Universität Stuttgart
Institute for Sanitary Engineering, Water
Quality and Solid Waste Management

**Digital Tools for Monitoring and
Reducing Food Waste in the Tourism
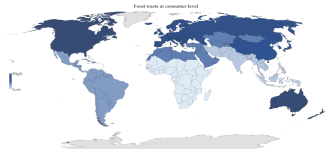Sector - Experiences and Results
from Greece and Germany**

UIA URBAN INNOVATIVE ACTIONS A2UFood

ELoFoS
Efficient Lowering of
Food Waste in the Out-
of-Home Sector

Gerold Hafner, 21.06.2023

iswa

Background

Global Food Waste

FAO-Study (2011)[1]

Worldwide approx. **1.3 billion tonnes** of food waste per year.
1/3 of global production.

EU-Studie FUSIONS (2016)[2]

Approx. **88 million tonnes** of food waste per year in Europe.[2]
20 % of European production.

[1]Quelle: (Gustavsson et al., 2011)   [2]Quelle: (Stenmarck et al., 2016)

Activities

Global & European Context

UN-Agenda 2030 for Sustainable Development

SDG 12.3 & interpretation by Champions 12.3

University of Stuttgart
Germany

SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY

2 ZERO HUNGER

3 GOOD HEALTH AND WELL BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS

SUSTAINABLE DEVELOPMENT GOALS

Goals

12

Ensure sustainable consumption and production patterns

---

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Target
12.3

By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses

Indicators ▲

12.3.1
Global food loss index

Political Framework

2020
Start of
Data collection

2025
target:
-30%

2030
target:
-50%

◆ annual reports

UN
Sustainable
development goal
„SDG 12.3"

Future challenges:

- EU-wide Monitoring of Food Waste - Directive (EU) 2018/851.

- Development of a Reliable Data Basis

- Development & Implementation of Prevention Measures

- Reporting & Documentation

Research Projects

A2UFood
UIA Initiative (EU)

Heraklion
Circular economy
A2UFood – Avoidable and Unavoidable Food Wastes: A Holistic Managing Approach for Urban Environments

- software to support families in reducing avoidable food waste
- software and hardware for reducing avoidable food waste in the hospitality sector
- a second opportunity food restaurant
- a bioplastic production system for the production of compostable bags
- a range of stateof-the-art Autonomous Composting Units (ACUs) where treatment will take place on-site.

- City of Heraklion
- United Association of Solid Waste Management in Crete
- ENVIROPLAN S.A
- University of Crete
- Technological Educational Institute of Crete
- Harokopio University
- University of Stuttgart

"For a city receiving hundreds of thousands of visitors each year, it is imperative that holistic solid waste management takes account of them and the respective hospitality industry, if any planning and implementation should be successful."

Charalambos Mamoulakis, Vice-mayor of Heraklion

- Urban Innovative Actions: **www.uia-initiative.eu/en/uia-cities/heraklion**
- A2UFood: **a2ufood.gr**

University of Stuttgart
Germany

ELoFoS

Efficient Lowering of food Waste in the Out-of-Home Sector
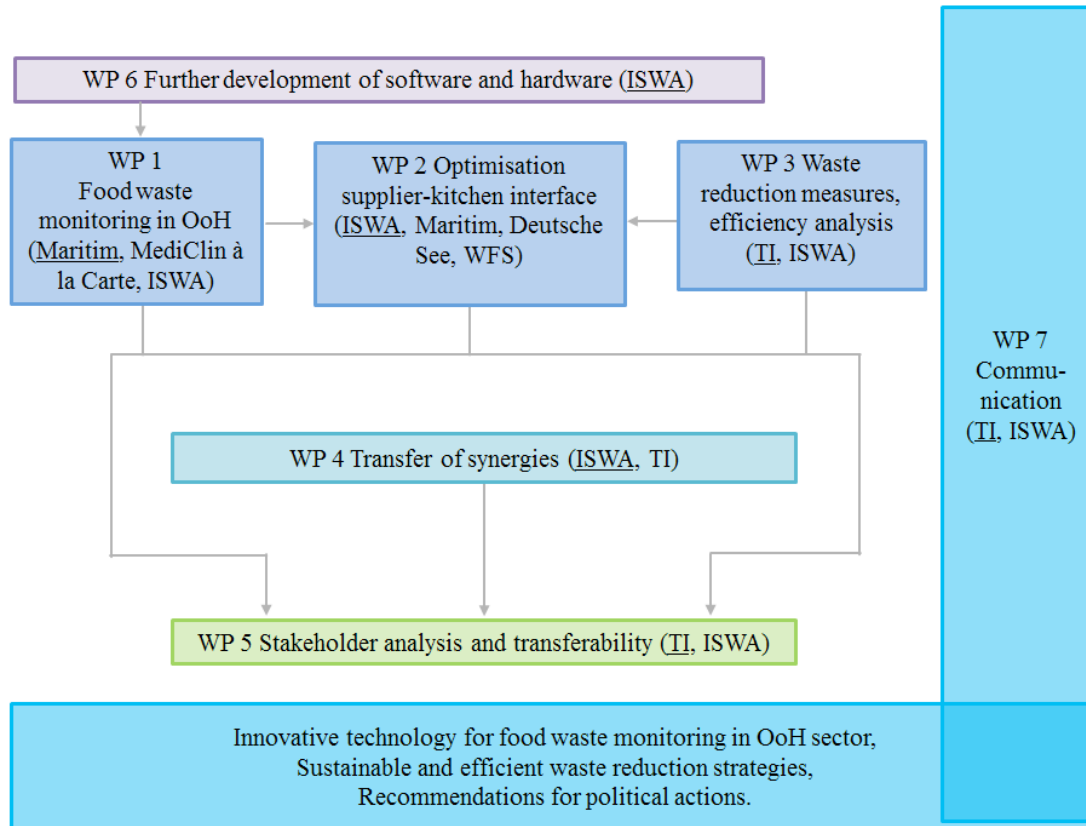
Monitoring Tools

If you can't measure it,

you can't manage it.

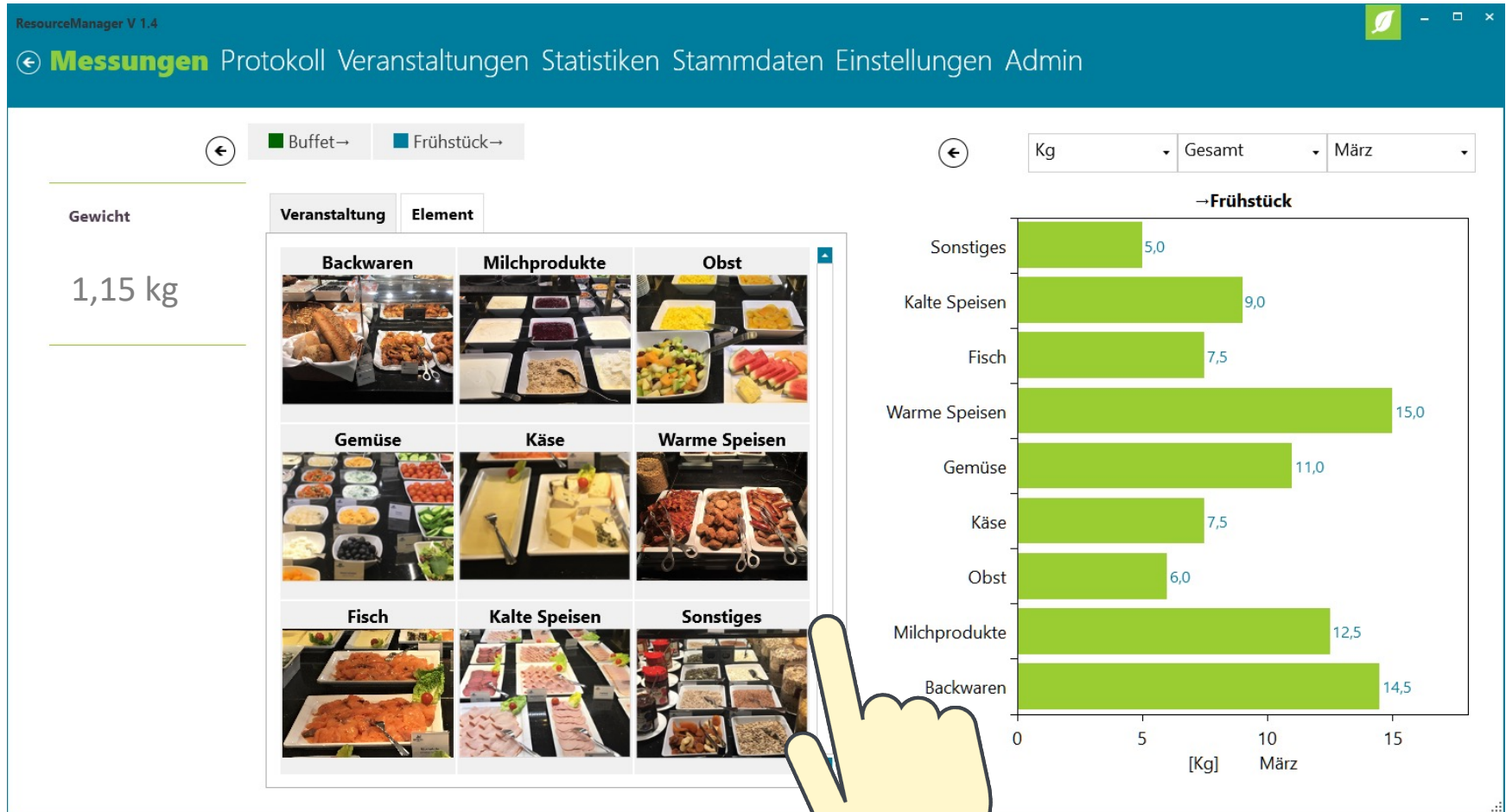**Kaplan, R.S., Norton, D.P. (1997)**

RESOURCEMANAGER FOOD

RESOURCEMANAGER

FOOD

1 All-in-one-PC (Tablet)

2 own software development
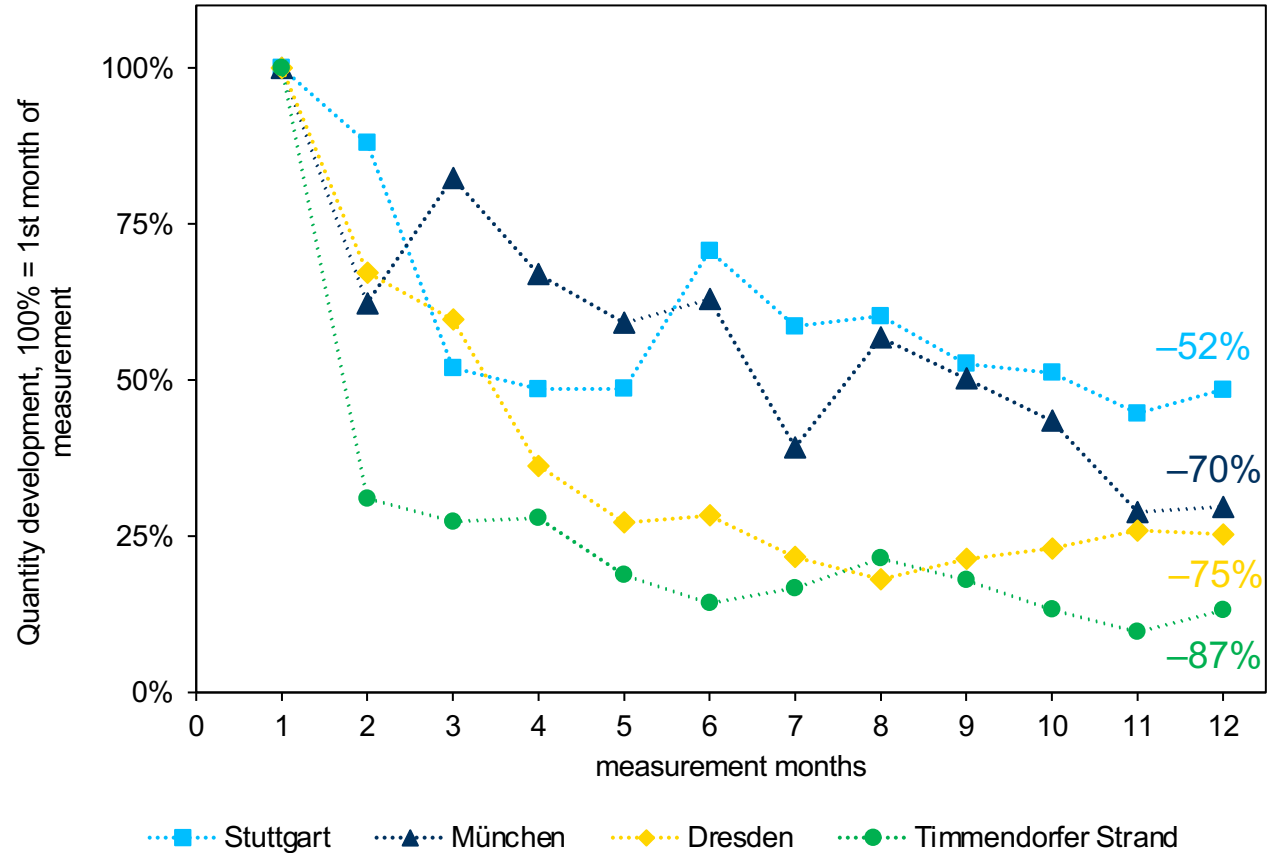
3 electronic scale (USB)

4 serving container

User Interface – Resourcemanager Food

Proof of Concept

RESOURCEMANAGER FOOD

Time course of food waste at the breakfast buffet

Quantity development, 100% = 1st month of measurement

measurement months

–52%
–70%
–75%
–87%

···■··· Stuttgart   ···▲··· München   ···◆··· Dresden   ···●··· Timmendorfer Strand

Customer Benefits — RESOURCEMANAGER FOOD

example Breakfast buffet	mass	climate	costs	nutritional value
Potential	-64%	-55%	-61%	-61%
Savings (per kitchen and year)	1.800 kg	6.800 kg CO_2-eq	8.137 EUR	$3{,}6 \cdot 10^6$ kcal
COST– BENEFIT (savings per € invested)	2:1 (kg/€)	9:1 (kg CO_2 eq./€)	11:1 (€/€)	4.600:1 (kcal/€)
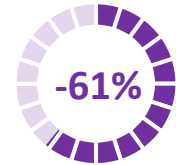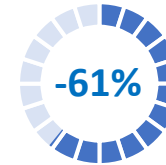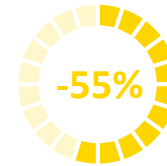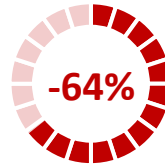
ELoFoS
Efficient Lowering of Food Waste in the Out-of-Home Sector

App for Smartphone / Tablet

Greek Version

Online App

https://play.google.com/store/apps/details?id=com.evolvice.resourcemanager

RESOURCEMANAGER FOOD

Smartphone App
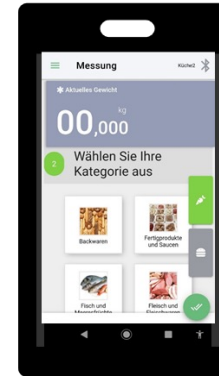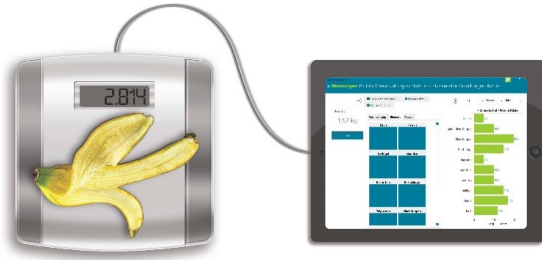
system: hardware & software

pairing with hardware via Bluetooth

OUTLOOK – goals, unique features, innovation & customer benefit

1. Android-App worldwide

RESOURCEMANAGER
FOOD 4.0

INTELLIGENT IMAGE RECOGNITION

MKN cloud concept

CONNECT ALL KITCHEN DEVICES

CLOUD CONNECTION

process optimisation

AI-BASED DEMAND FORECASTS

Central monitoring of all kitchens
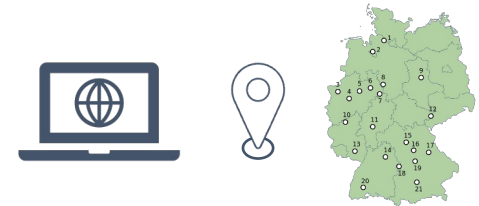
WEB INTERFACE & PLANNING TOOLS
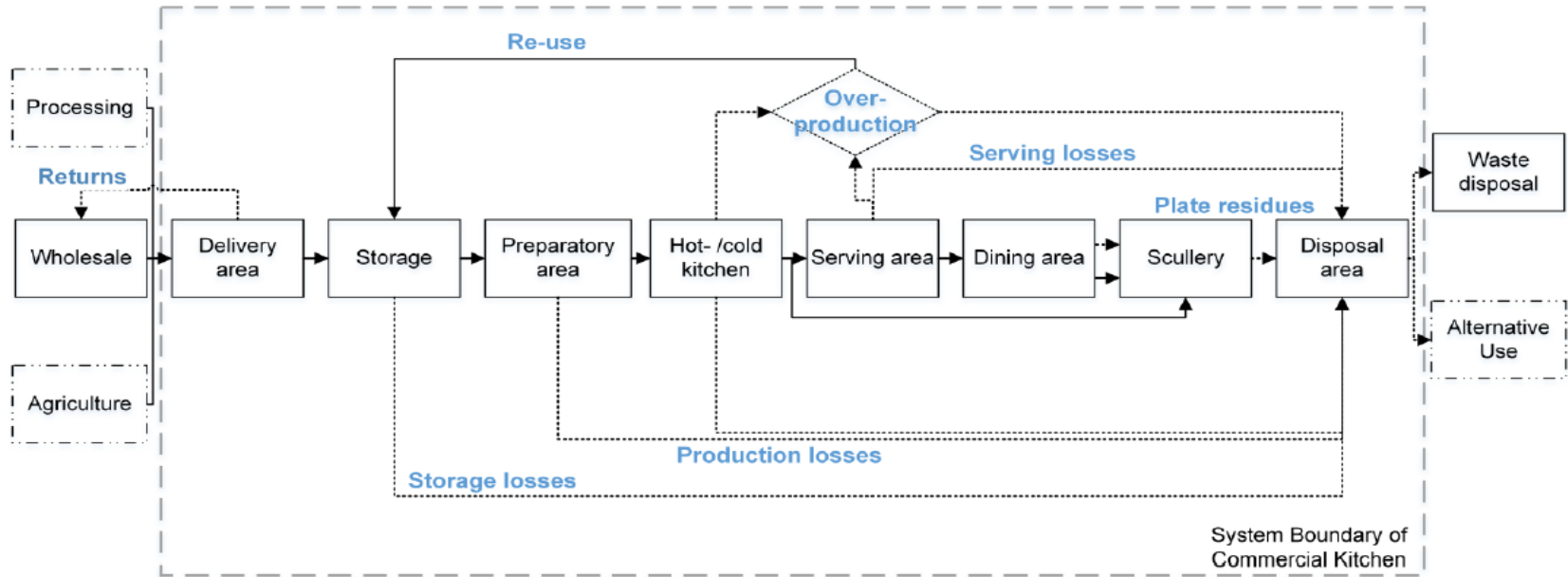
OUTLOOK – goals, unique features, innovation & customer

- SmartFood BaWü

- Private Households in county

- Method development

- Quick Check

- Benchmarks

- Nutrition information

- Monitoring according EU delegated decision

- Upscaling whole county

- Potential analysis

Heraklion Monitoring

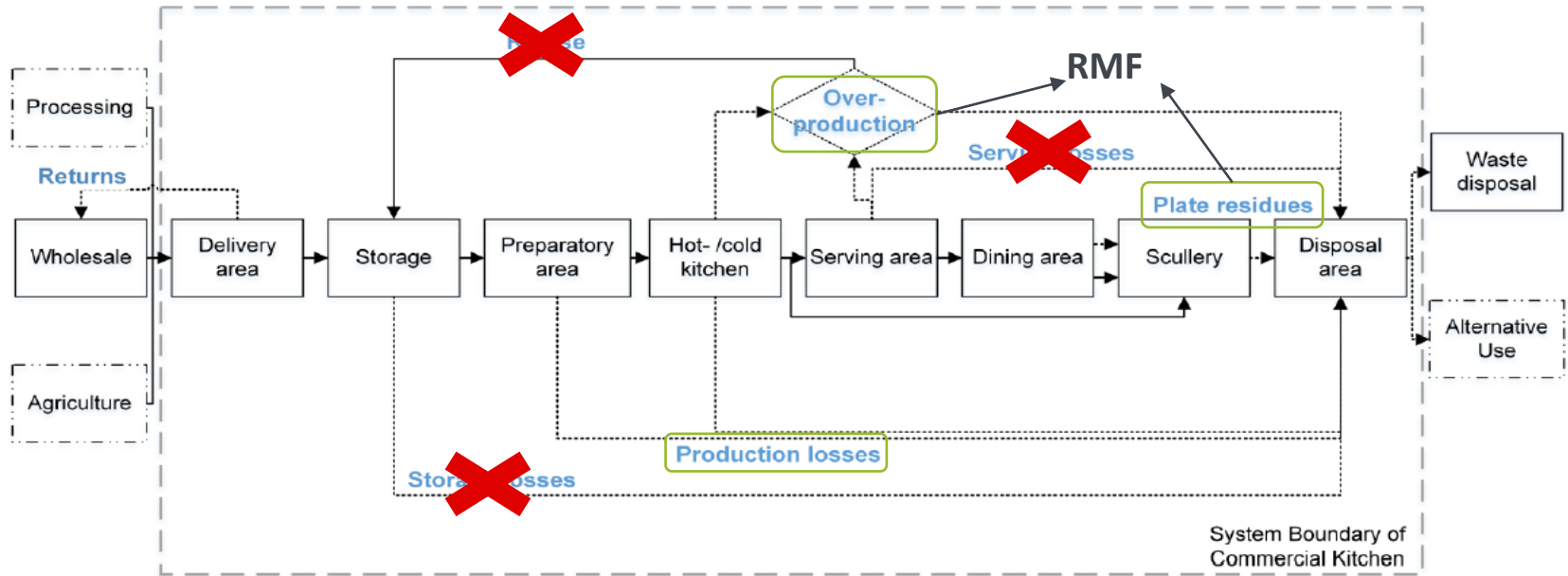# measurement setup

2. Measurement setup and data acquisition

Area of investigation

Source: Fuchs, "Food Waste Reduction using RESOURCEMANAGER-FOOD"

2. Measurement setup and data acquisition

Area of investigation

Source: Fuchs, "Food Waste Reduction using RESOURCEMANAGER-FOOD"

2. Measurement setup and data acquisition

RMF location and categorization of overproduction

Categorization of overproduction according to the areas in the serving area:

- Main course

- Salad

- Supplements

- Desserts

- Bakery products

- Hot dishes (only breakfast)

- Fruits

- Cold cuts & local products (marginal no. of measurements)

## 2. Measurement setup and data acquisition

Extent of the measurements

Type	Overproduction (main kitchen)			Plate residues			Production losses
Mealtime	Bf	Lu	Din	Bf	Lu	Din	Din
Hotel 1	x	x	x	x	x	x	
Hotel 2	x	x	x				
Hotel 3		x					
Hotel 4						x	
Hotel 5						x	x
Hotel 6			x				

	Measurement duration	Number of measurement days
Hotel 1	16.04.2019 – 30.06.2019	75
Hotel 2	18.04.2019 – 30.06.2019	66
Hotel 3	02.05.2019 – 14.05.2019	10
Hotel 4	17.04.2019 – 15.06.2019	33
Hotel 5	02.05.2019 – 14.05.2019	14
Hotel 6	06.08.2021 – 01.10.2021	49

Universität Stuttgart

Heraklion Monitoring

food waste in hotels
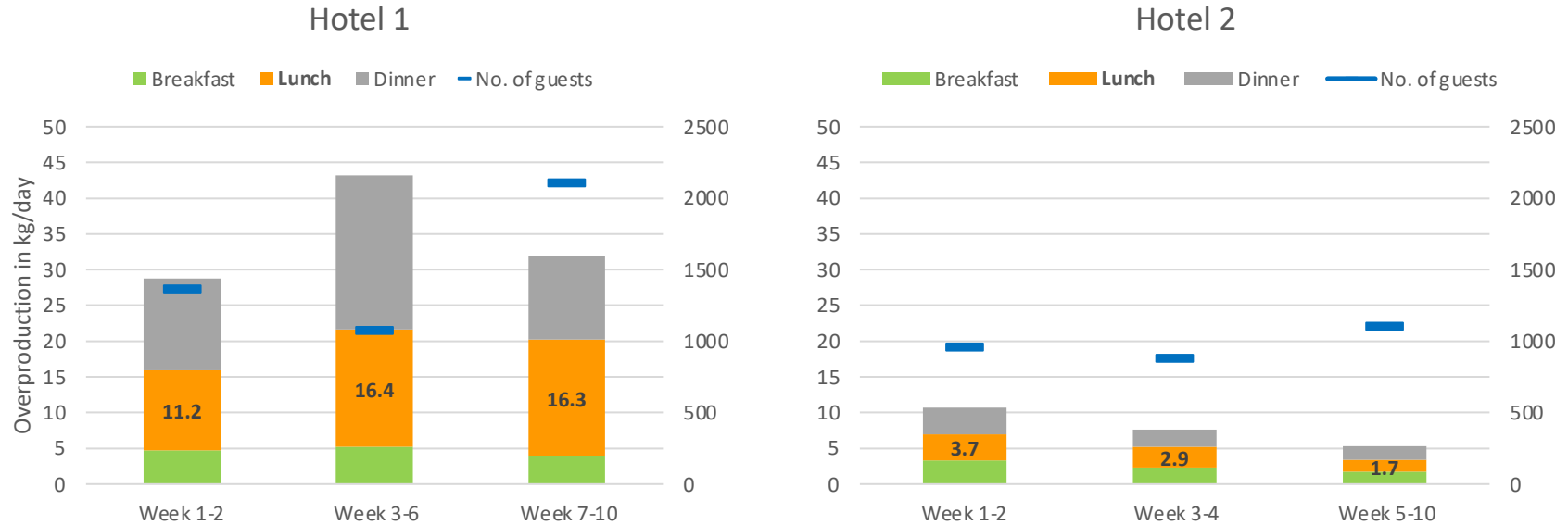
3. Food waste amounts

Overproduction at buffet in Hotel 1 and 2
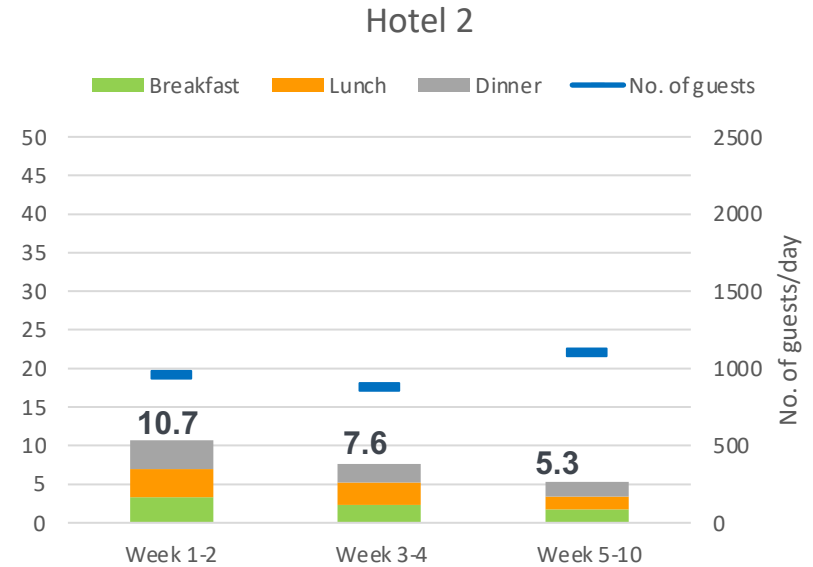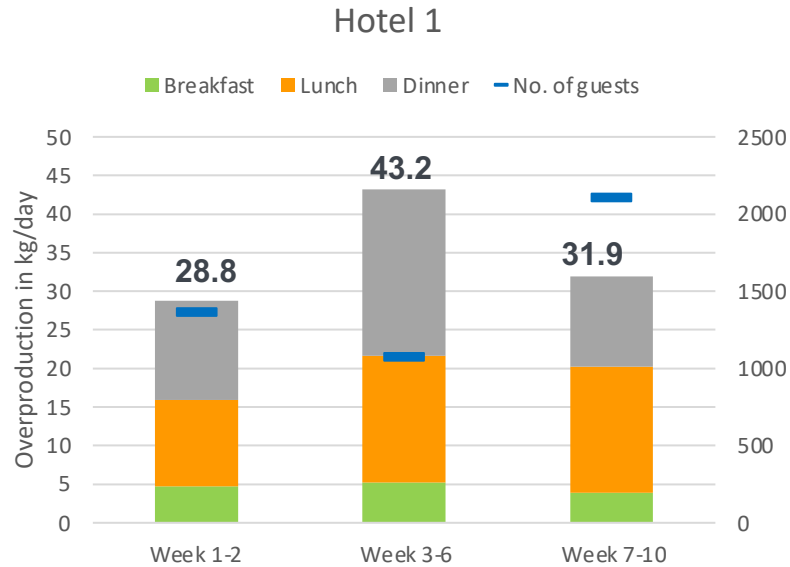
Hotel 1

Hotel 2

- No reduction of overproduced food
- Halved the amount of overproduced food

- Overproducution in Hotel 1 is **three to 6 times higher** than in Hotel 2.

Universität Stuttgart
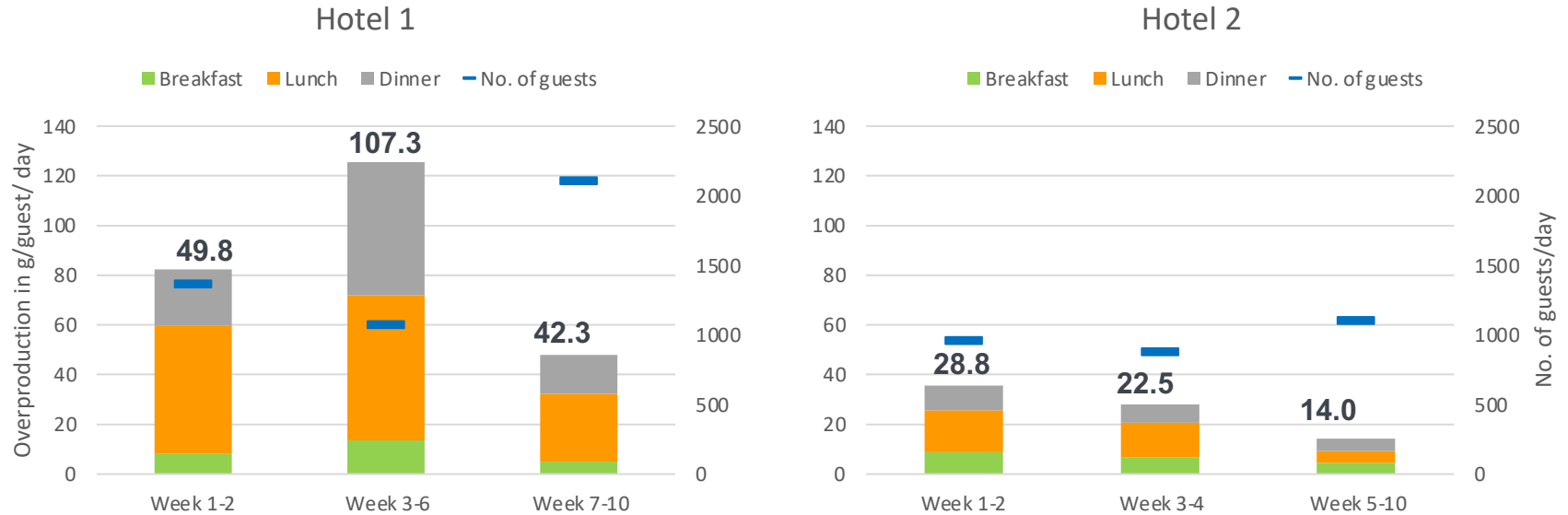
3. Food waste amounts

Overproduction at buffet in Hotel 1 and 2 at lunch

Hotel 1

Legend: ■ Breakfast ■ **Lunch** ■ Dinner ▬ No. of guests

Overproduction in kg/day

Week 1-2	Week 3-6	Week 7-10
11.2	16.4	16.3

Hotel 2

Legend: ■ Breakfast ■ **Lunch** ■ Dinner ▬ No. of guests

Week 1-2	Week 3-4	Week 5-10
3.7	2.9	1.7

- **Week 1-2:** 11.2 kg/day (Hotel 1) **> 5.4 kg/day (Hotel 3) >** 3.7 kg/day (Hotel 2)

- Overproduction at lunch in Hotel 1 is **three to ten times higher** than in Hotel 2.

Universität Stuttgart
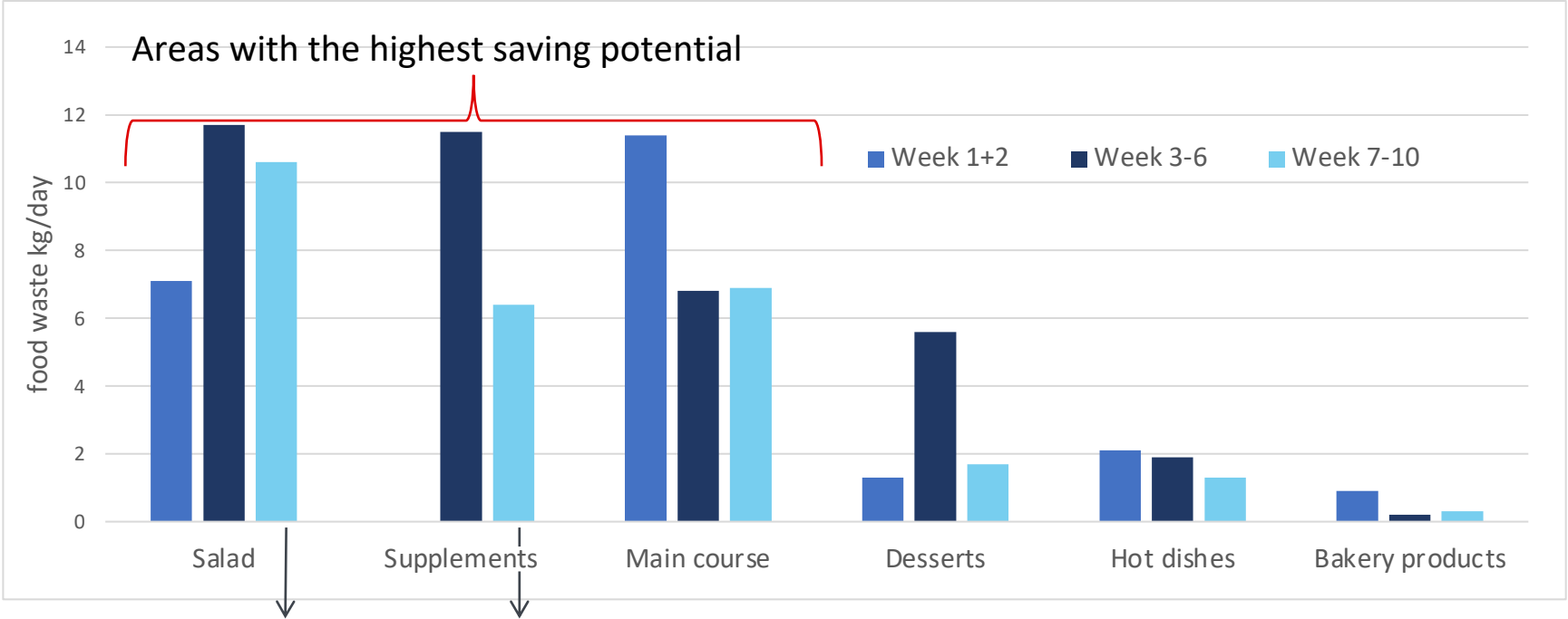
3. Food waste amounts

Overproduction **per guest** in Hotel 1 and 2

- Overproduction that was generated on average per guest and day.

- The overproduction per guest in Hotel 1 is **up to four times higher** than in Hotel 2.

4. Food waste amounts per food category
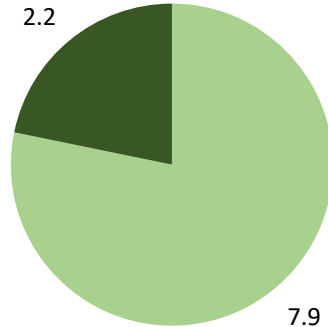
Composition of overproduction in Hotel 1

Areas with the highest saving potential

Legend: Week 1+2, Week 3-6, Week 7-10

y-axis: food waste kg/day (0 to 14)

Categories: Salad, Supplements, Main course, Desserts, Hot dishes, Bakery products

Except for the categories "Salad" and "Desserts", the daily overproduction in all categories
has decreased in comparison from weeks 1-2 to weeks 7-10.

Universität Stuttgart

4. Food waste amounts per food category

Example: Composition of overproduction in Hotel 1 Week 7-10

Salad 10.1 [kg/day]

■ Mixed Salad   ■ Fresh salad

2.2

7.9

Supplements 6.2 [kg/day]

■ Pasta   ■ Fries   ■ Rice   ■ Potatoes   ■ Vegetables   ■ Others
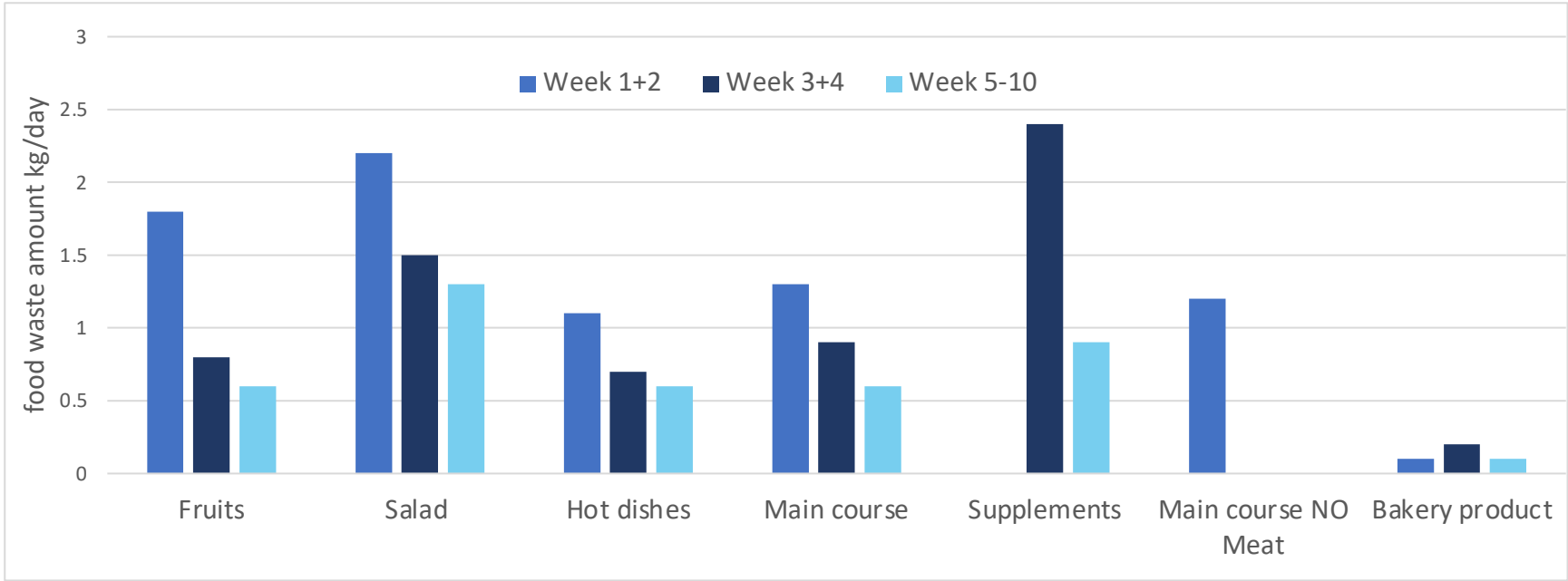

1.5   1.1

0.4

0.8

0

2.2
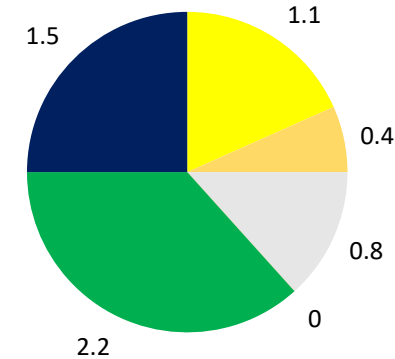
→More demand-oriented production.

→Smaller containers for these dishes.

4. Food waste amounts per food category

Composition of overproduction in Hotel 2

The daily amount of overproduction decreased in all food categories!

→ Potential to reduce more food waste in other areas than overproduction.

Android App, Greek Version
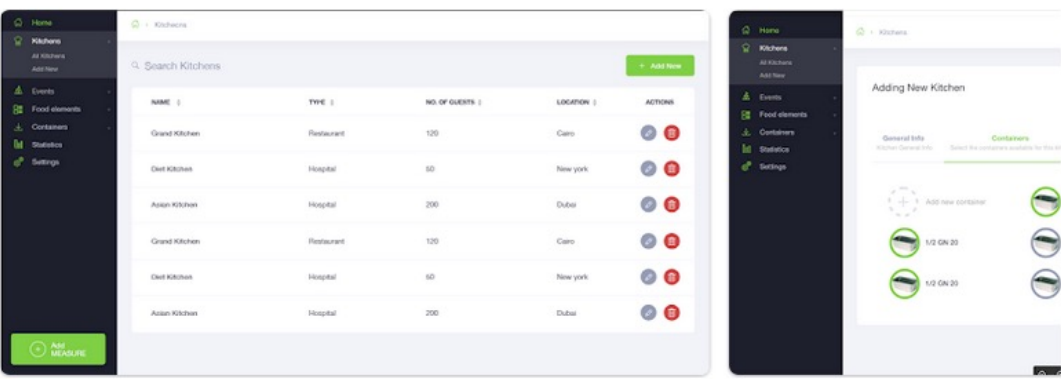
Universität Stuttgart

Thank you for your attention!

Dr.-Ing. Gerold Hafner

E-Mail   Gerold.Hafner@iswa.uni-stuttgart.de

Phone   +49 (0) 711 685-65438

Universität Stuttgart

Institut für Siedlungswasserbau, Wassergüte- und Abfallwirtschaft

Bandtäle 2, 70569 Stuttgart