Carbon dioxide emissions in the food retail sector

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Abstract

Increased attention has been paid recently to the analysis of the effects of applying the concept of sustainable development in retail. In that context we have particularly considered greenhouse gases emission in the food retail sector.This is achieved through the use of modern ecological technology in business – through the whole food value chain. The ultimate goal is to achieve the planned reductions of carbon dioxide in the food retail sector, which positively reflects the overall performance ofretail food companies, environmental in particular. The costs of carbon dioxide emission reduction affect the performance ofretail food companies. Continuous empirical research shows that almost all globalretail food companies achieve a significant reduction in carbon dioxide emissions from year to year. Empirical research conducted in this paper on the example of globalretail food companiesin the United States, Europe and the European Union, the United Kingdom, and Serbia shows significant and planned reduction of carbon dioxide emissions in the food retail sector, especially in countries with developed market economies. This empirical research is mainly based on the analysis of the original sustainable (environmental and ecological) reports officially disclosed by selected retail food companies, primarily from the countries of a developed market economies, which they started to publish with regular annual financial statements. They are now an integral part of the so-called integrated reporting on performance of globalretail food companies. Due to the general importance, harmonized regulations on sustainablein the food retail companies reporting are being increasingly applied as a data source for more efficient environmental management. In perspective, this will ease the comparative analysis of the carbon dioxide emission of global retail food companies.

Greenhouse gas emissions, carbon dioxide, CO_2 emission sources, sustainable reporting

Introduction

The overall goal of global at retail food companiesis to reduce carbon dioxide emissions through the entire food value chain. The *subject* of research in this paper is the significance and trend of carbon dioxide emissionsin the food retail companies. The costs of carbon dioxide emission reduction are significant and affect the performance ofretail food companies.

The *problem* of comprehensiveness of the research on carbon dioxide emissions in the food retail sector is that, at the time being, there is no unified system of sustainable (environmental) reporting for all retailers. In addition, many at retail food companiesstill do not publish this report, what as a consequence, has an incomplete "comparability" of data on carbon dioxide emissions by individual retail food companies.

Nevertheless, knowledge of the importance and trend of carbon dioxide emissions from global retail food companiesis very important in order to manage overall, integrated and, in particular, environmental performance in the food retail sector. In view of the global, other retail food companieswill increasingly publish *reports on sustainable development* (with data on carbon dioxide emissions). In this way, they will increase its information base for more efficient management of total business, including environmental protection. This will have a positive impact on the achievement of the target profit.

This paper attempts to make thorough *analysis of specific issues of carbon dioxide emissions in the retail sector*, firstly on the example of global retail food companiesfrom different countries, primarily developed market economies, which, due to the general

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importance of the matter, publish reports on sustainable development with regular annual financial reports. This practice of global retail food companiesprovides them with more reliable information base for efficient management of carbon dioxide emissions through the whole value chain.

Material and Methods

There is voluminous *literature* devoted to analyzing the way company's performance is affected by general problems and effects of carbon dioxide emission reduction through the whole food chain (Kahn, 2014; Congcong, 2016; Li, 2016; Clune, 2017; Wang et al., 2017; Ji, 2017; Linda, 2014**;** Eriksson, 2017; Igl, 2017; Lukic, 2013, 2014, 2016, 2017; Lukic et al., 2018).

The general research *hypothesis* in this paper is that the reduction of carbon dioxide emissions positively reflects on overall (integrated, especially environmental) performance of retail food companies.

The *methodology* of the study of the given hypothesis is primarily based on the comparative analysis of the carbon dioxide emission of global selected retail food companiesfrom various comparable countries with the developed market economy.

Main *data* sources for the research of the treated problem in this paper are literature, articles, and, in particular, officially disclosed annual financial and sustainable reports of global retail food companies. They were processed in such a way that is easy to comprehend the significance and trend of carbon dioxide emission in the food retail sector.

Results and Discussion

The carbon dioxide emission through the entire *food value chain* is shown in Table 1.

Table 1. Emissions of carbon dioxide through the life cycle of post-farm food

Life cycle stage post-farm gate	Number of GWP (global warming potential) values	Median ($kgCO_2$-eq/kg)	Mean ($kgCO_2$-eq/kg)	SD	Min ($kgCO_2$-eq/kg)	Max ($kgCO_2$-eq/kg)
Processing meats	5	0.59	0.66	0.14	0.54	0.87
Processing vegetables	15	0.06	0.07	0.04	0.01	0.013
Packaging	8	0.05	0.06	0.06	0.01	0.21
Transport to RDC (Regional Distribution Centre	21	0.09	0.13	0.19	0.02	0.95
Retail	20	0.04	0.10	0.25	0.01	1.14

Note: The table is compiled on the basis of various relevant studies.Source: Clune et al., (2017)

The data in the given table show that, on average, emission of carbon dioxide is higher in the processing of meat than vegetables. It is also higher in transport than in retail, and is the lowest in the packaging phase. This is in line with the nature of the activities concerned. Figure 1 (Plate I, Fig 1) shows sources of carbon dioxide emission throughout the value chain, with an emphasis on Tesco's participation in carbon footprint.

Different is the carbon dioxide emissions of individual at retail food companies. This is shown by the results of the research in this paper.

At Wal-Mart (United States of America, Dominant operational format: Hypermarket / Supercenter / Superstore), a great significance is given to the reduction of carbon dioxide emissions (Table 2). This is achieved by: investing in renewable energy sources, reducing energy demand, improving energy efficiency, improving refrigeration in stores and maximizing the efficiency of the vehicle fleet.

Table 2. Carbon dioxide emission (Scope 1 and 2) and retail area at Wal-Mart, 2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Carbon dioxide emission (milliontonCO_2e)	18.9	19.3	20.1	20.8	20.3	20.6	20.8	21.2	21.0	21.9
Retail area (million square meters)	740	805	867	921	952	985	1.037	1.072	1.102	1.134
Carbon dioxide intensity (millionton$s$ CO_2e/million m2)*	0.025	0.024	0.023	0.022	0.021	0.021	0.020	0.020	0.019	0.019

Note: *Calculations performed by the author(s).
Source: Wal-Mart Stores, Inc. 2016 Global Responsibility Report. Available at: https://cdn.corporate.walmart.com/9c/73/3f9abcef444397f2c771e081e095/2016-global-responsibility-report.pdf#page=58&zoom=auto,-130,628. Accessed May 5, 2017

In generating greenhouse gas emissions, Wal-Mart participates with (Table 3):

Table 3. Greenhouse gas emissions, Wal-Mart

Greenhouse gas emissions	
electricity supply	69%
refrigeration	18%
fuel transport	7%
mobile refrigerators	0.1%

Source: Wal-Mart Stores, Inc. 2016 Global Responsibility Report. Available at: https://cdn.corporate.walmart.com/9c/73/3f9abcef444397f2c771e081e095/2016-global-responsibility-report.pdf#page=58&zoom=auto,-130,628 . Accessed May 5, 2017

Therefore, the main source of greenhouse gas emissions in Wal-Mart is electricity supply. With the increased application of the ecological operation principles, Wal-Mart reduced carbon dioxide emissions from year to year, which reflects favourably on its overall performance, especially environmental.

At Tesco (United Kingdom, Dominant operational format: Hypermarket / Supercenter / Superstore), as with Wal-Mart, considerable attention is paid to the research and control of carbon dioxide emissions. This positively reflects on its overall performance, including the surrounding ones. In Figure 2 (Plate I, Fig 2), an illustration of the specificity of carbon dioxide emissions measurement at Tesco is shown.

Therefore, Tesco participated in total emission of carbon dioxide through entire value chain with 9%. Table 4 shows ecological performances at Tesco.

Table 4. Global ecological performances at Tesco

	2013/14	2014/15	2015/16	2016/17
Carbon dioxide (million ton CO_2e)	-	5.26	5.1	3.9
Emission of CO_2 reduction (stores and distributional centres) compared to 2006/07	-	38.3%	39.5%	40.5%
Emission of CO_2 reduction (distribution) compared to 2011/12	7.8%	14.47%	17.4%	19.7%
Direct water consumption (million m3)	32.9	32.6	25.5	23.5
Waste percentage (food and non-food) which is recycled, used again or turn into energy	86%	84%	88%	93%

Source: Reducing our impact on the environment.Available at: https://www.tescoplc.com/tesco-and-society/sourcing-great-products/reducing-our-impact-on-the-environment/ . Accessed May 3, 2017

The data in the given table show that the intensity of carbon dioxide emissions in Tesco is decreasing from year to year. Tesco has tendency to improve ecological performances (carbon dioxide emission reduction, direct water consumption reduction and waste treatmentimprovement). This reflects favourably on its market, economic and financial performances.

At Ahold (Germany, Dominant operational format: Supermarket), considerable attention is paid to the reduction of carbon dioxide emissions. This is shown in Table 5.

Table 5. Carbon dioxide emission at Ahold

	2008	2009	2010	2011	2012	2013	2014	2015
Carbon dioxide emissions (thousand tons)				2.176	2.106	2.107	2.090	2.019
Carbon dioxide emissions (kg CO2/m2 sales area)	567	574	543	507	480	473	465	420
Sources (%)								
Electricity	n/a	n/a	n/a	n/a	n/a	n/a	n/a	49%
Refrigerant appliances	n/a	n/a	n/a	n/a	n/a	n/a	n/a	29%
Fuel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12%
Gas	n/a	n/a	n/a	n/a	n/a	n/a	n/a	10%

Source: Ahold -Responsible Retailing Report 2015. Available at: https://www.aholddelhaize.com/media/1934/ahold-responsible-retailing-report-2015.pdf . Accessed May 9, 2017

Carbon dioxide emissions at Ahold has been decreasing year after year. Since 2016, Ahold has been operating under the name of Ahold Delhaize. In view of this, Table 6 shows data on carbon dioxide emissions for Ahold Delhaize (Belgium, Dominant operational format: Supermarket) in 2016.

Table 6. Carbon dioxide emission at Ahold Delhaize

	2016 Actual	2020 Target
% reduction in CO2 equivalentemissionsper m2 of sales area (from 2008 baseline)	-22%	-30%
Total CO2 equivalentemissions per m2 of sales area – location-based approach	496	n/a
Total CO2 equivalentemissions (thousand tonnes) – location-based approach	4,505	n/a
Total Scope 1 CO2 equivalentemissions (thousand tonnes) – location-based approach	1,940	n/a
Total Scope 2 CO2 equivalentemissions (thousand tonnes) – location-based approach	2,420	n/a
Total Scope 3 CO2 equivalentemissions (thousand tonnes) – location-based approach	144	n/a
Offset CO2 equivalentemissions (thousand tonnes)	241	n/a
Avoided grid electricity CO2 emissions (thousand tonnes)	31	n/a

Source: Ahold Delhaize Supplementary report on Sustainable Retailing performance 2016. Available at: https://www.aholddelhaize.com/media/3984/supplementary-report-on-sustainable-retailing-performance-2016.pdf . Accessed May 9, 2017

Significant reduction in carbon dioxide emissions by 2020 (30%) is expected at Ahold Delhaize. This will be achieved by using so-called „green energy“ in business operations. Sources of carbon dioxide emissions were: electricity 60%, cooling devices 31% and transport 9% (Ahold Delhaize Supplementary Report on Sustainable Retailing performance 2016). Delhaize Serbia is also part of Ahold Delhaize which employs the same sustainable development strategy and environment reporting as well as company at its higher organizational level.

Conclusion

A growing number ofretail food companiesin the world are increasingly publishing report on their performance related to the aspects of sustainable development. By their reputation, and because of its importance, other retailers will certainly tend to publish such report in the future. It provides the basis for a comparative analysis of environmental performance in the food retail sector from various aspects. In this report, special significance is given to trend of greenhouse gas emissions, in particular, carbon dioxide.

Carbon dioxide emissions in trade, in total and by sectors, vary by country. Carbon dioxide emissions differ in individual stages of the product life cycle, retail companies and product categories. Carbon dioxide emission generators in retail companies are electricity, transport, ventilation, heating and cooking, refrigeration, and waste. The goal of all retailers be to take appropriate measures, primarily ecological in nature, to reach a planned reduction of carbon dioxide emissions in the future. Among other things, this is achieved with the increasing use of electricity from renewable sources (so-called “green energy”), by using modern ventilation, heating and cooking systems, refrigeration units, green logistics (ecological vehicles) and more efficient waste treatment. The effect of this is to improve the overall performance of retail food companies,especially environmental.

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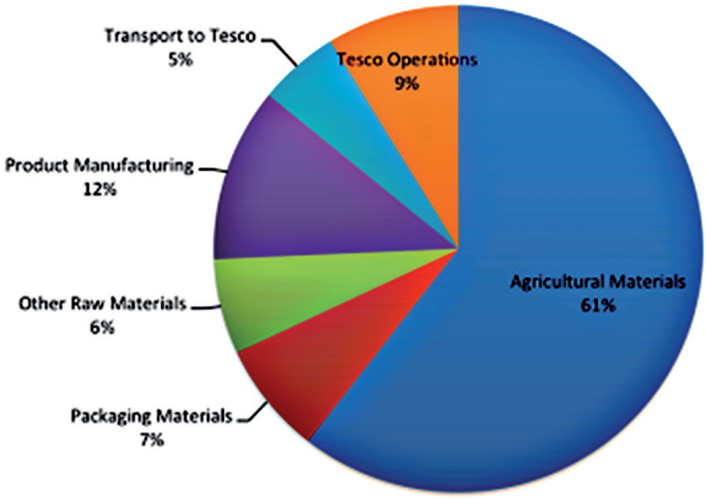

Fig 1. Emissions of carbon dioxide by source in Tesco
Source: Tesco - Our Carbon Footprint. Available at: https://www.tescoplc.com/tesco-and-society/sourcing-great-products/reducing-our-impact-on-the-environment/our-carbon-footprint/ . Accessed May 24, 2017

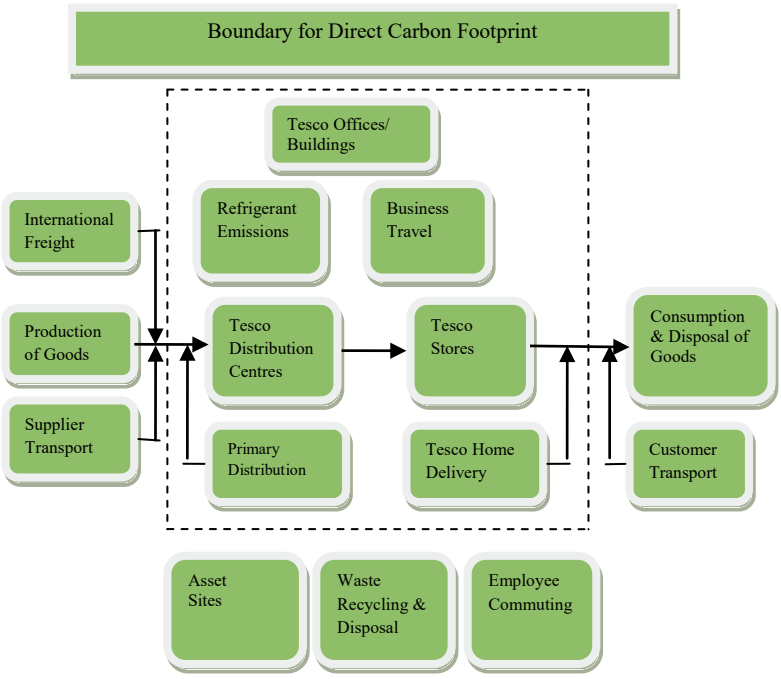

Fig. 2. Tesco's emission limit
Source: Carbon Footprint 101: A Guide for Food Retailers. Available at: https://www.fmi.org/docs/sustainability/carbon-footprint-101-a-guide-for-food-retailers.pdf?sfvrsn=4#page=11&zoom=auto,-121.85 . Accessed May 10, 2017