *World commission on environment and development (1987): Our common future*. World Commission for Environment and Development.

Butchart, S. H., Walpole, M., Collen, B., Van Strien, A., Scharlemann, J. P., Almond, R. E., & Bruno, J. (2010). Global biodiversity: Indicators of recent declines. *Science*, *328*(5982), 1164–1168. doi:10.1126/science.1187512 PMID:20430971

Cao, Q., Leggio, K. B., & Schniederjans, M. J. (2012). Efficiency Measurement in: Branch Bank Service with Data Envelopment Analysis. *International Journal of Information Systems in the Service Sector*, *4*(2), 1–18. doi:10.4018/jisss.2012040101

Chang, D.-S., Kuo, L.-R., & Chen, Y. (2013). Industrial changes in corporate sustainability performance–an empirical overview using data envelopment analysis. *Journal of Cleaner Production*, *56*, 147–155. doi:10.1016/j.jclepro.2011.09.015

COP 21. (2015) COP 21 Paris France Sustainable Innovation Forum 2015 Retrieved from www.cop21paris.org/

Dayan, V. (2015). The Importance of Sustainable Banking: A Comparative Study of Practices in Turkey and Canada. In *Proceedings of 31st International Business Research Conference*. Academic Press.

Deutsche Bank. (2015). Corporate Responsibility Report. Retrieved from https://cr-report.db.com/2015/en/servicepages/downloads/files/dbcr2015_entire.pdf

Ditz, D. W., & Ranganathan, J. (1997). *Measuring up toward a common framework for tracking corporate environmental performance*. World Resources Institute.

Durmuşoğlu, B., Selam, A. A., & Fırat, S. Ü. O. (2017). A Comparative Study on the Relations among Sustainability Focused Indexes with REC, CO_2, and GDP. *American Scientific Research Journal for Engineering, Technology, and Sciences*, *34*(1), 81–94.

Er Kara, M., & Oktay Fırat, S. Ü. (2016). Sustainability, Risk, and Business Intelligence in Supply Chains. In M. Erdoğdu, T. Arun, & I. Ahmad (Eds.), *Handbook of Research on Green Economic Development Initiatives and Strategies*. Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0440-5.ch022

Er Kara, M., Yurtsever, Ö., & Oktay Fırat, S. Ü. (2016). Sustainable Supplier Evaluation and Selection Criteria. *Social and Economic Perspectives on Sustainability*, *159*.

Ganda,F and Ngwakwe, C.C. (2014). Energy and Carbon reductionpractices in South African Banks. Environmental Economics, 5(4)

Goyal, K., & Joshi, V. (2011). A study of social and ethical issues in banking industry. *International Journal of Economics and Research*, *2*(5), 49–57.

ING Group. (2015). Annual Report. Retrieved from https://www.ing.com/web/file?uuid=edb1ce3f-532f-4ddb-a58f-c91c6212d37e&owner=b03bc017-e0db-4b5d-abbf-003b12934429&contentid=36989

HSBC. (2015). Sustainability Key Facts at a Glance Report. Retrieved from http://www.hsbc.com/~/media/hsbc-com/our-approach/sustainability/reports-and-documentation/key-facts-at-a-glance

ICBC. (2015). Corporate Social Responsibility 2015 Report. Retrieved from http://www.icbc-ltd.com/ICBCLtd/SocialResponsibility/Corporate%20Social%20Responsibility/2015/

Imeson, M., & Sim, A. (2010). Sustainable Banking: Why Helping Communities and Saving the Planet is Good for Business? SAS Institute Inc.

IPCC. (2007). Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland. Retrieved from https://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_full_report.pdf

Islam, M. S., & Das, P. C. (2013). Green banking practices in Bangladesh. *IOSR Journal of Business and Management*, *8*(3), 39-44.

Islam, T., Sharmeen, K., & Rahman, S. (2014). Adopting Green: from the Perspective of Private Commercial Banks in Bangladesh. *Proceedings of Annual Shanghai Business, Economics and Finance Conference*. Academic Press.

Jha, N., & Bhome, S. (2013). A study of green banking trends in India. *International Monthly Referred Journal of Research in Management and Technology*, *2*, 127–132.

Meena, R. (2013). Green Banking: As Initiative for Sustainable Development. *Global Journal of Management and Business Studies*, *3*(10), 1181–1186.

Mitsubishi, U. F. J. (2015). Financial Group Corporate Social Responsibility Data. Retrieved from http://www.mufg.jp/english/csr/data

Morelli, J. (2011). Environmental sustainability: A definition for environmental professionals. *Journal of environmental sustainability*, *1*(1), 2.

J.P. Morgan Chase. (2015). Environmental Social and Governance Report. Retrieved from https://www.jpmorganchase.com/corporate/Corporate-Responsibility/document/jpmc-cr-esg-report-2015.pdf

Mortimer, N. D., Ashley, A., Moody, C., Rix, J., & Moss, S. (1998). Carbon dioxide savings in the commercial building sector. *Energy Policy*, *26*(8), 615–624. doi:10.1016/S0301-4215(98)00019-6

Nisha, N. (2016). Exploring the dimensions of mobile banking service quality: Implications for the banking sector. *International Journal of Business Analytics*, *3*(3), 60–76. doi:10.4018/IJBAN.2016070104

Office of Sustainability and Environment, City of Seattle. (2008). HomeStreet Bank: A Carbon Footprint Measurement Case Study. Seattle Office of Sustainability and Environment. Retrieved from http://nbis.org/nbisresources/case_histories/homestreet_carbon%20footprint_case_study.pdf

Oktay Fırat, S. Ü., Ağlan, C., Kalender, Z. T., Ülkü, İ., Bayram, G., & Erdem, M. (2016). Lean Thinking via Business Intelligence Technologies and Innovation Process. In L. Al-Hakim, X. Wu, A. Koronios, & Y. Shou (Eds.), *Handbook of Research on Driving Competitive Advantage through Sustainable, Lean, and Disruptive Innovation*. Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0135-0.ch003

Oktay Fırat, S. Ü., Yurtsever, Ö., & Bilsel, M. (2015). Taşıtlarda Enerji Verimliliği. İstanbul: Sürdürülebilir Kalınma Derneği. Retrieved from http://www.skdturkiye.org/yayin/skddokumanveyayinlar-65

Oktay Fırat, S. Ü., Yurtsever, Ö., İleri, Ç., & Kıvılcım, I. (2017). *Sürdürülebilir Bir Dünyaya Doğru: Küresel Gündem ve Türkiye*. İstanbul: İktisadi Kalkınma Vakfı Yayınları. Retrieved from http://www.ikv.org.tr/images/files/Surdurulebilir_Bir_Dunyaya_Dogru_Kuresel_Gundem_Turkiye.pdf

Paribas, B. N. P. (2015). Corporate Social Responsibility Report. Retrieved from https://invest.bnpparibas.com/sites/default/files/documents/2015_corporate_social_responsibility.pdf

Rahman, M., Ahsan, A., Hossain, M., & Hoq, M. (2013). Green Banking Prospects in Bangladesh. *Asian Business Review.*, *2*, 2305–8730. doi:10.18034/abr.v2i2.305

Royal Bank of Canada. (2015). Corporate Responsibility Report. Retrieved from http://www.rbc.com/community-sustainability/_assets-custom/pdf/RBC-CRR-Report-2015-e.pdf

Sahoo, B. P., Singh, A., & Jain, M. N. (2016). Green Banking In India: Problems and Prospects. *International Journal of Research-Granthaalayah*, *4*(8), 92–99.

Sharma, N., Sarika, K., & Gopal, R. (2014). A Study on Customers Awareness On Green Banking Initiatives in Selected Public & Private Sector Banks With Special reference to Mumbai. *IOSR Journal of Economics & Finance*, 28-35.

Shaumya, K., & Arulrajah, A. A. (2016). Green Banking Practices of Selected Private Sector Banks in Sri Lanka. In *Proceedings of the Third Jaffna University International Research Conference*, University of Jaffna (pp. 68-73). Academic Press.

Statista (2016). Largest Banks in the World by Total Assets Retrieved October 08, 2016 from http://www.statista.com/statistics/269845/largest-banks-in-the-world-by-total-assets

Türkiye Bankalar Birliği. (2016a). Information on Bank ATMs Retrieved from http://www.tbb.org.tr/app/harita.aspx?sube_tipi=6

Türkiye Bankalar Birliği. (2016b). Information on Bank Statistics. Retrieved from https://www.tbb.org.tr/tr/bankacilik/banka-ve-sektor-bilgileri/istatistiki-raporlar/59

Türkiye Cumhuriyeti Ziraat Bankası. (2015). 2015 Sustainability Report Retrieved from http://www.ziraat.com.tr/tr/Bankamiz/YatirimciIliskileri/Documents/SurdurulebilirlikRaporu2015.pdf

Türkiye Garanti Bankası. (2016). 2016 Sustainability Report Retrieved from https://www.garanti.com.tr/proxy/novaform/press-room?file=/assets/pdf/tr/diger/garanti_surdurulebilirlik2016_tr.pdf

Türkiye Halk Bankası. (2016). 2016 Sustainability Report. Retrieved from https://www.halkbank.com.tr/images/Bankamiz/surdurulebilirlik/2017/halkbank_SB_tr_web.pdf

Türkiye İş Bankası. (2016). 2016 Sustainability Report Retrieved from http://www.isbank.com.tr/TR/hakkimizda/surdurulebilirlik/raporlarimiz/Documents/SurdurulebilirlikRaporu2016.pdf

Türkiye Vakıflar Bankası. (2016). 2016 Sustainability Report. Retrieved from http://www.vakifbank.com.tr/documents/surdurulebilirlik/surdurulebilirlik_rapor_16.pdf

UBS. (2016). Sustainability Disclosure. Retrieved from https://www.ubs.com/global/en/about_ubs/ubs-and-society/information-center.html#objectives

UniCredit. (2015). Integrated Report. Retrieved from https://www.unicreditgroup.eu/content/dam/unicreditgroup-eu/documents/en/sustainability/reporting-and-metrics/integrated_report/Integrated_Report_2015_eng.pdf

United Nations. (1994) United Nations Framework Convention on Climate Change. Kyoto Protocol. Retrieved from http://unfccc.int/kyoto_protocol/items/2830.php

United Nations. (2015). Paris Agreement. Retrieved from https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

United Nations Environment Programme Finance Initiative. (2007). *Banking on value: A new approach to credit risk in Africa*. Geneva: UNEP FI.

Wackernagel, M., Schulz, N. B., Deumling, D., Linares, A. C., Jenkins, M., Kapos, V., & Norgaard, R. (2002). Tracking the ecological overshoot of the human economy. *Proceedings of the National Academy of Sciences of the United States of America*, *99*(14), 9266–9271. doi:10.1073/pnas.142033699 PMID:12089326

Wolf, F., & Mujtaba, B. G. (2011). Sustainability in Service Operations. *International Journal of Information Systems in the Service Sector*, *3*(1), 1–20. doi:10.4018/jisss.2011010101

Worldbank. (2017). Statistics on CO_2 Emission Ranking in the World Retrieved from http://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE/countries

Yapı ve Kredi Bankası. (2016). 2016 Sustainability Report. Retrieved from https://assets.yapikredi.com.tr/WebSite/_assets/pdf/arsiv/surdurulebilirlik/SurdurulebilirlikRaporu2016v2.pdf?v4

Özlem Yurtsever is a PhD candidate in Industrial Engineering at Marmara University, Istanbul. She completed her B.Sc. in Chemical Engineering in 2006 and M.Sc. in Engineering Management in 2008 both at Marmara University. She is currently a lecturer in Vocational School of Technical Sciences at the same university. Her research interests include sustainability, calculation of carbon emissions and energy efficiency. She has been worked as researcher for two national projects supported by Business Council for Sustainable Development Turkey (SKD) and Economic Development Foundation (IKV).

Seniye Umit (Oktay) Firat PhD, is the Professor of Industrial Engineering at the University of Marmara. She has been carried out many field surveys and projects on Data Mining Applications, Sustainability (energy topics), Productivity Analysis and Performance Measurement, Quality Engineering, TQM and SPC Applications, Multivariate Data Analysis, Risk Analysis, Supplier Evaluation, Six Sigma Implementation, Process Analysis, Marketing Research, Customer Segmentation and BI implementation in the SME and Large Size manufacturing firms, retailing and banking sectors. Recent years, her focus on sustainability issues and Industry 4.0 and its components. She has been worked as researcher and director for several national and international projects that supported by, EPSRC -Engineering and Physical Science Research Council –UK, İKV, SKD Türkiye, ISO, ITO, Italian Foreign Trade Institute, BAP-Marmara University etc. She has published over 200 academic papers in national and international journals and conferences, and many edited books and book chapters in international publications on her research areas. She has given many seminars and training in the industrial units and institutes. In addition, she has published several informative articles in sector magazines in order to share new scientific developments with the industry.