Scientific Studies on Food Waste in Turkey

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Introduction

Food waste in Turkey is a significant issue primarily stemming from systemic deficiencies in production, consumption, and distribution processes. Inadequate storage infrastructure, losses during transportation, and the tendency of consumers to engage in indiscriminate over-purchasing contribute to the escalation of this problem. Strategies aimed at reducing food waste should prioritize the promotion of sustainable consumption habits and the adoption of more effective logistical systems.

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The COVID-19 pandemic has significantly impacted consumption habits, precipitating notable shifts in behavior. Throughout the course of the pandemic, many individuals exhibited a tendency to curtail expenditures due to economic uncertainties and restrictions, redirecting their focus towards essential needs and fostering an increased reliance on online shopping. Concurrently, travel restrictions and quarantine measures led to a decline in demand, particularly within the service sector. The pandemic has also played a role in cultivating consumer awareness and sensitivity to environmental factors. (

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Food waste is a significant global issue with substantial implications. Studies have shown that approximately 14% of the world's food supply is lost before it reaches retail outlets, and an additional 17% is wasted at the consumer level (Vieira et al., 2021). This is particularly concerning given that more than 850 million people worldwide suffer from long-term undernourishment, while nearly a third of the world's food is lost or wasted each year (Tabbara et al., 2022). The management of food waste is a complex and multifaceted challenge, often characterized as a "wicked problem" due to its unstructured, cross-cutting, and relentless nature (Närvänen et al., 2019).

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The environmental impacts associated with the inefficient use of natural resources and disposal to landfills, as well as the economic implications of soaring food prices and increasing global food insecurity, have brought food waste prevention to the forefront of international political agendas (Dumitru et al., 2021; Abdulla et al., 2013; Dooren et al., 2020). Furthermore, the prevalence of undernutrition among children in various regions underscores the urgency of addressing food waste, as failure in the consumption of complementary foods has been linked to wasting and stunting in infants (Udoh & Amodu, 2016; Mtonga & Nyaruhucha, 2022).

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The scale of food waste necessitates a comprehensive approach that spans the entire food supply chain, from production to consumption. Legislation and policy changes have been proposed as potential interventions to address food waste, with the aim of reducing waste and increasing recycling (Xu et al., 2023). Additionally, the utilization of food waste, such as bioprocessing post-consumer food waste for use as fish feed, presents opportunities to mitigate the impact of food waste while contributing to sustainable practices (Tabbara et al., 2022

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However, challenges related to upcycled foods and the public acceptability of such products highlight the complexities involved in addressing food waste at various stages of the supply chain (Moshtaghian et al., 2021). Moreover, the cultural influences on fruit and vegetable food-wasting behavior in the European Union emphasize the need for a nuanced understanding of consumer attitudes and behaviors towards food waste (Pelău et al., 2020). In conclusion, food waste is a global challenge with far-reaching implications for food security, environmental sustainability, and public health. Addressing this issue requires a concerted effort involving stakeholders across the food supply chain, as well as innovative approaches to minimize waste and maximize the utilization of food resources.

Aim of this research

The primary objective of this study is to explore the research conducted by agricultural economists on food waste in Turkey. Additionally, utilizing data from the Turkish Statistical Institute (TÜİK), the study aims to project the per capita waste amount over the next 5 years.

Material and Methods

A total of 87 studies conducted by agricultural economists in Turkey have been scrutinized. Among these, 69 were published in local scientific journals, while the remaining 18 were featured in journals within the scope of the Science Citation Index (SCI).

Analyses have been conducted on the Turkish Statistical Institute (TÜİK) time series data spanning the years 2000 to 2022.

Material and Methods

The summary table (Findings) has been shown below containing the MAPE (Mean Absolute Percentege Error), MAD (Mean Absolute Deviation) and MSD (Mean Squared Deviation) values of the forecasting methods. As can be seen, the forecast of Quadratic Trend Model gives the least values in all the 3 categories. But, due to inconsistencies in the estimation results, it has been found that the Growth Curve model with the second lowest MAD, MSD, and MAPE values is the best model for predicting the dataset, rather than the quadratic trend model.

Material and Methods

Linear Trend Model	$Yt = \beta0 + \beta1\ t + et$
Exponential Growth Trend Model	$Yt = \beta0 * \beta1t * et$
Quadratic (Degree 2) Trend Model	$Yt = \beta0 + \beta1\ t + \beta2\ t2 + et$
S-Curve Trend Model	$Yt = 10a / (\beta0 + \beta1\ \beta2t)$

Findings

The scientific studies conducted in Turkey exhibit a degree of overlap or alignment with each other.

Approximately 85% of the conducted studies are based on survey methodologies in Turkey.

Findings

- Municipal waste generated per capita for Türkiye (kilograms per capita)
- Time period: 2000 to 2022
- Forecast: 5 years
- The summary table has been shown below containing the MAPE (Mean Absolute Percentege Error), MAD (Mean Absolute Deviation) and MSD (Mean Squared Deviation) values of the forecasting methods. The models were evaluated based on the criteria of MAPE, MAD, and MSD, and the mathematical model with the lowest values among these criteria was chosen as the preferred model. As can be seen, the forecast of Quadratic Trend Model gives the least values in all the 3 categories.

Findings

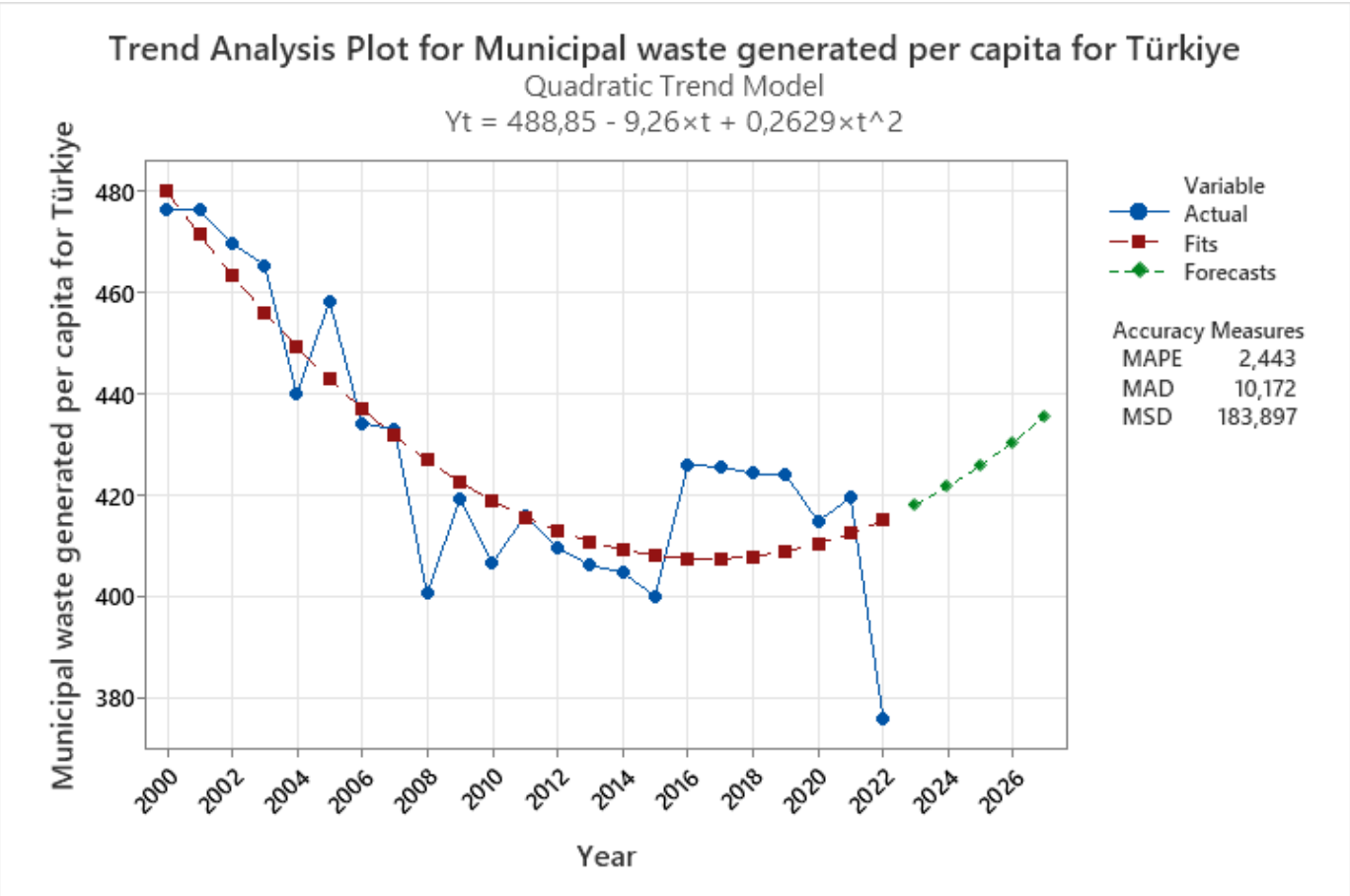
Table 1. Accuracy Measures

Municipal waste generated per capita for Türkiye	**Linear trend model**	**Quadratic trend model**	**Growth curve model**	**S-Curve trend model**
Trend Equations	Yt = 462,56 - 2,952×t	Yt = 488,85 - 9,26×t + 0,2629×t^2	Yt = 462,568 × (0,99323^t)	Cannot fit model to these data.
MAPE	3,777	2,443	3,714	
MAD	15,985	10,172	15,730	
MSD	290,314	183,897	282,685	

Table 2. The results of the 5 year forecasts

Forecast	2023	2024	2025	2026	2027
Municipal waste generated per capita for Türkiye	418,009	421,629	425,775	430,447	435,644

Findings

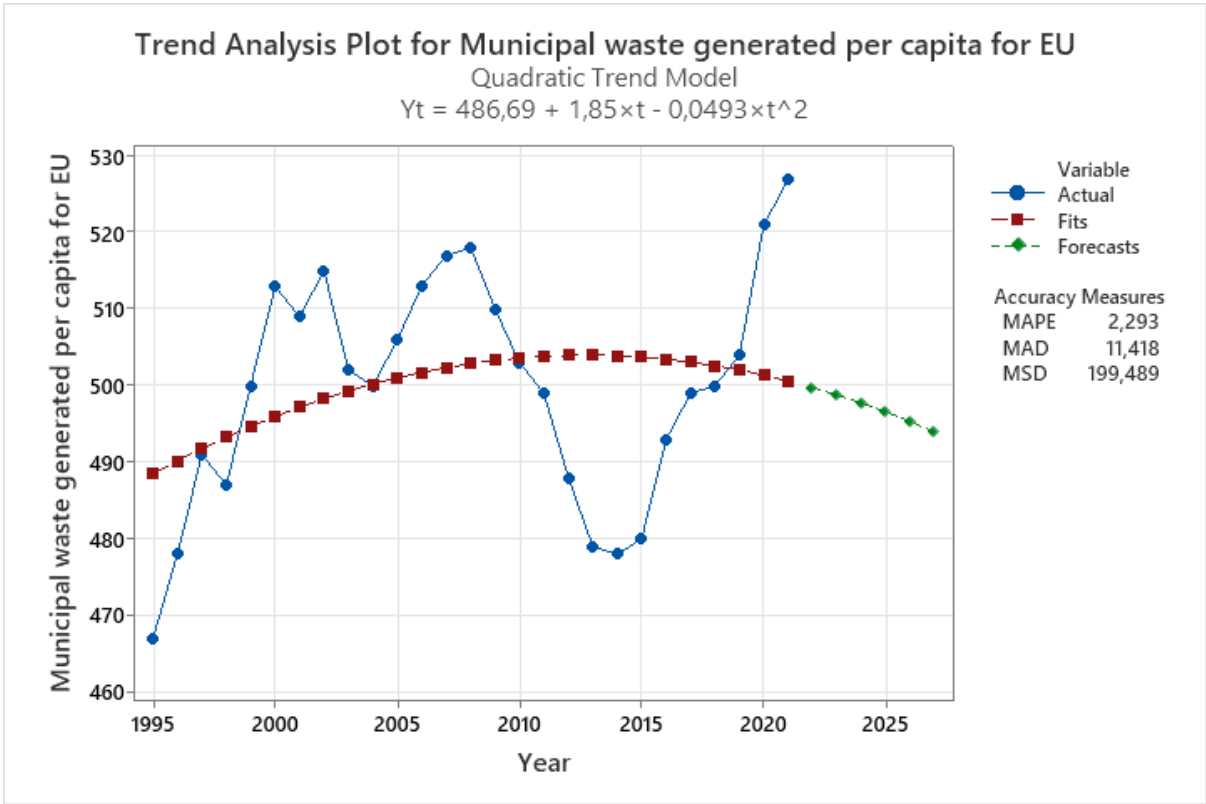

Trend Analysis Plot for Municipal waste generated per capita for Türkiye
Quadratic Trend Model
Yt = 488,85 - 9,26×t + 0,2629×t^2
Municipal waste generated per capita for Türkiye
480
460
440
420
400
380
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
Year
Variable
Actual
Fits
Forecasts
Accuracy Measures
MAPE 2,443
MAD 10,172
MSD 183,897

Findings

- Municipal waste by waste management operations for EU(27 countries) (kilograms per capita)
- Time period: 1995 to 2021
- Forecast: 6 years

Municipal waste generated per capita for EU	**Linear trend model**	**Quadratic trend model**	**Growth curve model**	**S-Curve trend model**
Trend Equations	Yt = 493,36 + 0,466×t	Yt = 486,69 + 1,85×t - 0,0493×t^2	Yt = 493,154 × (1,00094^t)	Cannot fit model to these data.
MAPE	2,435	2,293	2,437	
MAD	12,110	11,418	12,124	
MSD	206,604	199,489	206,711	

Forecast	2022	2023	2024	2025	2026	2027
Municipal waste generated per capita for EU	499,752	498,790	497,729	496,570	495,312	493,956



Conclusion

To live like a tree alone and free and in brotherhood like the forests