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Faculty of Natural and Agricultural Sciences

Fakulteit Natuur- en Landbouwetenskappe

Lefapha la Disaense tša Tlhago le Temo

Development and Validation of a Tool to Address Food Waste in the University Food Service Sector: A Delphi Consensus Study

B.P Lefadola*, A.T Viljoen, G.E. Duvenage

*Doctoral Candidate



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Presentation Outline

- Introduction
  - Definition of food waste in the context of the study
  - Scope of the study
  - Magnitude of the problem
  - Social, economical and environmental implications of food waste.
- Aim of the Study
- Theoretical Perspectives
- Methodological Approach
- Findings of the Study
- Conclusion

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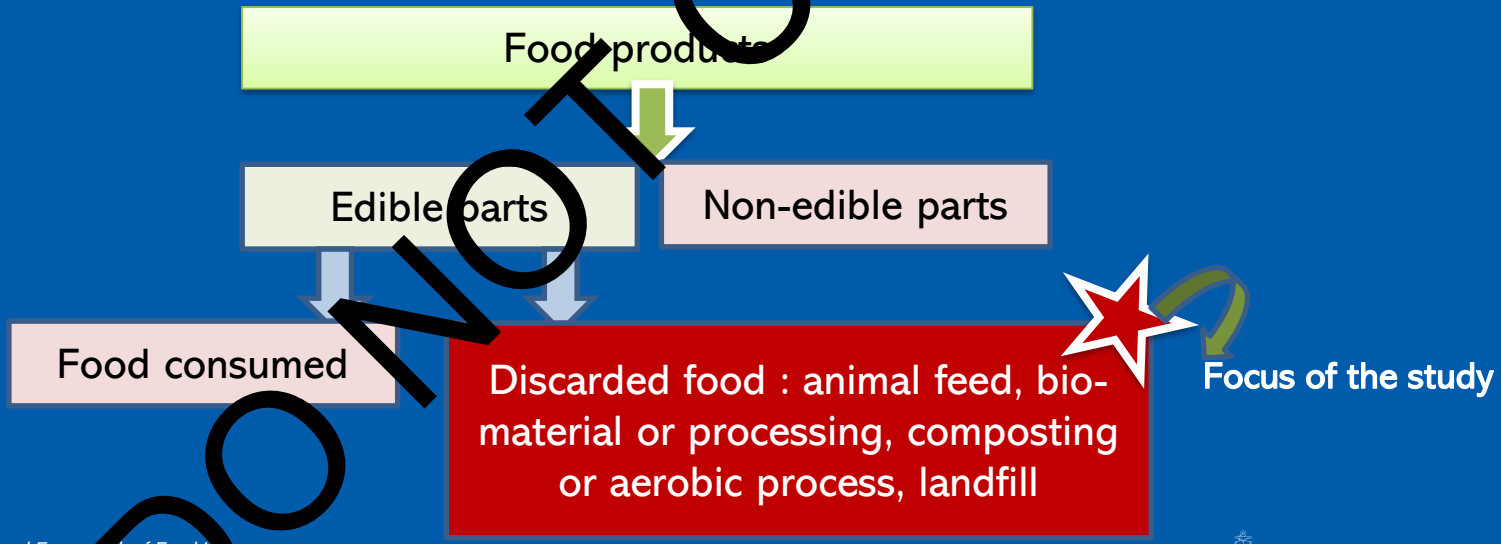
Defining Food Waste

- Food waste in this study is defined as the edible parts of food intended for human consumption that are discarded at some point along the food service system, from procurement to service.



Adapted from FAO(2014) Definitional Framework of Food Loss

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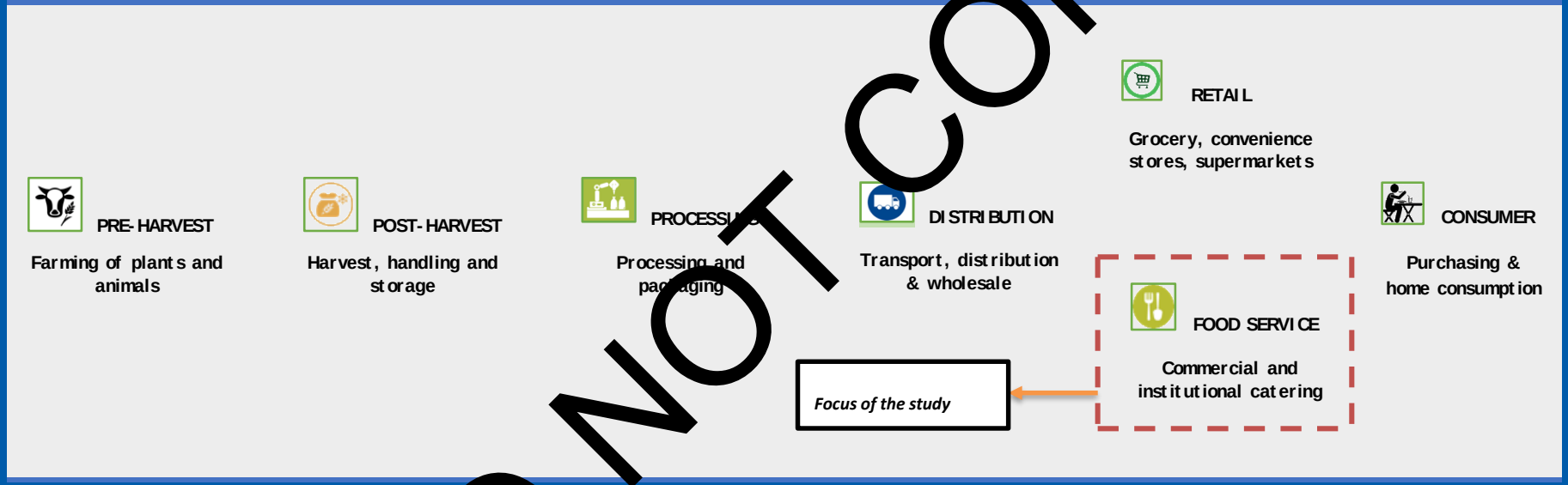
Introduction – Scope of the Study



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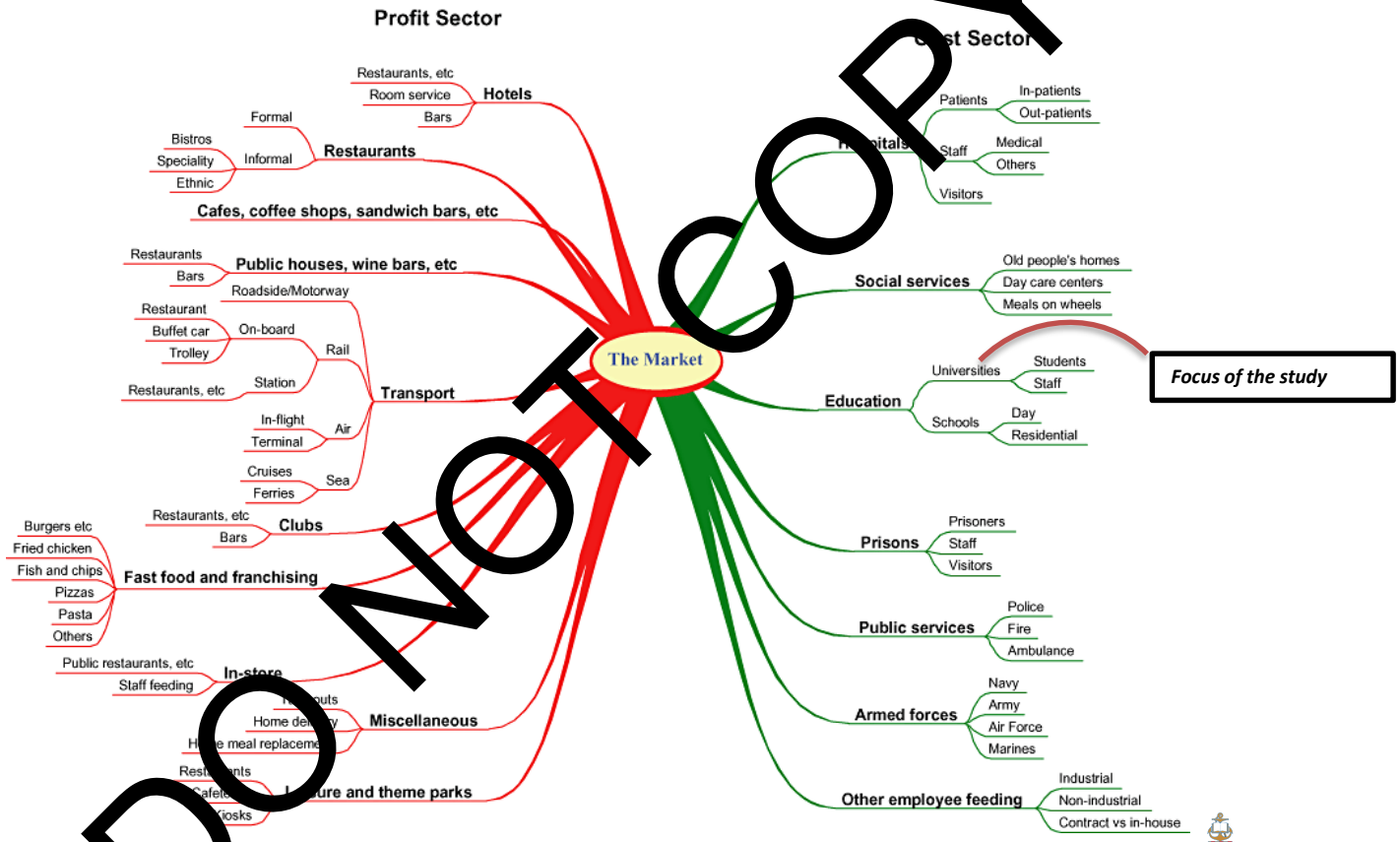
Introduction – Scope of the Study



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CATEGORISATION OF THE FOOD SERVICE INDUSTRY (Edwards & Causa, 2009: 3)

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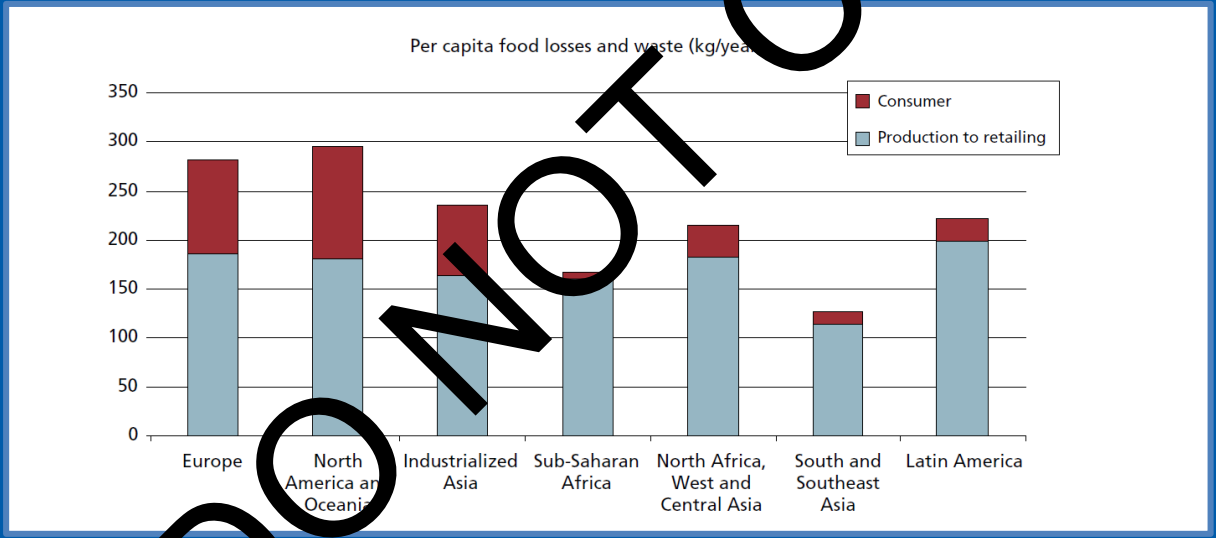
Magnitude of the Problem – Global Perspective

- Food waste is a concern worldwide – roughly a third of food produced is lost or wasted globally (Gustavsson et al., 2011).
- 1.3 billion tonnes of food per year is wasted globally (Gustavsson et al., 2011).
- 40 % of food produced get wasted (FAO, 2015)



Source: Gustav son *et al.* 2011)

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Magnitude of the Problem – In South Africa

- 1/3 of food produced for consumption in SA ends up at the landfills (WWF, 2017).
- This amounts to approximately 10 million tonnes of food waste per year (WWF, 2017).
- Financial burden: R61.5 billion which is equivalent to 2.1% of the national GDP (Nahman et al., 2012).
- Most studies in SA study food waste at household level, and a few focus on the university food service sector.

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Magnitude of the Problem – SA University Food Service

- 2 empirical studies conducted in Rhodes University and Stellenbosch.
- Rhodes University: 555g of food waste per student is generated daily which translates to about 450 tonnes of FW per year.
- Stellenbosch University: 26.7 % of food wasted
- Conclusion: Estimates are much higher compared to food waste generated in some universities globally.



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A Glimpse of Food Waste at the Case University Food Service Unit

- SAR 290 650.18 lost to food waste which is equivalent to 6% of the annual food purchases budget.
- Most of the food waste generated end up at landfills



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Implications of Food Waste

- Linkage to **Sustainable Development Goal** 2 (zero hunger) and 12 (responsible consumption and production).
- **Social implications of food waste** : food security, ethical issues of food waste and food poverty.
- **Economical impacts**: loss in food production costs (food supplies, equipment, labour, energy, water) and disposal costs.
- **Environmental implications**: 90% of wasted food ends at landfills (Thi, Kumar & Lin, 2015), greenhouse gases (CH4,CO2) -7% due to food waste (Papargyropoulou et al., 2016). In SA, organic waste which consists of food waste contributes 4.3% of the total GHG emissions. Other environmental impacts include pollution and pressure on limited natural resources.



Photo Credit: BioCycle Magazine

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Aim of the Study

To develop a total quality management tool integrating sustainability practices to address food waste in the university food service sector.

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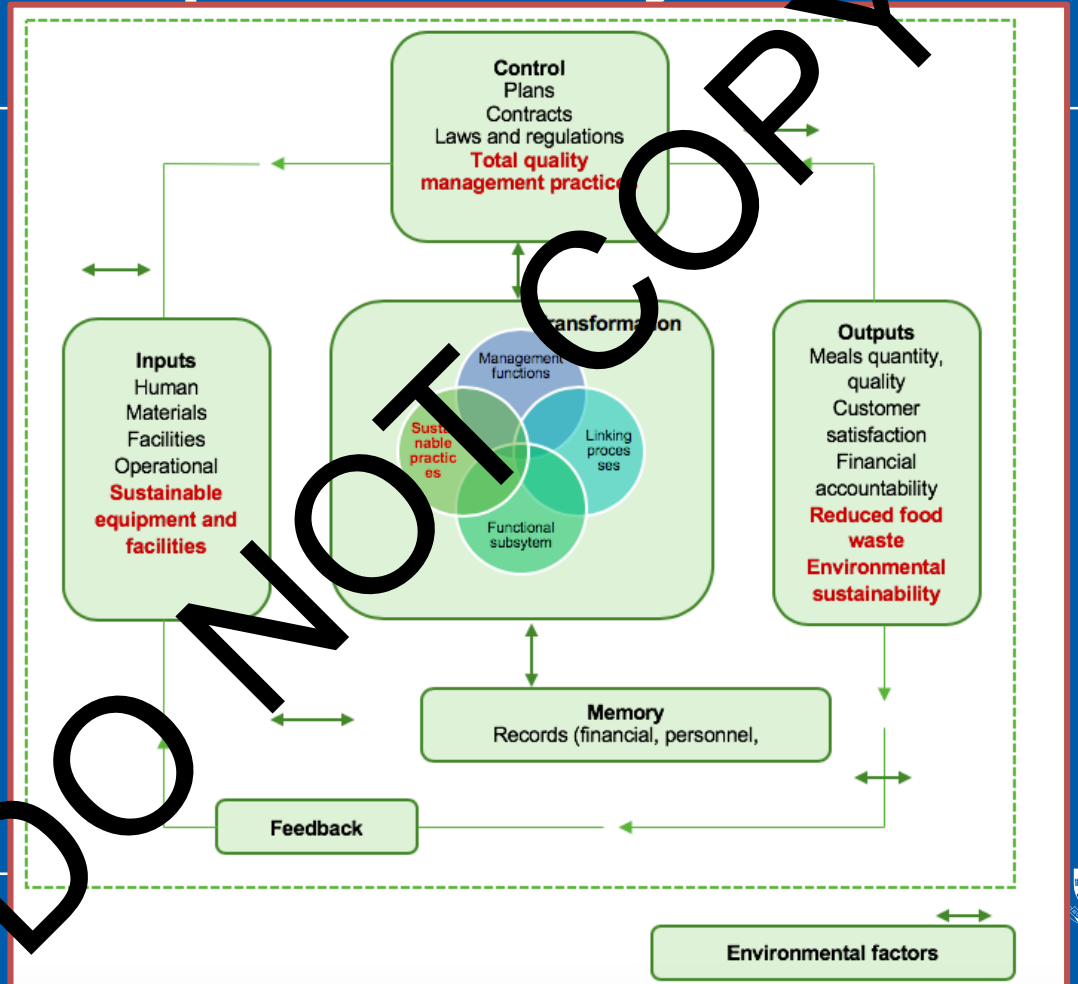
Theoretical Perspectives – Systems Theory



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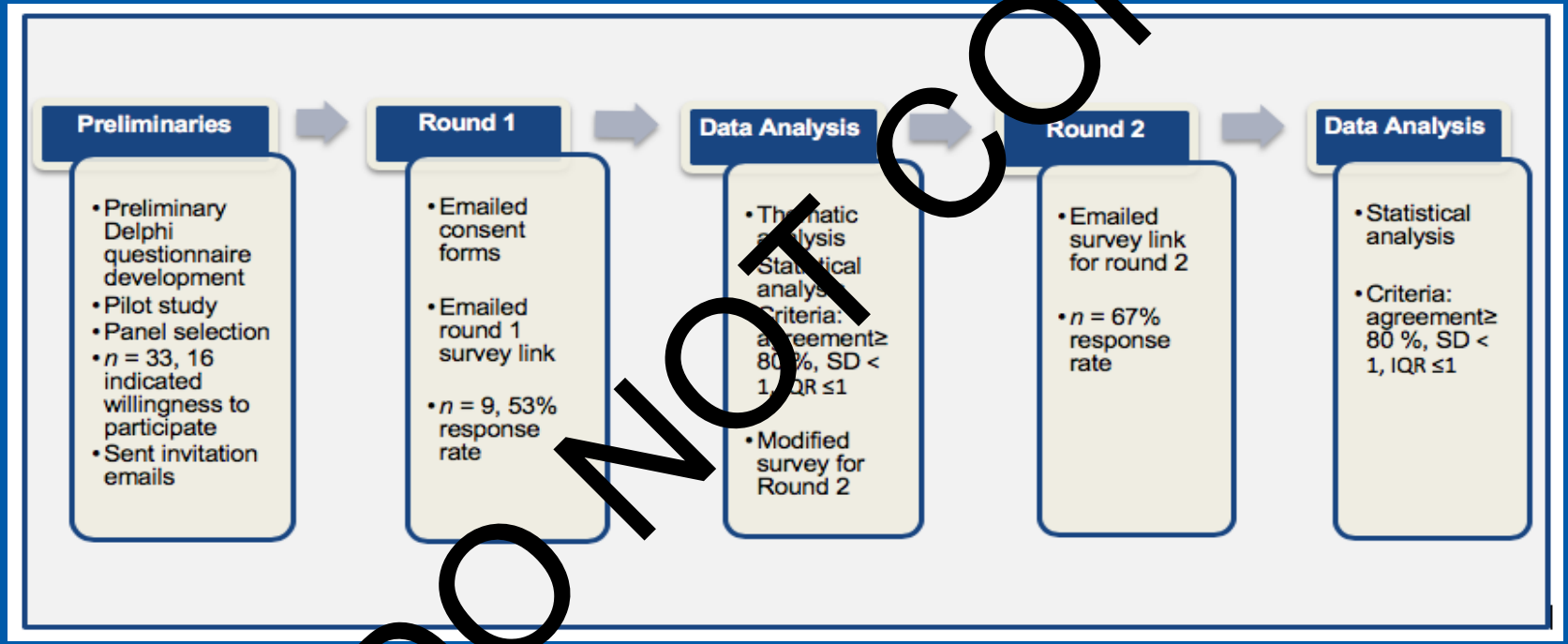
Methodological Approach – eDelphi



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Findings of the Study

69 percent of the indicators reached consensus, that is experts agreed that 88 of the 127 indicators should be included in the tool to address food waste in the university food sector. 39 indicators did not reach consensus and 22 additional indicators were further identified as important in addressing food waste.

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Quality practices of management			
Management actively participates in quality improvement efforts.	88.9	0.707	1
Management holds regular meetings to discuss quality related issues.	88.9	0.667	1
Management supports quality improvement efforts by providing the necessary resources.	88.9	0.707	0.5
Food quality policy is taken into consideration in strategic planning.	77.8	0.782	1
Food quality data is taken into consideration in decision making.	88.9	0.601	1
Food quality policy is communicated throughout the food service unit.	88.9	1.000	0.5
Management gives employees authority to manage food quality problems.	77.8	0.601	1.5
Management sets food quality strategies for employees.	77.8	0.928	0.5
Food quality results are evaluated to check improvements.	88.9	0.726	1
Management gives priority to food production processes.	88.9	0.726	0.5

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Employee knowledge and education			
Qualification of employees are evaluated for relevance with food service.	77.8	1.118	1
Employees have experience in food service.	77.8	0.782	1.5
Employees have the knowledge and know-how related to food service.	88.9	0.707	1
Employees are trained in topics with regard to their specialty and daily work in different areas of food service.	77.8	1.054	1.5
Employees are offered quality oriented training.	88.9	1.000	1
Resources are provided for staff training.	88.9	0.726	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Employee management and involvement			
Employees who improve food quality are rewarded.	62.5	1.035	1.75
Employees are evaluated on how well they ensure food quality.	75.0	0.641	0.75
Employees participate in food quality improvement activities.	100	0.535	1
Employees are motivated to improve food quality performance.	100	0.518	1
Systems exist for promoting teamwork across the food service system.	75	1.356	1.75
Approaches to work promote open communication between departments and food service units.	75	1.458	1.75
Employees take initiatives during their work processes to solve problems that would impact on food quality.	87.5	0.991	1
Employees' suggestions on food quality assurance are adopted.	88.9	0.463	0.75
Employees recognize superior quality performance	87.5	0.744	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Information and analysis			
A variety of data collection methods are used to ensure reliability of quality performance data.	75	0.756	1.5
There is adequate storage for archiving information.	37.5	0.916	1.75
Easy retrieval of stored information.	75	0.886	1.75
There is systematic analysis of food quality data.	87.5	0.756	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Supplier quality management			
There is a solid partnership with suppliers	87.5	1.035	1
Adherence of suppliers to food quality specifications	100	0.354	0
Suppliers comply with requested food expiration dates	87.5	0.744	1
Suppliers provide food quantities ordered	100	0.518	1
Suppliers comply with the transportation standards for perishable and non-perishable foods	100	0.518	1
Timely delivery of food products by suppliers	87.5	0.744	1
Monitoring and assessing quality performance of suppliers	100	0.535	1
Open communication between the food service unit and suppliers	100	0.535	1
Written documentation from suppliers that quality management procedures and legislation are adhered to.	75	1.309	2.5

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Consensus analysis of total quality management practices that can address food waste

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Process quality management			
Process non-conformities are detected through internal audits	75	0.991	1.5
Critical processes are determined and evaluated	100	0.518	1
Determination of areas, processes and points for improvement	100	0.535	1
Specific organizational structures have been formulated to support quality improvement	87.5	0.991	1
All employees are provided with work instructions	87.5	0.756	1
Mistakes are precluded in the process design	87.5	0.707	1
Benchmarking of quality management practices	87.5	0.707	1
Setting ranges within which non-conformities are tolerated or allowed	62.5	1.126	2

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Customer focus			
There is a process of collecting customer feedback	87.5	0.991	1
Customers are encouraged to submit complaints and proposals for quality improvement	62.5	1.126	2
Customer suggestions are taken into consideration for quality improvement	87.5	1.035	1
Customers' suggestions are recorded and analysed	87.5	1.061	1
Food service unit is in close contact with customers	87.5	0.991	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Process and product quality design ***Purchasing***			
The expected amount of time before a food item should be purchased is fore-casted	75	0.991	1.5
Food specifications are developed	100	0.518	1
Units of measure are specified in purchasing orders	100	0.535	1
Particular expiration dates are requested when purchasing food items	87.5	0.991	1
Only approved suppliers of food are selected	87.5	0.756	1
Select and establish a variety of suppliers to ensure supply options	87.5	0.707	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Receiving			
There are scheduled hours for receiving	75	0.756	1.5
Deliveries are inspected for quantity, against purchase order and invoice	100	0.463	0.75
Deliveries are inspected against quality specifications	100	0.518	1
Deliveries are checked to ensure undamaged packaging	100	0.518	1
Expiration dates of deliveries are checked	87.5	0.744	1
Temperature of perishable food is checked upon delivery	100	0.463	0.75
Food items that do not meet quality specifications are rejected	100	0.463	0.75
All newly received food items are date marked	100	0.535	1
Received food items are promptly transferred to appropriate storage areas	100	0.354	0

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus agreement (%)	Standard Deviation	Interquartile range
Storage and inventory control			
Storage areas have adequate dimensions for storing all food-related items	[illegible]	0.756	1.5
Storage areas meet specifications for walls, ceilings, floors, windows, baseboards, floor drains, lightning and ventilation	82.5	0.707	1
Storage areas protect food from direct sunlight, heat, moisture and smoke	100	0.518	1
Storage areas are regularly cleaned	100	0.354	0
Storage areas have insect and rodent control	87.5	0.756	1
Temperature of refrigerators is regularly checked	100	0.354	0
Chemicals and cleaning agents are stored separately from food items	87.5	0.756	1
The organization of food items in storage areas prevents cross contamination	87.5	0.744	0.75
The FIFO (First-In, First-Out) rotation system is applied at all times	100	0.463	0.75
Expiration dates of food items are regularly checked	100	0.518	1
Raw food is stored separately from cooked or ready to eat food	87.5	0.756	1
Food is always kept covered	87.5	0.756	1
A continuous track of food items held in storage is kept	100	0.518	1
Relative humidity of refrigerators is regularly checked	87.5	0.744	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Issuing			
A requisition form is used to issue food from storage to production	62.5	1.126	2
Only the quantity of food needed as specified on an authorized production record is removed from the storage	87.5	0.707	1
Requested items are measured using appropriate measuring equipment before issuance	75	0.835	1.75
Food items issued are checked against standardized recipes before production	87.5	0.744	1
Unused food is returned to appropriate storage area	87.5	1.035	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Preparation and production			
Use of production schedules	87.5	0.707	1
Ingredients are accurately measured with appropriate measuring equipment	87.5	0.707	1
Food items requiring thawing are properly thawed	87.5	0.744	1
Food is not exposed to the temperature danger zone for more than 4 hours	100	0.518	1
Cooking temperature is properly controlled during production	100	0.535	1
Food is cooked to appropriate cooking time	100	0.518	1
Standardized recipes are adhered to during production	100	0.535	1
Food is cooked to appropriate, stipulated quality standards	100	0.518	1
Food is cooked to appropriate internal temperature	100	0.518	1
Food is evaluated for quality prior to meal service	100	0.535	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Holding, chilling, freezing and reheating			
Specialized equipment with approved temperature controls is used	100	0.518	1
Food holding temperatures are monitored	100	0.463	0.75
An appropriate procedure is followed for chilling and freezing food	100	0.518	1
An appropriate procedure is followed for reheating food	100	0.535	1
Reheating is done in small batches	87.5	0.707	1
Frozen food is reheated to appropriate service temperature	100	0.535	1
Sensory quality is retained during reheating	100	0.535	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Distribution			
Proper equipment is used for distribution	87.5	0.756	1
Temperature of food is properly controlled	100	0.463	0.75
Time at which food is held under distribution is controlled	100	0.518	1

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Consensus analysis of total quality management practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Service			
Front of house staff check quality of food before service	87.5	0.707	1
Portions of food are verified upon receipt from back of the house	100	0.518	1
Bain-Maries, chauffeur dishes and heated cabinets are kept at correct temperatures	100	0.518	1
Internal food temperature is measured and recorded	87.5	0.744	0
An appropriate food temperature is maintained during service	100	0.535	1
Food is kept covered until service	100	0.518	0
Standardized serving utensils are used for portioning	75	0.886	1.75
Portioning is done correctly	87.5	0.756	1
Food is neatly plated and presented	75	0.756	1.5
Proper management of surplus food	100	0.518	1
The amount of time food is held under temperature danger zone is highly controlled	100	0.463	0.75

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Consensus analysis of sustainability practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Sustainable food practices			
Use of locally sourced ingredients	50	1.165	2
Purchase and utilization of food in season	75	1.126	1.75
Cook in smaller batches or cook to order	87.5	0.744	0.75
Employ creative practices of utilizing leftovers	100	0.535	1
Use garnishes to a limited extent	50	1.488	2

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Consensus analysis of sustainability practices that can address food waste

Dimension	Consensus (% agreement)	Standard Deviation	Interquartile range
Environmental focused sustainable practices			
Less energy consumption cooking methods are adopted	75	0.916	1
Adherence to optimal cooking times	75	0.535	1
Reduced food miles	100	1.195	2
Limited use of running water	87.5	1.126	1.75
Use of just enough water for production	62.5	1.126	1.75

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Conclusions

An important contribution of this study is the potential application of the developed tool to prevent food waste in the university food service sector.

Addressing food waste in the food service sector requires a holistical view of elements of the food service system.

Further research is needed to evaluate the practicality of implementation of the tool and to measure the level of food waste reduction that can be achieved through implementation of the developed tool.

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References

- Babich, R., & Smith, S. (2010). “Cradle to Grave”: An Analysis of Sustainable Food Systems in a University Setting. Journal of Culinary Science & Technology, 8(4), 180-190.
- Gustavsson, J., Cederberg, C. & Sonesson, U. (2011). Global food losses and food waste: Extent, causes and prevention. Food and Agricultural Organisation.
- Heikkilä, L., Reinikainen, A., Katajajuuri, J. M., Silvennoinen, K., & Hartikainen, H. (2016). Elements affecting food waste in the food service sector. Waste Management, 56, 446-453.
- Painter, K., Thondhlana, G., & Kua, H. W. (2016). Food waste generation and potential interventions at Rhodes University, South Africa. Waste Management, 56, 491-497.
- Papargyropoulou, E., Wright, N., Lozano, R., Steinberger, J., Padfield, R., & Ujang, Z. (2016). Conceptual framework for the study of food waste generation and prevention in the hospitality sector. Waste management, 49, 326-336.
- Papargyropoulou, E., Lozano, R., Steinberger, J. K., Wright, N., & bin Ujang, Z. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. Journal of Cleaner Production, 76, 106-115.
- Priefer, C., Jörissen, J., & Bräutigam, K. R. (2016). Food waste prevention in Europe–A cause-driven approach to identify the most relevant leverage points for action. Resources, Conservation and Recycling, 109, 155-165.
- Thiagarajah, K., & Getty, V. M. (2013). Impact on plate waste of switching from a tray to a trayless delivery system in a university dining hall and employee response to the switch. Journal of the Academy of Nutrition and Dietetics, 113(1), 141-145.

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Boineelo Pearl Lefadola

University of Botswana | UB · Department of Family and Consumer Sciences
· MA in Culinary Arts Management

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Correspondence: u13275004@tuks.co.za or nkelepb@ub.ac.bw

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