INSTITUTE
OF MANAGEMENT

Sant'Anna
School of Advanced Studies – Pisa

Corfu 2022 Conference

Life Cycle Assessment (LCA) of a professional football match

Tiberio Daddi, Luca Marrucci, Niccolò Maria Todaro, Fabio Iraldo

S.Anna School of Advanced Studies

INSTITUTE
OF MANAGEMENT

Scuola Superiore
Sant'Anna

SUSTAINABILITY MANAGEMENT

Project overview

GOALS is a project funded by EU Commission through the **ERASMUS+ Sport Programme**.

Duration: 01/01/2021 - 30/06/2023 (30 months)

Co-funded by the Erasmus+ Programme of the European Union

Total budget: 398,983.00 Euro

Lead partner: Sant'Anna School of Advanced Studies

Partners: Portugal Football Federation (FPF), Real Betis Balompié Foundation, Romanian Football Federation (FRF), Football Federation of Kosovo (FFK), European Stadium & Safety Management Association (ESSMA)

Supporting entities: UEFA.

Introduction

- Environmental management in sport is in its early stage but the interest and concrete applications are increasing fast
- Sport organizations are more readily adopting environmental practices (McCullough et al., 2016, 2020; Todaro et al., 2021, in press)
- Such practices are becoming more sophisticated to include fan engagement campaigns (Casper et al., 2021), sponsors (Trail & McCullough, 2020), and strategies to address climate risks (Kellison & Orr, 2021; Orr & Inoue, 2018)
- The advancement of select individual organizations is also reflected in their collective efforts to forward practitioner organizations (e.g., Green Sports Alliance, Sport and Sustainability Initiative) and governing body programs (e.g., UN Sport for Climate Action Framework)
- Academic literature in environmental management in football is a complete green field, very few studies published, studies about the application of LCA has been never applied

Research questions

Question #1

Antecedent: the interest about football and environmental sustainability is increasing strongly in the last years.

Question: Is the environmental impact of a football match relevant?

Question #2

Antecedent: some football clubs are looking to carbon footprint as a tool to measure the impact and to plan environmental improvement actions .

Question: Why only carbon emissions? Is it sufficient to look at the carbon footprint or we should look to the environmental footprint?

Question #3

Antecedent: after the assessment clubs want to plan environmental improvement actions.

Question: where to start? What are the main contributors of the environmental impact of a football match?

Environmental Footprint (LCA) of a football match

Environmental footprint of a football match of Real Betis for the season 2018/2019

RealBetisBalompié

- The stadium (Benito Villamarín) of the club has a capacity of 60,000 seats
- Average number of fans in the considered season (2018/2019): 43,455 per match
- Matches played in the season: 20
- The club has also its training centre that is part of the environmental footprint calculation

Methods and functional unit

Methods:

- ISO 14040:2006 - *Environmental management -- Life cycle assessment -- Principles and framework,*
- ISO 14044:2006 - *Environmental management -- Life cycle assessment -- Requirements and guidelines.*
- European Commission Recommendation 179/2013/EC "on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations", PEF (Product Environmental Footprint) and OEF (Organization Environmental Footprint).

The **functional unit** is the quantified performance of a product system, to be used as a **reference unit**. It provides a reference to which the inputs and outputs can be related, thus enabling comparison of alternative systems.

Functional unit of our study: **1 played match**

Environmental footprint: data collection

The data collected were referred to the season 2018/2019 (to avoid covid impact).

The data collected for the targeted season were referred to:

- *Environmental data of the stadium*: electricity, natural gas, water consumption, waste;
- *Environmental data of the training centre*: electricity, natural gas, water consumption, waste;
- *Food and beverage bar and kiosks*: kg of sandwiches, litres of beverages
- *Food and beverages VIP area*: kg of served food, litres of beverages
- *Cleaning products*: kind and quantity of products used in the season
- *Sport suits and equipment*: number of shirts, shorts and balls of the first male team;
- *Merchandising*: number of shirts, shorts and balls sold by the stores
- *Fans mobility*: km of the fans in the season, means of transport
- *Turf maintenance*: materials and chemicals

Environmental footprint: data collection – examples

Electricity consumption in the season: 1,910,000 kwh (stadium + training centre)

Water consumption: 28,000 m3 (stadium + training centre)

Waste from matches: 172,800 kg (0,15 kg per fan)

Catering VIP area: 18,090 kg of food (VIP area capacity: 1,400 guests); 52,800 litres of beer; 22,700 litres of Coca Cola;…

Kiosks and bar: 9,664 kg of sandwiches (2,313 kg remaining); 28,384 litres of water; 34,110 litres of Coca cola;…

Sport apparel first male team: 2,575 shirts (home, away, third)

Results

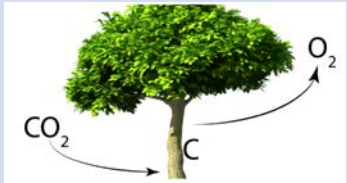
Environmental footprint results overview

All impact categories, impacts per single match (functional unit)

Impact category	Unit	Total
Climate change	kg CO2 eq	71,519.25
Ozone depletion	kg CFC11 eq	0.009
Ionising radiation, HH	kBq U-235 eq	19,903.01
Photochemical ozone formation, HH	kg NMVOC eq	312.077
Respiratory inorganics	disease inc.	0.002
Non-cancer human health effects	CTUh	0.010
Cancer human health effects	CTUh	0.0003
Acidification terrestrial and freshwater	mol H+ eq	466.031
Eutrophication freshwater	kg P eq	12.62
Eutrophication marine	kg N eq	138.07
Eutrophication terrestrial	mol N eq	1,336.50
Ecotoxicity freshwater	CTUe	43,816.27
Land use	Pt	1,431,246.45
Water scarcity	m3 depriv.	70,315.49
Resource use, energy carriers	MJ	1,189,633.54
Resource use, mineral and metals	kg Sb eq	0.021

To better understand the relevance of our results…

The **carbon footprint** of a professional football match is equivalent to:

499,075 km with an average car **i.e. 41 times the street distance between Rome and Hong Kong**	
The CO2 absorbed by 2,405 trees in 1 year	

The **water footprint** of the match is equivalent to:

The water needed to fill in 28 times an olympic swimming pool	
The water needed to irrigate 27,5 hectares cultivated with tomatoes	

Other comparisons

The yearly amount of produced **waste** is equal to the weight of 199.7 Fiat 500

Comparison with manufacturing sectors:

The yearly **water consumption** of a football club is the amount needed by a **paper production company** to produce **1,076.92 tons of paper**.

The yearly electricity consumption is the amount needed by a **tannery** to produce **612,179.4 m2 of finished leather**.

i.e. the yearly production of 3.5 of this plant

T. D

Key question #1

Antecedent: the interest about football and environmental sustainability is increasing strongly in the last years.

Question: Is the environmental impact of a football match relevant?

Answer: YES

Environmental footprint results overview

Impact categories converted in unique unit comparable (Pt), single match

Impact category	Unit	Total	%
Climate change	Pt	2.05	**31.83**
Ozone depletion	Pt	0.03	0.47
Ionizing radiation HH	Pt	0.25	3.88
Photochemical ozone formation	Pt	0.39	**6.06**
Respiratory inorganics	Pt	0.26	4.04
Acidification terrestrial and freshwater	Pt	0.56	**8.70**
Freshwater eutrophication	Pt	0.15	2.33
Marine eutrophication	Pt	0.15	2.33
Terrestrial eutrophication	Pt	0.30	4.66
Land use	Pt	0.09	1.40
Water resource depletion	Pt	0.55	**8.54**
Resource use, energy carriers	Pt	1.63	**25.31**
Resource use, mineral and metals	Pt	0.03	0.47

According to this table, the main environmental impact of a professional football match are: climate change (carbon footprint), Water scarcity (water footprint), resource use and terrestrial and freshwater acidification

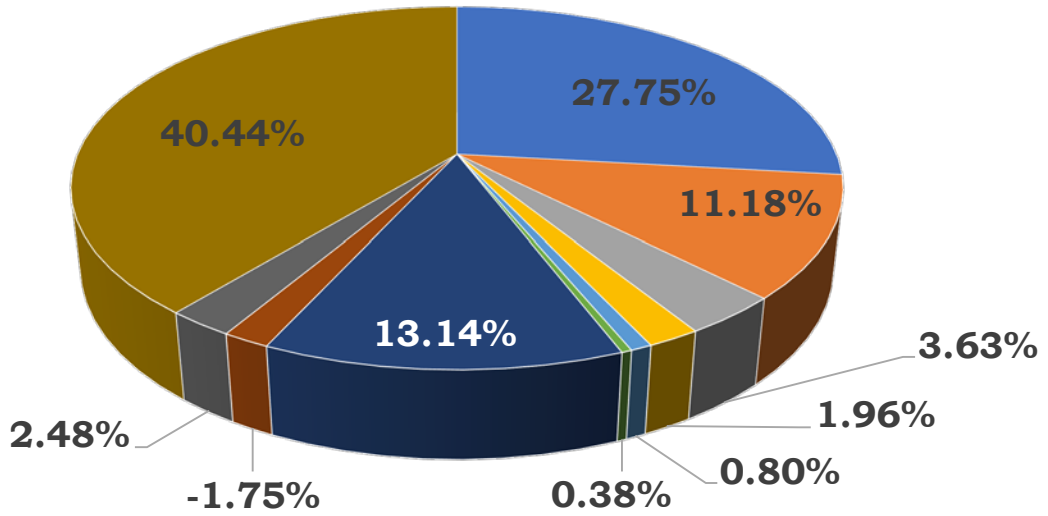
Key question #2

Antecedent: some football clubs are looking to carbon footprint as a tool to measure the impact and to plan environmental improvement actions.

Question: Why only carbon emissions? Is it sufficient to look at the carbon footprint or we should look to the environmental footprint?

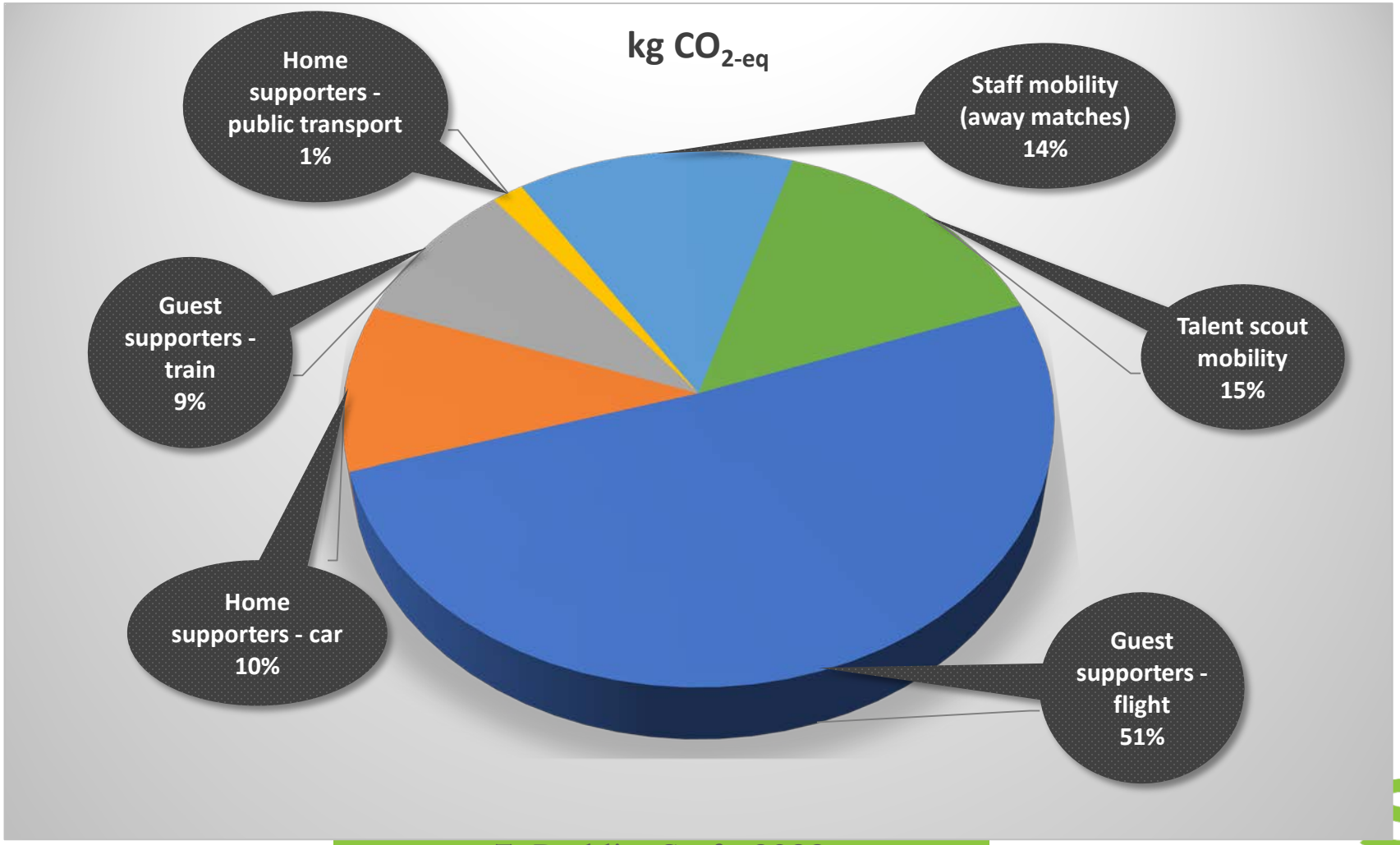
Answer: climate change impacts of football are important but they are "only" the 32% of the whole environmental impact.

Contribute to the environmental footprint from each considered activity

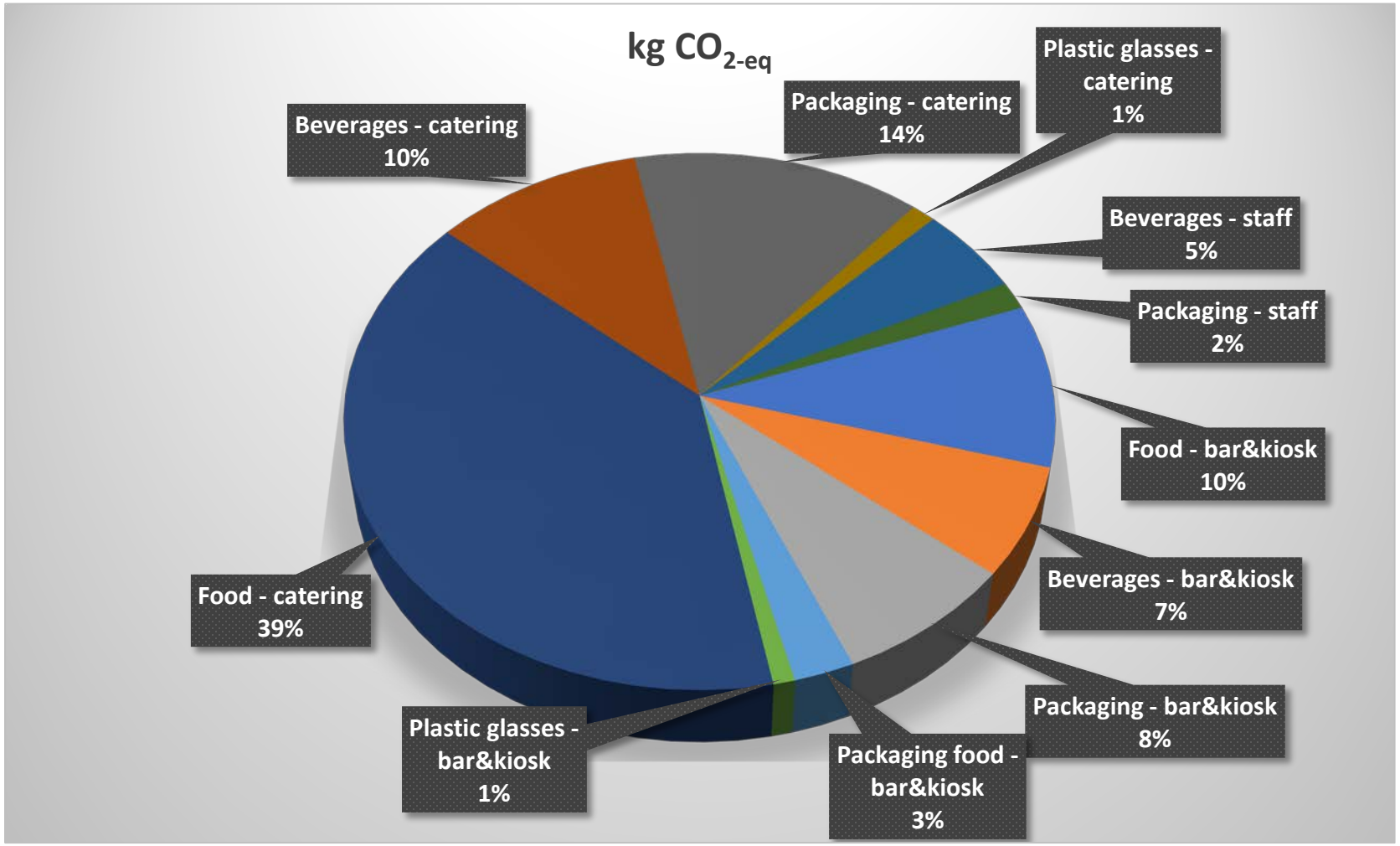


Energy consumption (stadium)	Energy consumption (training center)	Water consumption (stadium)	Water consumption (training center)	Turf maintenance	Cleaning chemicals	Food&beverages	Waste management	Sports apparel & equipment	Mobility
27.75%	**11.18%**	3.63%	1.96%	0.8%	0.38%	**13.14%**	-1.75%	2.48%	**40.44%**

Focus on environmental impacts of mobility (climate change impacts)



Focus on environmental impacts of Food&beverages (climate change impacts)



SUSTAINABILITY MANAGEMENT

Key question #3

Antecedent: after the assessment clubs want to plan environmental improvement actions.

Question: where to start? What are the main contributors of the environmental impact of a football match?

Answer: mobility, energy consumption, food&beverages are 3 areas to focus on to plan the environmental improvements

INSTITUTE
OF MANAGEMENT

Sant'Anna
School of Advanced Studies – Pisa

Thank You

Tiberio Daddi

tiberio.daddi@santannapisa.it

GOALS

INSTITUTE
OF MANAGEMENT
Scuola Superiore
Sant'Anna

SUSTAINABILITY MANAGEMENT