Smart Retail Summit

Programm

SMART RETAIL SUMMIT

»Smart Retail: Balancing Sustainability and Digital Omnichannel Management«

29. November 2022 · Alte Mensa, Adam-von-Trott-Saal, Wilhelmsplatz 3, 37073 Göttingen

11.00 **Welcome Coffee**

11.30 **Opening** | Prof. Matthias Schumann, Prof. Yasemin Boztuğ, Prof. Manuel Trenz
»Smart Retail Group Göttingen«

12.00 **Keynote** | Prof. Alexander Hübner (TU Munich)
»Smart Retail Logistics: How can Analytics and Sustainability be Reconciled?«

14.00 Tobias X. Gruber (Head of Sustainability, Otto Group), Prof. Waldemar Toporowski
»Smart Retail and the Sustainabiltiy Challenge with Digital Omnichannel Integration«

15.00 Dr. Melanie Bockemühl (Digital Transformation Expert), Prof. Maik Hammerschmidt
»Smart Retail and AI-based Customer Communication«

17.00 Lars Siebel (Head of Logistics, REWE), Prof. Matthias Klumpp
»Smart Retail and Logistics Innovations«

Programm

12.00 **Keynote** | Prof. Alexander Hübner (TU Munich)
»**Smart Retail Logistics: How can Analytics and Sustainability be Reconciled?**«

Prof. Dr. Alexander Hübner

Professur für Supply and Value Chain Management

Technische Universität München

Smart Retail Logistics: How can Analytics and Sustainability be Reconciled?

Smart Retail Summit 2022

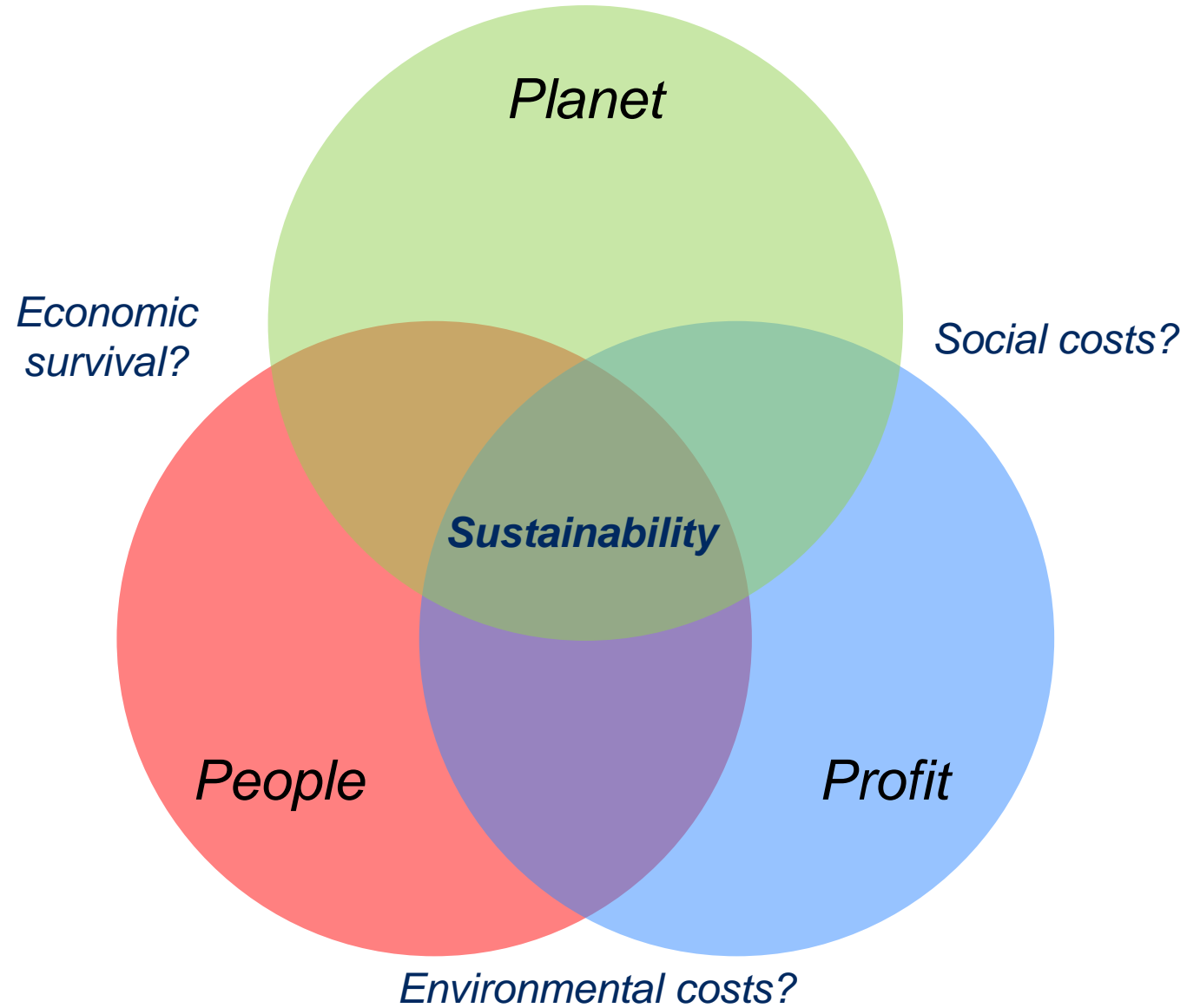Georg-August-University Göttingen

Alexander Hübner

Technical University of Munich

November 29th, 2022

Sustainability means addressing 3Ps

Planet

Economic survival?

Social costs?

Sustainability

People

Profit

Environmental costs?

Example People: Should I be bothered as a supply chain manager?

- Many **multi-national brands produced in Rana Plaza**
- **Garment factory**
- Cracked walls and workers afraid to go in

- 3,639 workers
- $0.12 to $0.24 per/hour
- 14 hour shifts
- 2 days off/month

- **Certified factory**

Source: Institute for Global Labour and Human Rights, "Factory Collapse in Bangladesh,"
http://www.globallabourrights.org/campaigns/factory-collapse-in-bangladesh

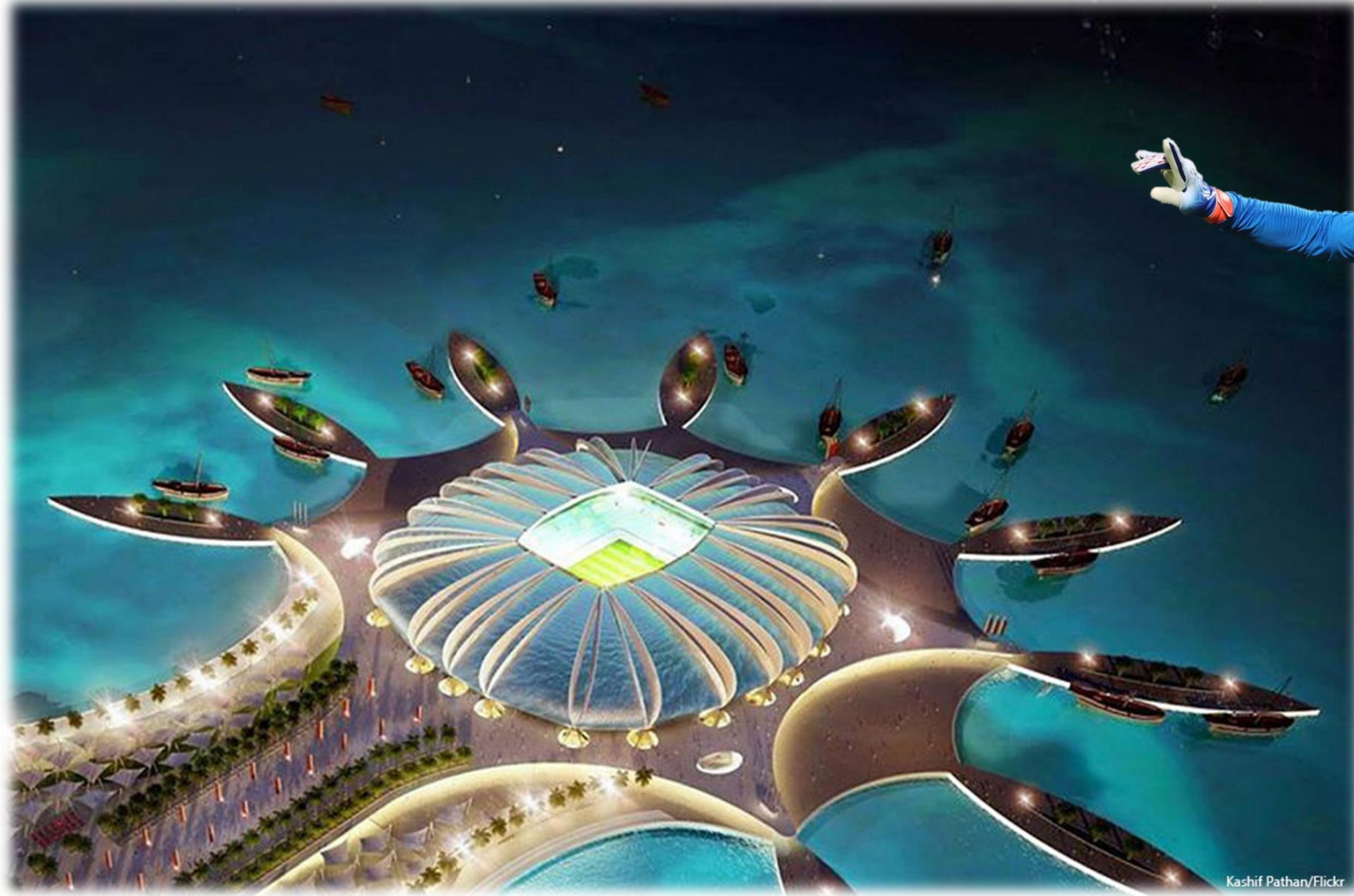# Example People: Should I be bothered as a supply chain manager?

Rana Plaza factory in Bangladesh was audited and approved …

… 1,137 deaths in factory collapse in 2013

Example People: Should I be bothered as a supply chain manager?

Kashif Pathan/Flickr

Example People: Should I be bothered as a supply chain manager?

A Nepalese World Cup Worker Dies Every Other Day in Qatar

Per Liljas @perliljas Dec. 24, 2014

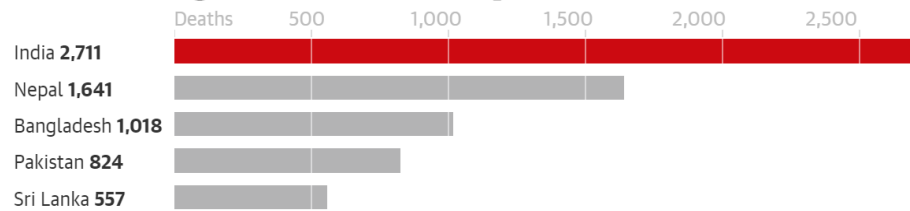**The appalling toll comes despite Qatari claims of reform**

The *Guardian* reports that Nepalese migrants building the infrastructure for the 2022 World Cup in Qatar died at a rate of one in every two days during 2014.

The death toll excludes deaths among Indian, Sri

Prakash Mathema—AFP/Getty

Nepalese migrant workers queue to receive official documents in order to leave Nepal

There have been 6,750 deaths of south Asian migrants since Qatar was awarded the right to host the World Cup in 2010

	Deaths	500	1,000	1,500	2,000	2,500
India **2,711**						
Nepal **1,641**						
Bangladesh **1,018**						
Pakistan **824**						
Sri Lanka **557**						

Guardian graphic | Source: Supreme Council of Health (Qatar), Embassy of India (Qatar), Embassy of Nepal (Qatar), Foreign Employment board (Nepal), Wage Earners' Welfare Board (Bangladesh), Embassy of Sri Lanka (Qatar). Figures 2011 to late 2020 for nationals from India, Nepal, Bangladesh and Sri Lanka. Pakistan figures from 2010 to 2020

Number of workers who died in construction in the run op to recent sporting events

■ FIFA ■ Olypmics

6x more than in Rana Plaza!

>7.000

60

6   2   0   8   9

| Bejing 2008* | South Africa 2010 | London 2012 | Sochi 2014 | Brazil 2014 | Russia 2018 | Qatar 2022 |

Example Planet: Should I be bothered as a supply chain manager?
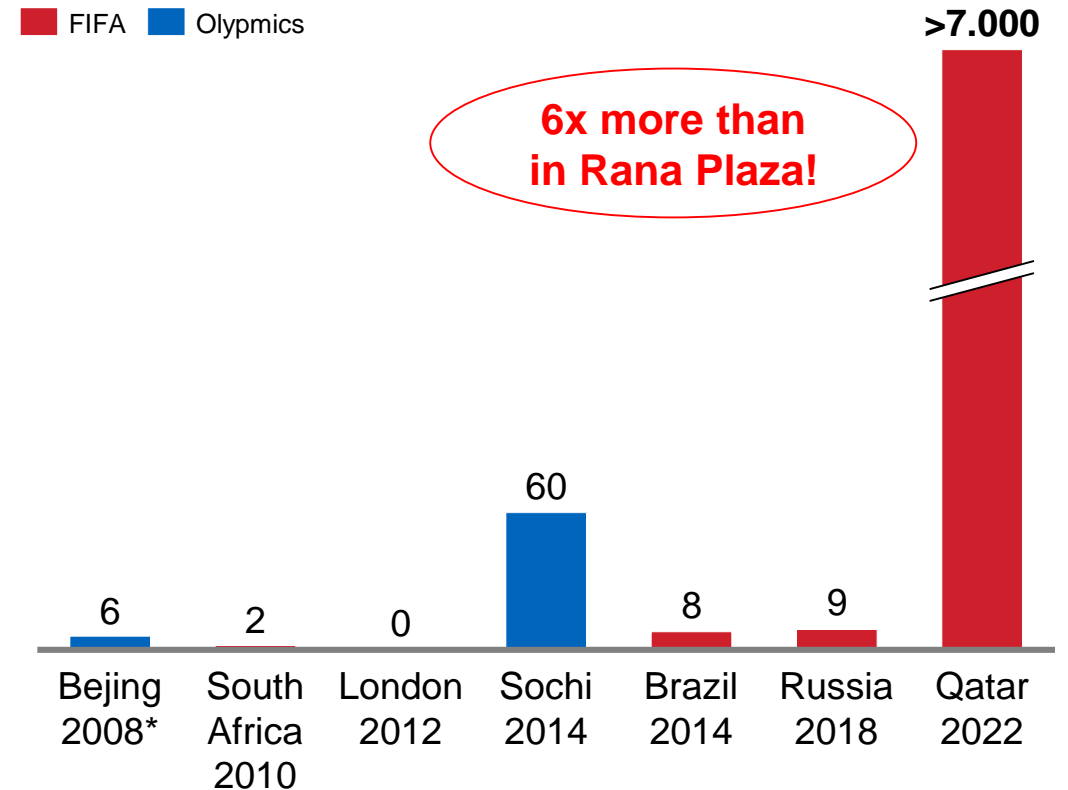
How much food is wasted?

In % of total food produced

Worldwide: 1/3 of total produced food is wasted

(Gustavsson et al., 2011)

In kg per person in EU

EU: 344 kg per capita are wasted annually

(Eurostat, 2020)

Food waste is a massive ecological issue

- Global food loss and waste equaled **8–10% of global GHG emissions**[1]

- As a country, **3rd largest emitter of GHG** behind China and the US [3]

- Food production and distribution amounts to **17% of energy consumption, 46% of land usage, and 80% of fresh water consumption** (U.S.)

- Wasted food means wasted resources in production (agricultural resources, use of fertilizers, packaging), transport (often long distances, fuel) and storage (powering the cold chain)

1. IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. https://www.ipcc.ch/srccl/ (2019).
2. FUSIONS. Estimates of European food waste levels. https://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf (2016).
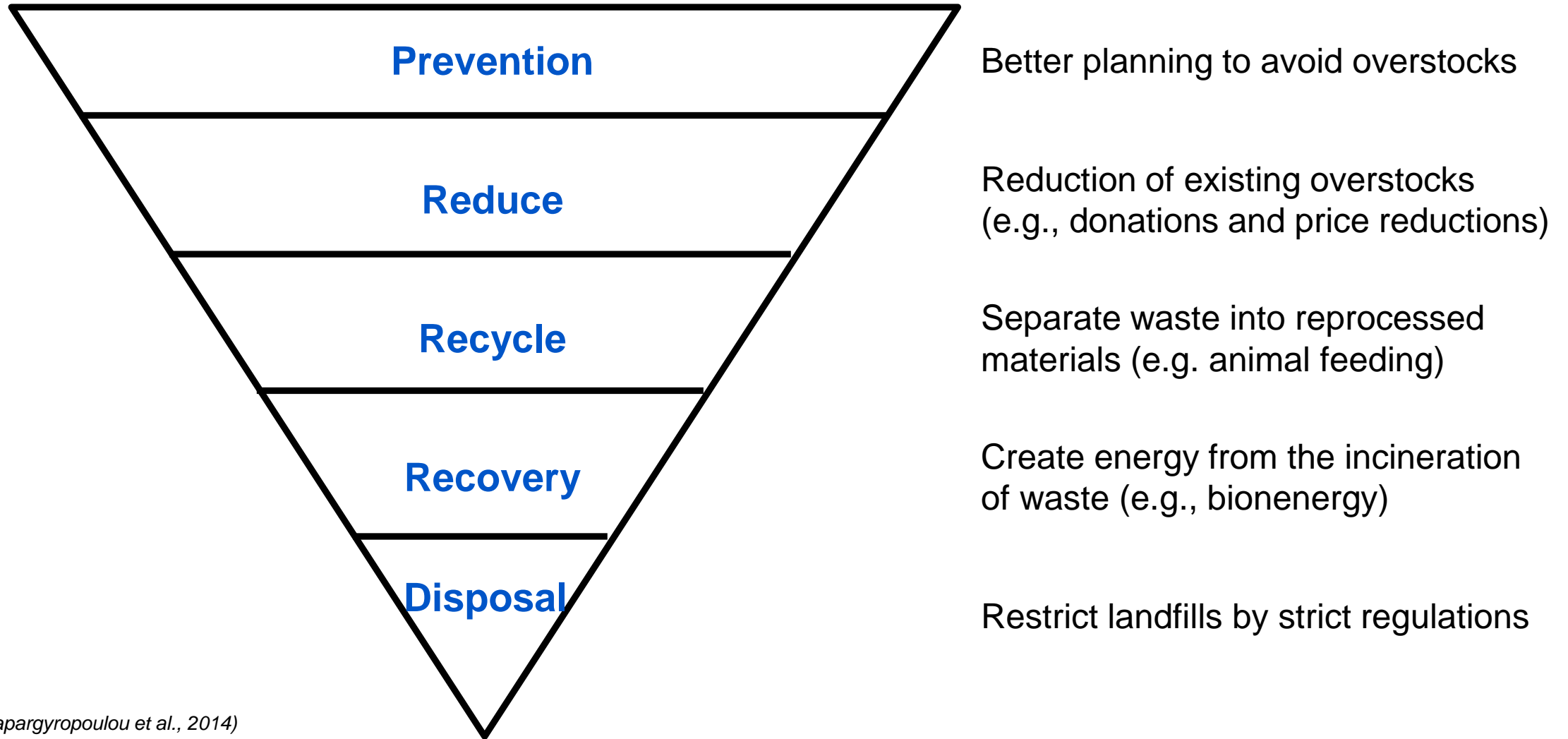3. Food and Agriculture Organization (2020)

Agenda

TUΓΠ

The waste hierarchy and its application to food

Prevention

Better planning to avoid overstocks

Reduce

Reduction of existing overstocks (e.g., donations and price reductions)

Recycle

Separate waste into reprocessed materials (e.g. animal feeding)

Recovery

Create energy from the incineration of waste (e.g., bionenergy)

Disposal

Restrict landfills by strict regulations

Source: Papargyropoulou et al., 2014)

Retailers need to balance risking food waste against availability of products

The retailer's dilemma

⬤ **Cause: High product availability**

On-shelf availability of products is a prerequisite for **high sales**, e.g., to achieve financial targets

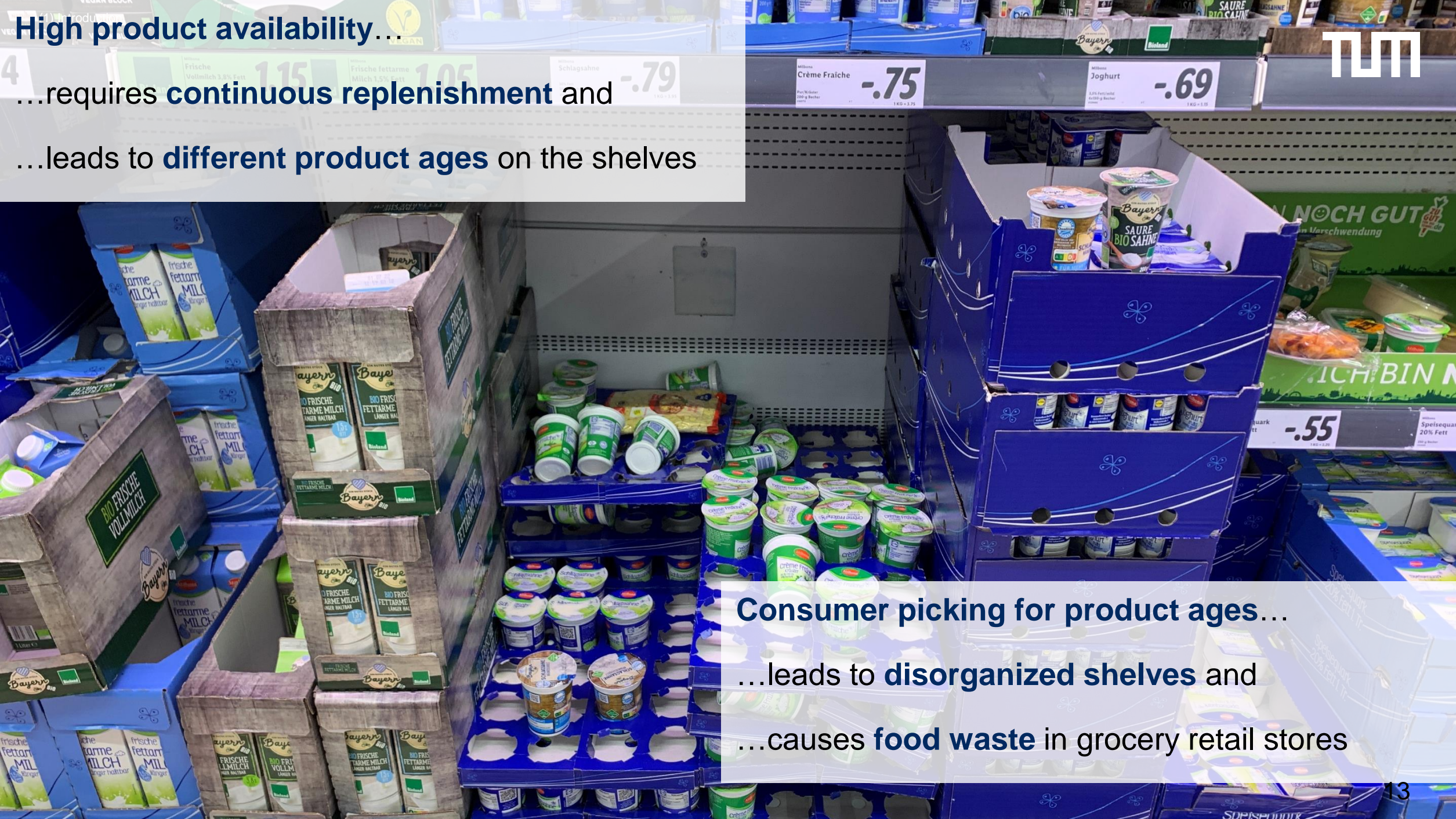⌄

⬤ **Effect: Risk of food waste**

Food waste through expiration is caused by excess stock, however, often not penalized due to the lack of waste reduction incentives

High product availability…

…requires **continuous replenishment** and

…leads to **different product ages** on the shelves

Consumer picking for product ages…

…leads to **disorganized shelves** and

…causes **food waste** in grocery retail stores

13

Research question

RQ To what extent do consumers pick a more distant expiration date and what are store-related influencing factors in grocery retail?

Surveys and scanner data have limitations

Survey-based approaches may not reflect **actual consumer picking** (LEFO-FEFO share)

Barcodes scanned at the point-of-sale do not contain any **expiration date information**

15

We conducted a field study in cooperation with a leading European retailer

Product and store selection

Focus on the **fresh assortment** with limited shelf life and availability of expiration date labels

Selection of **representative products** for the most relevant product categories and **suitable stores** for data collection

Approach for data collection

Collection of **expiration date and inventory information** in stores on an hourly basis

No manipulation of supply or demand, however execution of a **strict FEFO shelf arrangement**

Methodology validated with a **pilot study** in two stores

>700 hours of data collection in stores

>28.000 data points generated

Picking was observed in all product categories

Picking factor for product categories

n = 4,809

Product category	#Data points	#Withdrawals	#Picking	Picking factor
Milk	415	945	422	45%
Cream/sour cream	602	1,849	657	36%
Cream cheese	354	724	237	33%
Buttermilk/kefir	187	301	98	33%
Semi-hard/soft cheese	361	691	197	29%
Butter	502	1,719	485	28%
Mozzarella	562	1,771	479	27%
Yoghurt	248	586	155	26%
Curd (Quark)	350	734	191	26%
Convenience	286	466	111	24%
Wurst	303	571	136	24%
Fish	250	436	96	22%
Dessert	236	447	77	17%
Vegetarian substitute	153	242	11	5%
Total	**4,809**	**11,482**	**3,352**	**29%**

Agenda

Two research questions have been derived

Research questions

RQ1: Are promotions **drivers for food waste** of perishable goods in retail and do they differ between **product categories**?

RQ2: What are **mitigating measures to reduce food waste**?

1 Mena et al. (2011) | 2 Sethuraman (2002) | 3 Narasimhan (1996)

Hypotheses to be tested

H1	The amount of **food waste increases with promotions**[1]
H2	The amount of food waste of non-promoted SKUs increases with promotions due to **cannibalization** within sub-product categories[1]
H3	The amount of food waste increases with **higher frequency of promotions**[2]
H4	The amount of food waste increases with **higher relative price discounts**[3]

The cooperating German retail chain provided relevant panel data on a store-product-day level

Data collection

Empirical propietary data was provided by a **major German retail chain** (RetailCo)

~170 stores

Data description

📅	**Time horizon**	**2019** (Full year)
❄	**Products covered**	**Chilled** consumer packaged goods
🗂	**Granularity**	**SKU** level data **per day per retail store**
📊	**Product categories**	▪ Dairy/milk products ▪ Convenience ▪ Delicacies ▪ Cheese self-service ▪ Meat self-service
📦	**# of products per data set based on remaining shelf life**	▪ 149 (for next 14 days) ▪ 984 (for next 28 days)

Variables for Fixed Effect Model

Dependent variable

Food Waste

Independent variables

Promotions	Substitution
# promotions per year	Price discount

Control variables

Store type	Store size
Revenue with time lag	Overforecast error
Revenue	Price
Case size cover	

Fixed entities (dummy variables)

Store, month, SKU

Promotions drive food waste. Effect depends on the product category

Promotions are a **food waste driver for highly perishable goods**

The greatest evidence was found for **food waste generally caused by promotions** and **due to cannibalizations**

The strongest effects were found for **Delicacies** and **Milk/Dairy**

Important to note: **great differences** exist **between product categories** and even smaller differences within product categories between products with **differing shelf lives**

Agenda

Novel human-machine interactions in warehousing lead to mental impoverishment
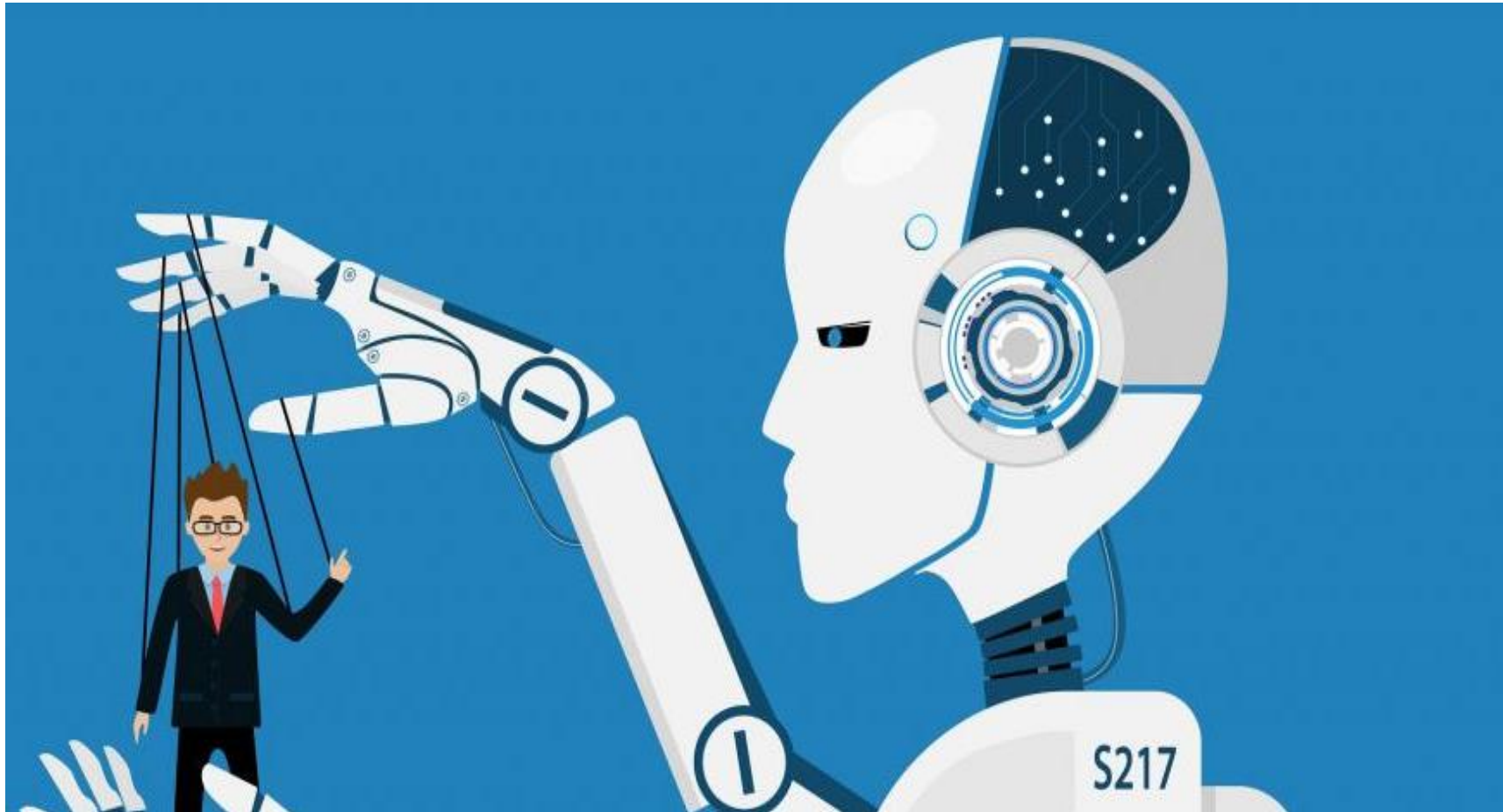
Often, machines and robots perform the assignment and planning of tasks,

while human workers execute repetitive and monotonous activities

Human-machine interaction in a semi-automated picking system

Context

- Pick-to-light system with two aisles and 12 workstations with **different characteristics**

- **Algorithm determines** pick location and duration for each employee

- **Stagnating system performance** and high fluctuation

- **Monotonous operational picking process** with a lack of satisfaction, self-determination and perceived fairness

→ *Necessity to innovate the human-machine interaction*

Source: Lorson/Fügener/Hübner (2022): Let pickers pick their picks: Effect of a goal-setting intervention on performance and human factors in a human-machine interaction

Goal-setting mechanisms trigger a boost in effort while the intervention increases the amount of workstation changes

TUM

Mechanisms

- Higher engagement based on an **increase in effort, energy and persistence**

- Reduced **average login time at workstations** triggered by the maximum amount of pick per workstation

Login name

Password

Select desired pick quantity

| 25 | 35 | 45 | 65 | 105 |

Source: Lorson/Fügener/Hübner (2022): Let pickers pick their picks: Effect of a goal-setting intervention on performance and human factors in a human-machine interaction

The average pick performance per employee hour increased by 6% compared to the year before

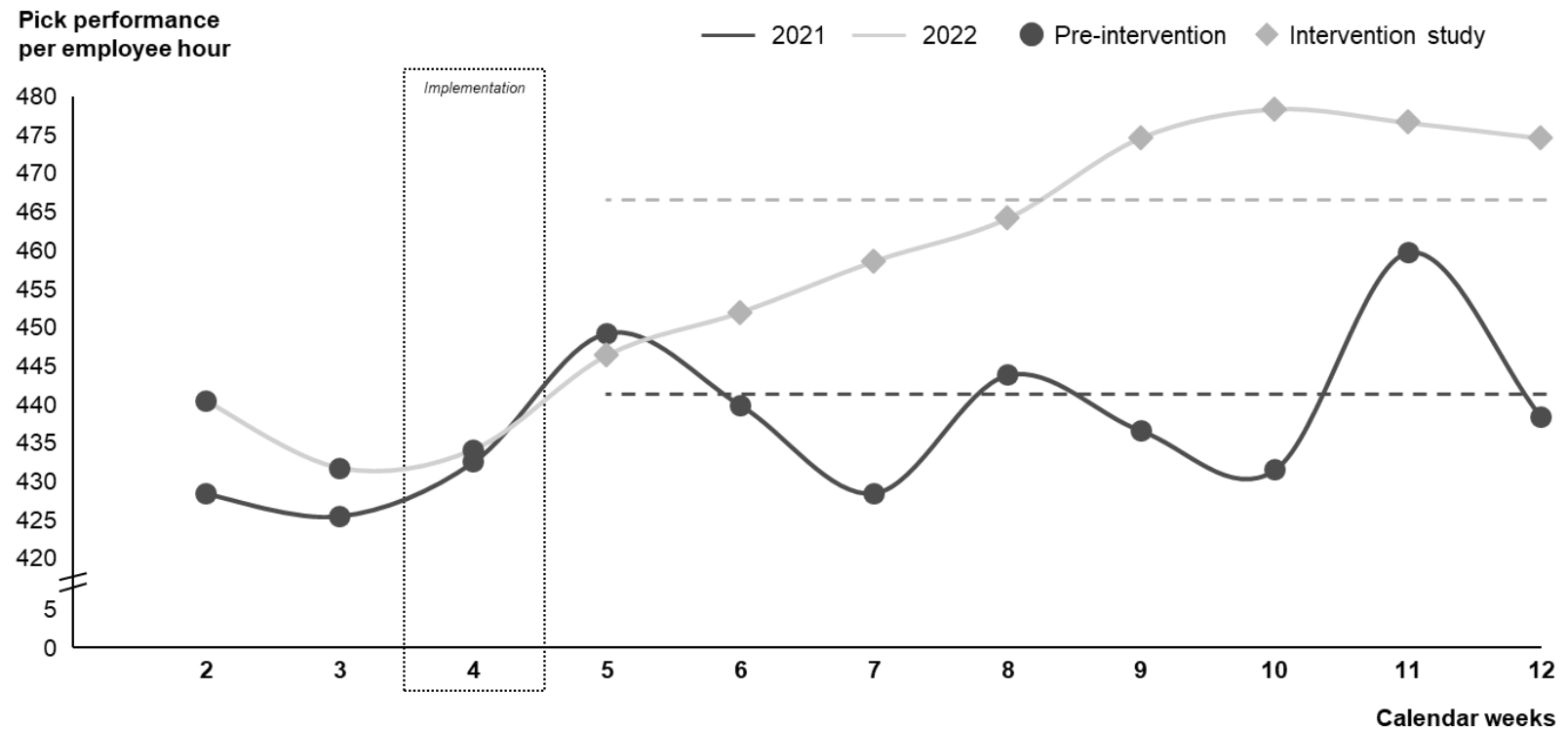Definition Pick Performance per employee hour

Sum of conducted picks / Sum of picking time

Source: Lorson/Fügener/Hübner (2022): Let pickers pick their picks: Effect of a goal-setting intervention on performance and human factors in a human-machine interaction

Human factors scores deteriorated due to the intervention mainly due to the suspension of informal arrangements

Satisfaction

I am generally satisfied with my job.

Self-determination

I work in a self-determined way, that is, I make decisions.

Perceived fairness

I believe that the assignment of pickers to the workstations is fair.

Weekly survey score, n = 41

1 = no
2 = rather no
3 = neither/nor
4 = rather yes
5 = yes

Satisfaction:
- 4.4 — Pre-intervention (Calendar week 3)
- 3.2 — Intervention (ø Calendar weeks 5-9)

Self-determination:
- 2.4 — Pre-intervention (Calendar week 3)
- 2.0 — Intervention (ø Calendar weeks 5-9)

Perceived fairness:
- 3.7 — Pre-intervention (Calendar week 3)
- 2.1 — Intervention (ø Calendar weeks 5-9)

Source: Lorson/Fügener/Hübner (2022): Let pickers pick their picks: Effect of a goal-setting intervention on performance and human factors in a human-machine interaction
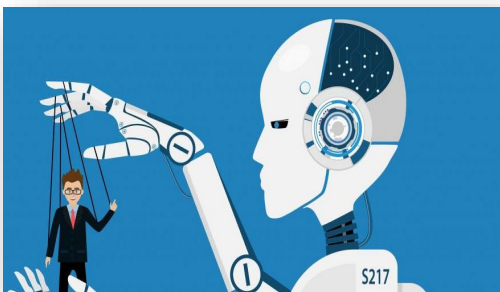
Agenda

What should you take from today?

- Sustainability is not any more an abstract term
- **Sustainability means addressing 3Ps** (people, planet and profit)

- **Retailers** facing the **dilemma of high availability** and **food waste**
- **Customers pick** in 30% of possible cases **for fresher products**
- **Promotions** contribute significantly to **food waste**

- Shortage of work force and **novel human-machine interactions** call for **enhancing social sustainability** within the firm

References

- Hübner, Hense & Dethlefs (2022): The revival of retail stores through omnichannel operations: A literature review and research framework, European Journal of Operations Research

- Lorson, Fügener & Hübner (2022): New team mates in the warehouse: Human interactions with automated and robotized systems, IISE Transactions

- Lorson, Fügener & Hübner (2022): Let pickers pick their picks: Effect of a goal-setting intervention on performance and human factors in a human-machine interaction

- Riesenegger & übner (2022): Reducing food waste at retail stores – An explorative study, Sustainablity

- Wink, Schäfer, Goerg & Hübner (2023): Impact of promotions on retail food waste

- Winkler, Schäfer, Ostermeier & Hübner (2023): Picking for Expiration Dates in Grocery Retail - A Field Study

Thank you for your attention!

Any questions?

Prof. Dr. Alexander Hübner
Technical University of Munich
Campus Straubing for Biotechnology and Sustainability
Chair of Supply and Value Chain Management

alexander.huebner@tum.de
www.scm.cs.tum.de