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

Quantification of food waste and identification of food waste management strategies in bakeries

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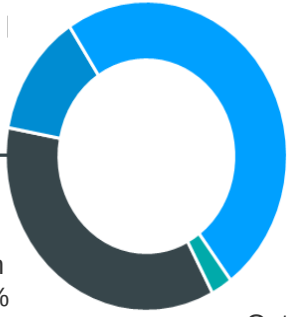
Introduction

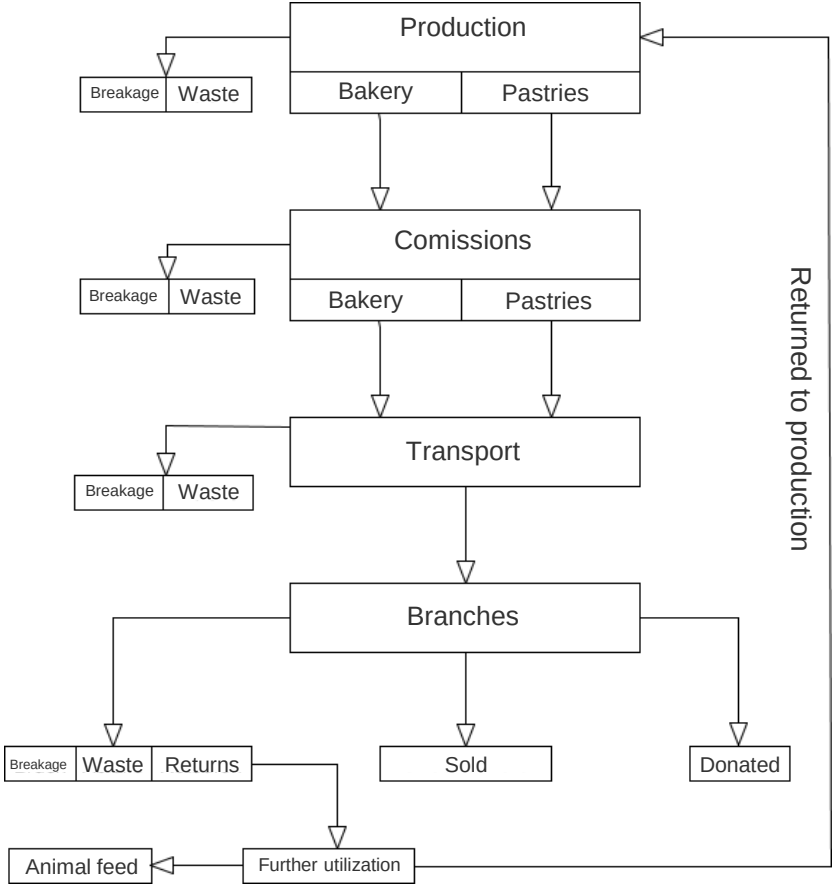
Bakery products: production and losses in Germany 2015

Production
ca. 4.9 Mil t/a

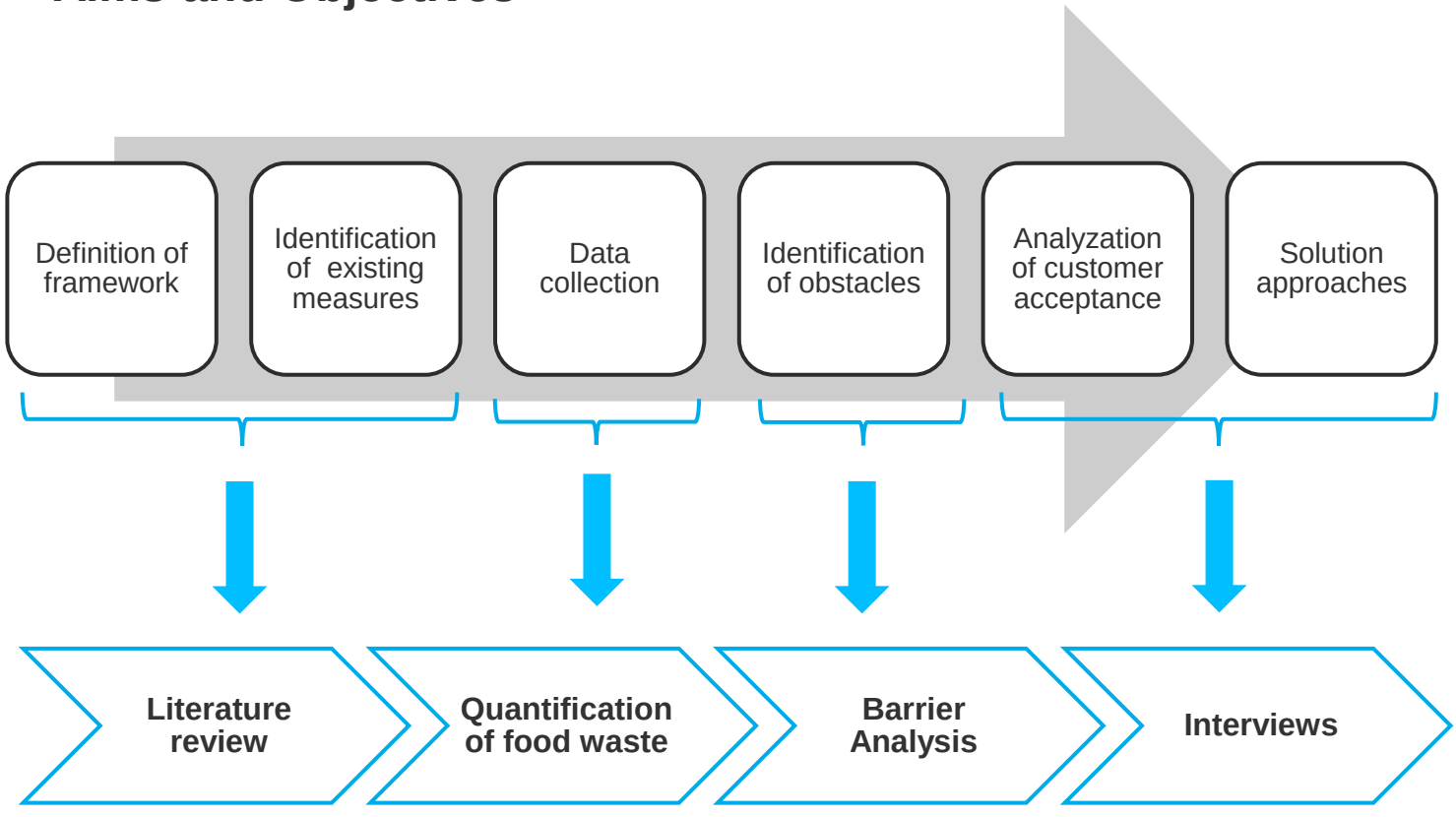
Losses
ca. 1.7 Mil t/a



Introduction



Aims and Objectives



Methodology

Definition of framework

"Single business" (1 branch)	"Small business" (6-8 branches)	"Medium business" (40-60 branches)
Lists and protocols about waste	**Weighing in baskets and with cash register systems**	**Assessing data of management systems**

- **Sample size:** 6 bakery companies (2 of each size)
- **Indicator:** Quantification of accruing food waste in bakeries
- **Time frame:** Min. of 4 weeks → Max of one year

Methodology

Sample characteristics

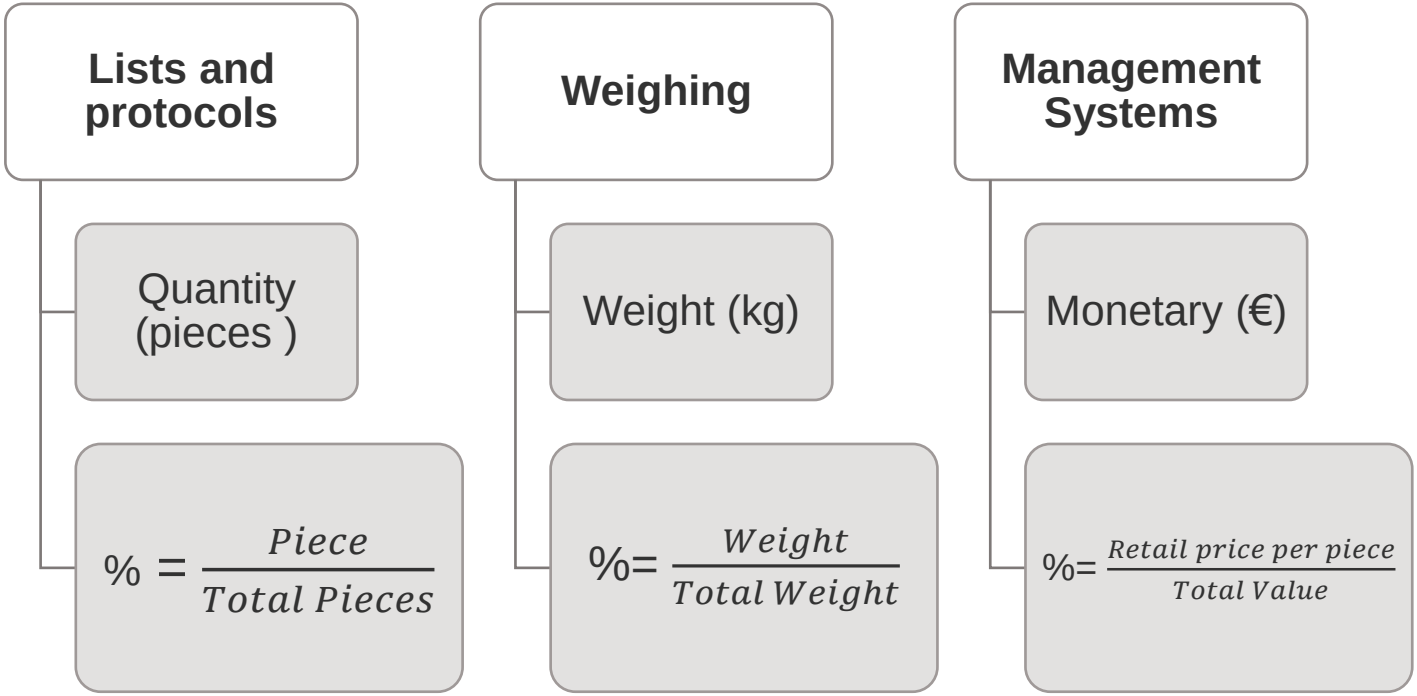
Bakeries	Number of branches	Number of employees
Bakery 1	1	ca. 15
Bakery 2	6	ca. 80
Bakery 3	8-12	ca. 50
Bakery 4	31	ca. 600
Bakery 5	1	ca. 7
Bakery 6	60	ca. 550

Methodology
Literature review

Intervention	References
Reduce assortment and offer	(Heidrich 2014; Ritter et al. 2015)
No full shelves until store closes	(Bakir 2015; Klein 2014)
Offer day before baked goods	(BrotPosten 2013; Ritter et al. 2015; Ludwig Stocker Hofpfisterei GmbH 2010)
Reduce product amount displayed	(Bakir 2015; Klein 2014)
Measuring return shipments	(Gusia 2012)
Classify products	(Wörrle 2015; Ritter et al. 2015)
Happy hour before the shop closes	(Bäckerei Schwendinger 2016;Hofpfisterei 2016;Schmich 2012;Heidrich 2014)

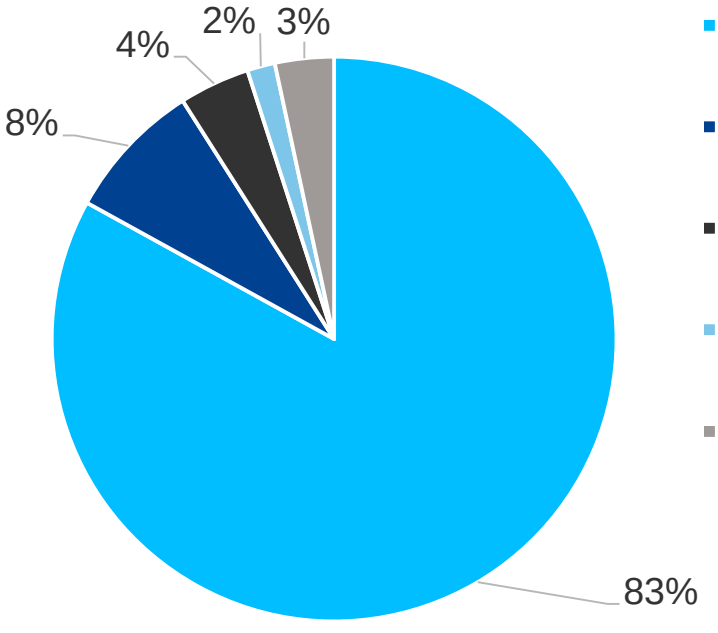
Quantification of food waste

Return rates



Distribution of food waste in Bakeries

Bakery 3



- **Returns (without animal products)**
- **Returns (with animal products)**
- Production Waste
- Comission Waste
- Pastry Waste

In total return shipments are 91%

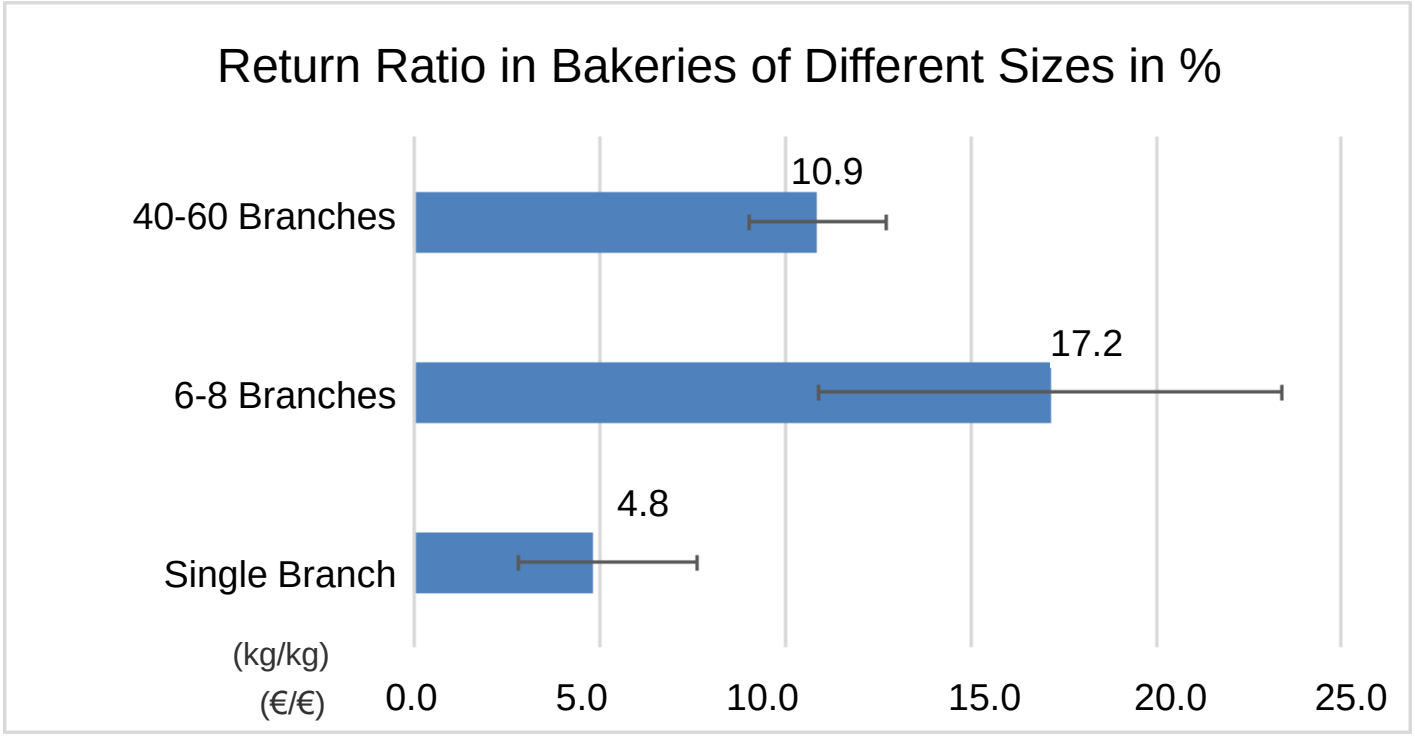
Results

Measurement of return shipments

Bakeries	Return Ratio (Pieces)	Return Ratio (Monetary)
Bakery 1	7.6%	10.6%
Bakery 2	10.9%	-
Bakery 3	23.4%	-
Bakery 4	-	9.0%
Bakery 5	2.0%	-
Bakery 6	-	12.7%

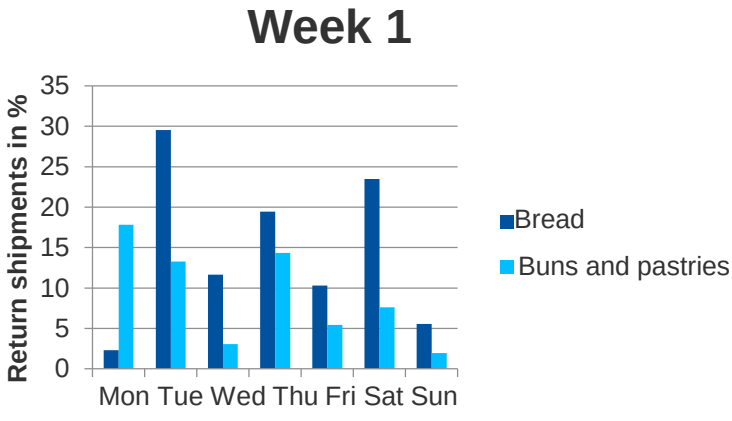
Results

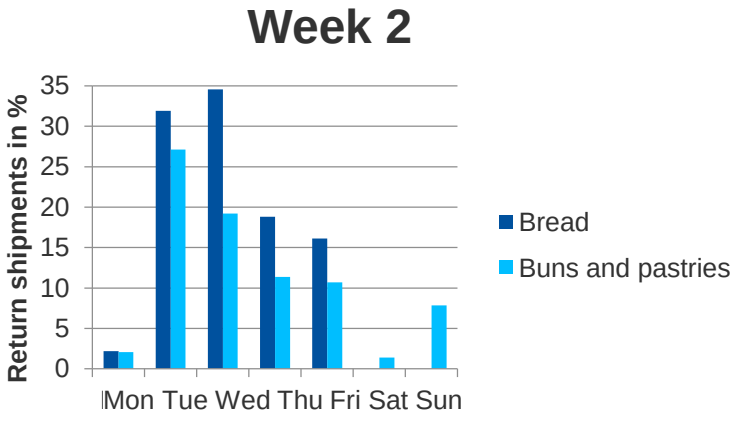
Measurement of return shipments

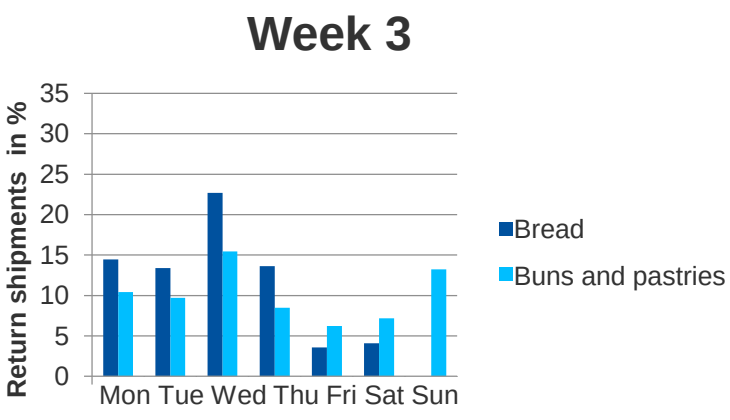


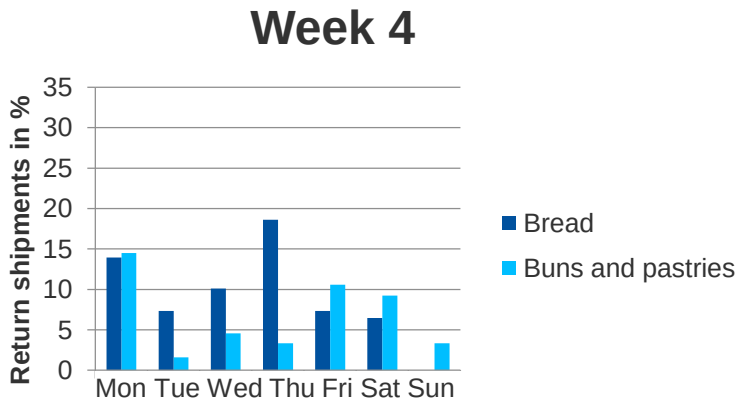
Results

Measurement of return shipments



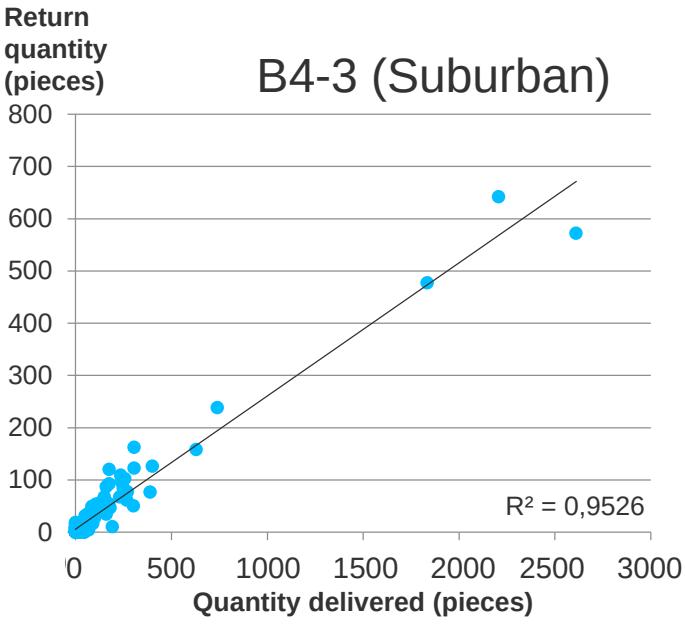


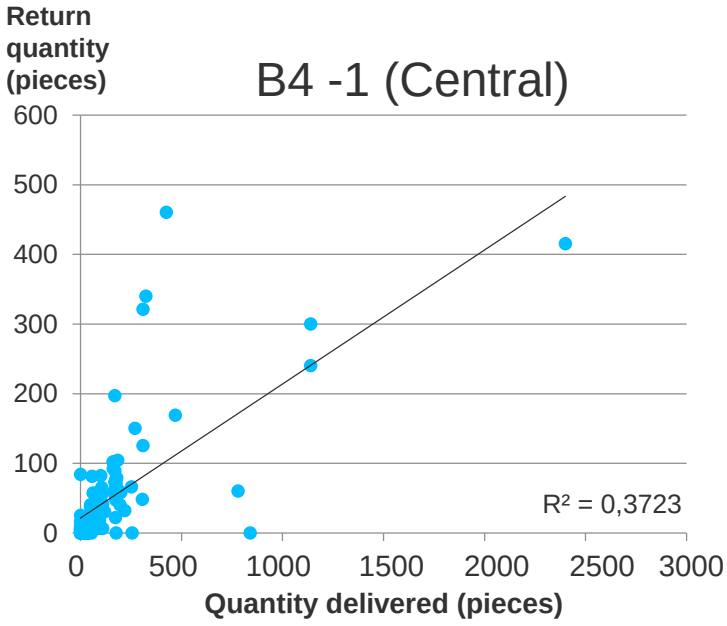




Results

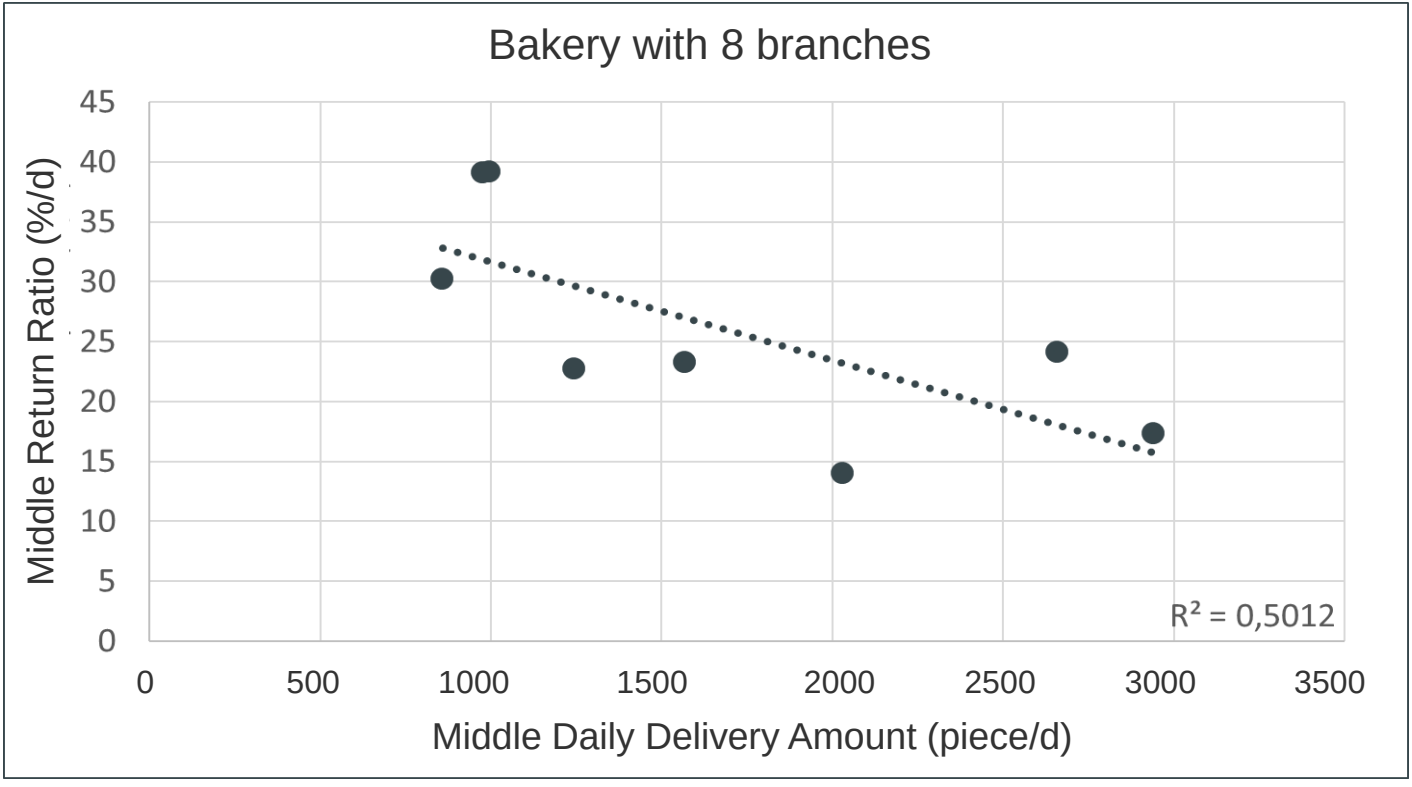
Measurement of return shipments: *Effect of location and type*





Results

Measurement of return shipments: *Size of branch*



Results

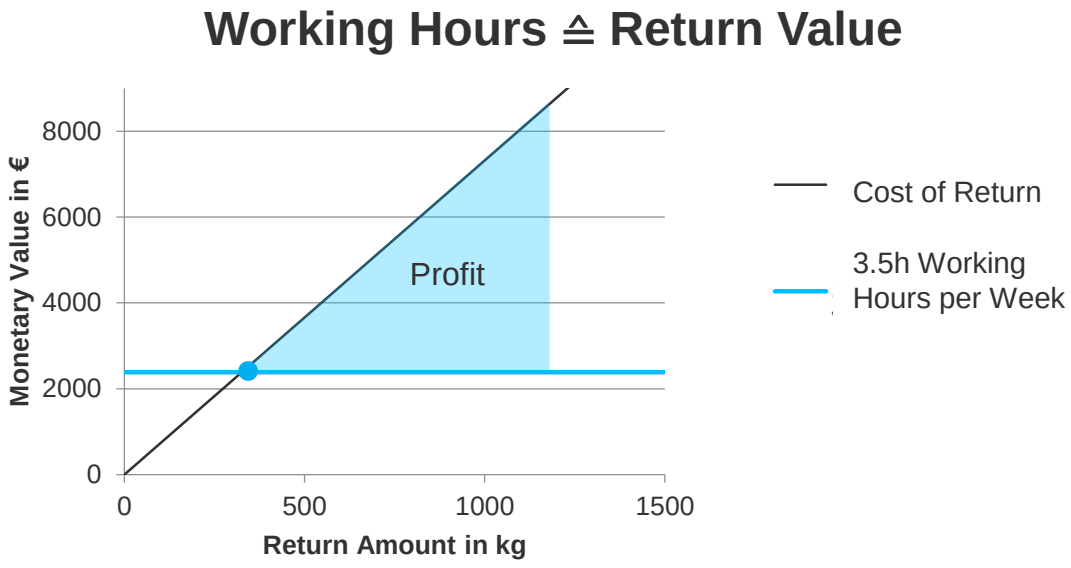
Interview: *Barrier analysis*

	Feasibility	Business management	Customer acceptance	Basic acceptance
Reduce assortment	0.3	0.6	3.6	1.3
No full shelves till closing	0.1	1.1	3.4	1.6
Offer day before backed goods	0.3	1.3	1.1	1.3
Reduce product amount displayed (appearance)	1.4	2.4	2.0	1.6
Measure waste	3.3	2.1	0	2.4
Classification of products	0.4	0.6	2.1	0.7
Happy hour before closing	0.4	2	1.1	1.7

(0 - no barrier, 5 - very strong barriers)

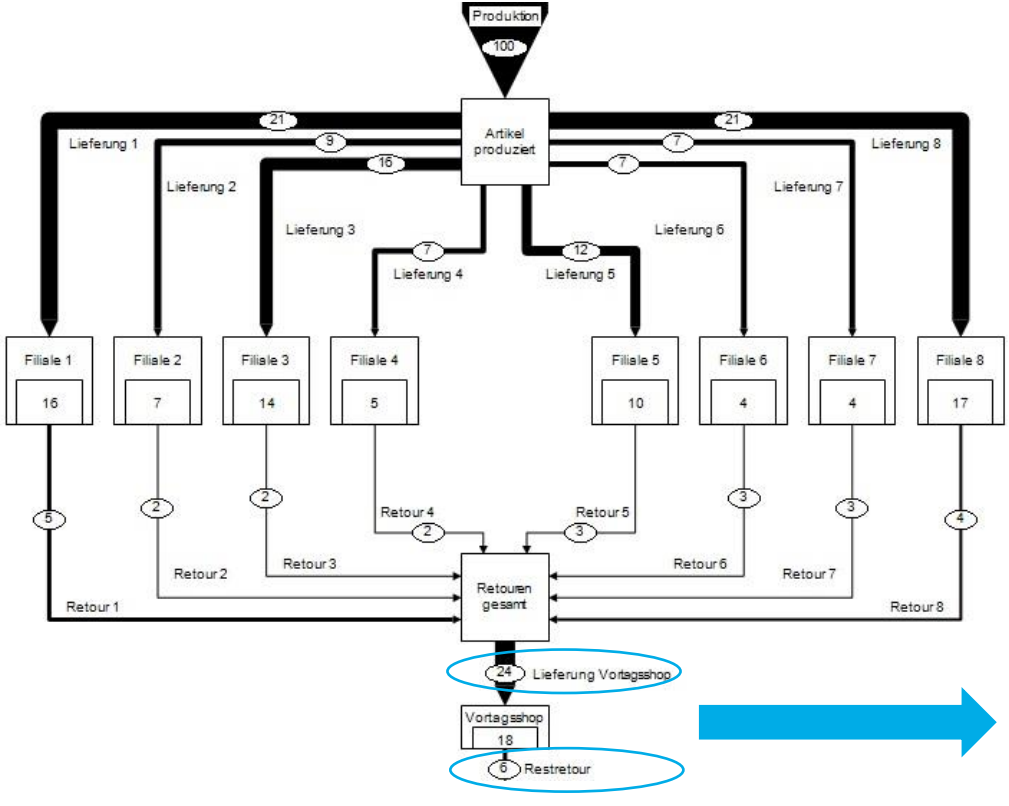
Results- Scenario

Optimization measures



Results

Bakery branch for day before bakery products



Reduction of return shipments from 24% to 6%

Outlook and Recommendations

Other measures to reduce returns: *Digital solutions*

Merchandise management system → **integration** into software systems

- **Compatibility** with merchandise planning and control system
- Unpredictable influences can be included for forecasts
- Measures applied
- Reduction of return shipments
- Potential sales volume
  - ➢ **Monitoring of applied measures**
  - ➢ **Influence to return shipments for transferrable solutions**

Conclusion

- Returns shipments of bakeries 91% of total food waste.
- Return rates: 4.8% - 17.2%
- Small sized businesses highest return rates
- Monetary equivalent (correlated with returns) range: €35,000 to €77,000 (/store/a)
- Return rates depend on company size, branch size, delivery volume, location, store type, assortment, weather and offer
- Applying measures, adaption to company size, logistics, location, assortment and infrastructure → greatest success achieved
- Include day before baked goods
- IT solutions to reduce return rates:
  - Use of forecast-systems with management systems for production planning

Thank you!

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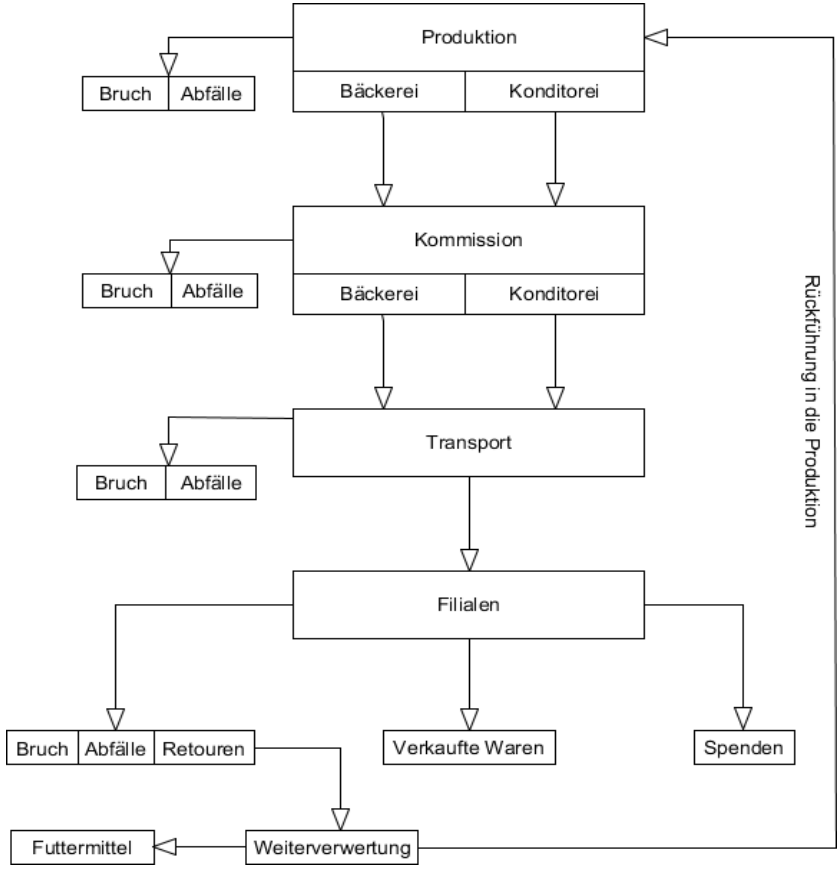
Outlook and Recommendations

- It was found that each measure has its barriers when assessing areas of technology/feasibility, business administration, customer acceptance and basic attitude.

Barrier Analysis

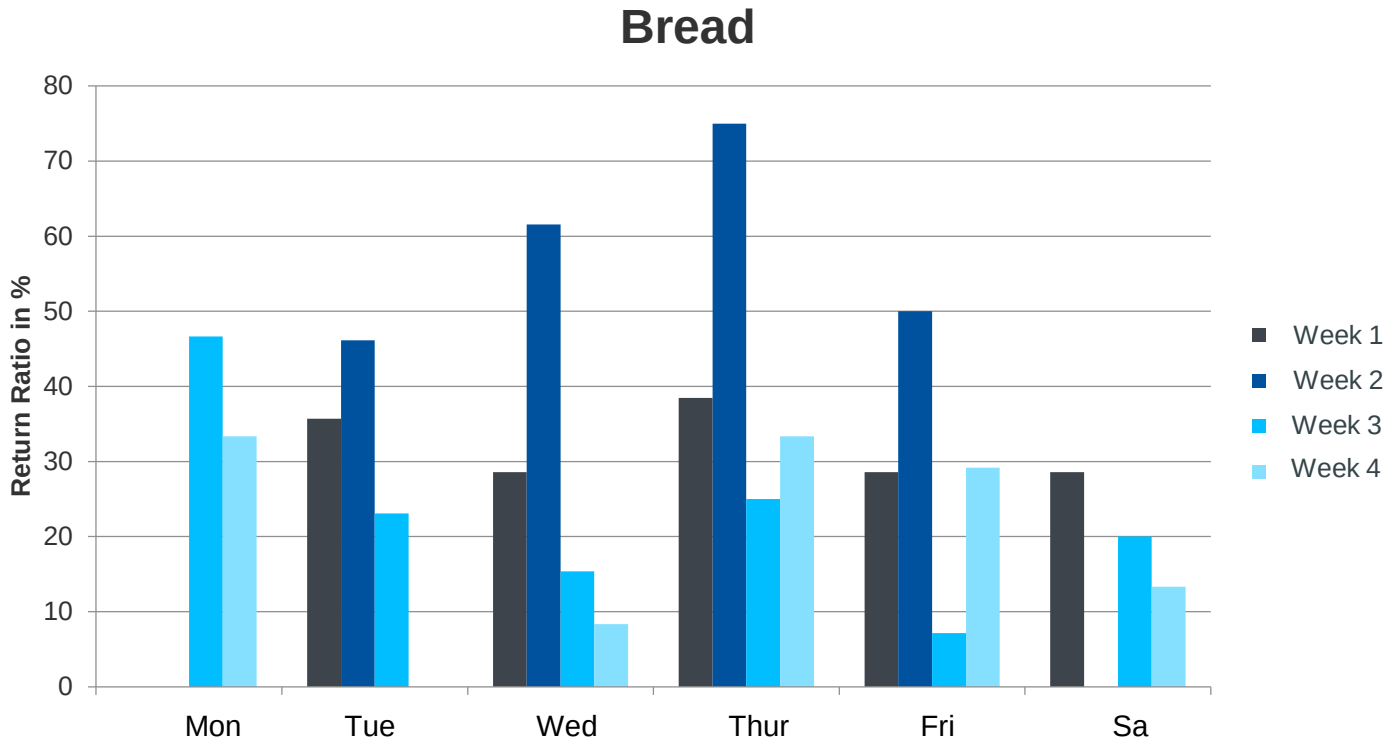
Measure	Barrier	Additional Notes
No full shelves until the closing of the shop	High resistance in customer acceptance	Customers will be more likely to go to another bakery if the desired product is no longer available some time before the store closes
Reduction in the amount of goods	Showed economic barriers	-
Measurement of waste	More personnel effort. Barriers in terms of technical/feasibility, business administration and basic attitude	Dependant on company size, branch size, delivery volume, location, store type, assortment, weather and supply
Digital Measures (such as forecasting systems)	Investment costs are very high	SME would still need more support with technological advancements
Offering pre-day baked goods	Only slight barrier and only one practice partner was resistant	A separate branch could be opened, which only offers pre-day baked goods, that were produced in the other branches

Original (for German Corrections)



Results

Measurement of Return Shipments



Results

Measurement of Return Shipments