Data Driven Assessment of PM2.5 Levels in Smart City Environments: Walailak University vs Bangkok

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Introduction

Global Death Toll

8.1 million deaths due to air pollution

7.8 million deaths linked to PM 2.5 exposure (90% of total)

Impact on Young Childre

Over **700,000 deaths** among children under 5

PM 2.5 is the **2nd** leading cause of death after malnutrition

Situation in Thailand

More than **13.6 million** Thai children are at risk from PM 2.5 exposure

NATURAL SOURCES

Dust storms

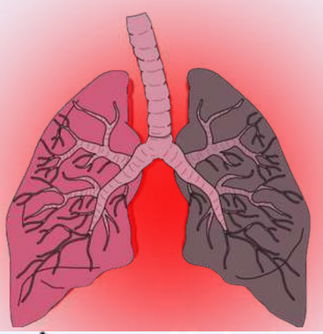
Volcanic eruptions

Forest fires

RESPIRATORY DISEASES

Asthma

Chronic bronchitis



Lung cancer

MAN-MADE SOURCES

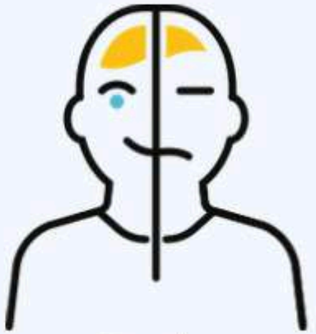
Burning fossil fuels

Industrial activities

Construction and demolition

CARDIOVASCULAR DISEASES

Heart attacks



Stroke

OBJECTIVES

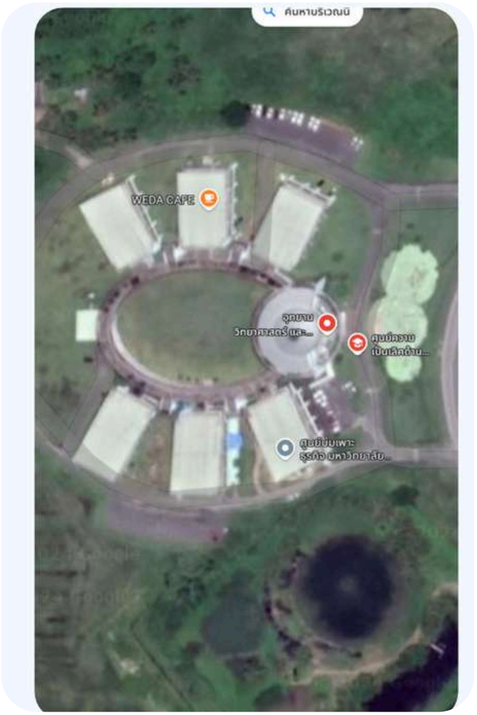
This research aims to study and compare the:

- **PM2.5 levels,**
- **Air temperature**, and
- **Relative humidity**

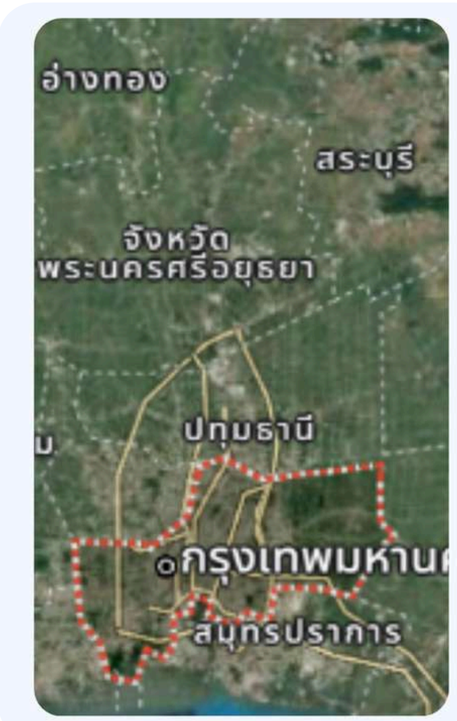
Two distinct environments:
(1) **Walailak University** in Nakhon Si Thammarat, and
(2) **Bangkok**.

Materials and Methods

Thailand



A : Wallailak University



B : Bangkok

Two locations in Thailand:

- (A) Walailak University in Nakhon Si Thammarat Province, and
- (B) Bangkok

- Davis AirLink PM2.5 sensors were deployed at both sites to facilitate comparative measurements of PM2.5 concentrations between the two locations.

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Walailak University

Davis Air Link
- PM 2.5
- Every 5 minutes

GLOBE Protocol
- Air Temperature
- Relative Humidity

Bangkok

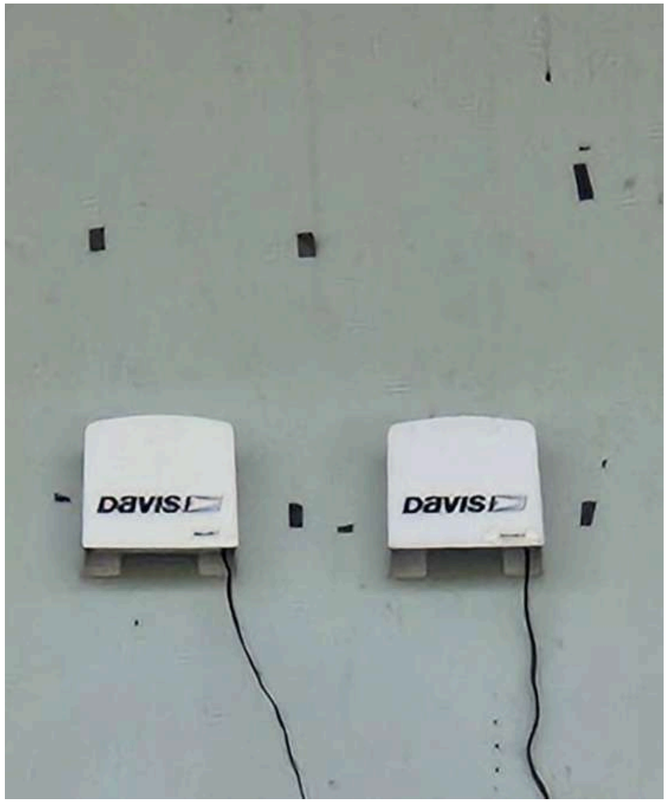
Davis Air Link
- PM 2.5
- Every 5 minutes

GLOBE Protocol
- Air Temperature
- Relative Humidity

30 Days
December 1-31, 2024

Data Analysis
- One Way ANOVA
- Linear Regression

Devices



DAVIS AIRLINK

WEATHER STATION

Results and Discussion

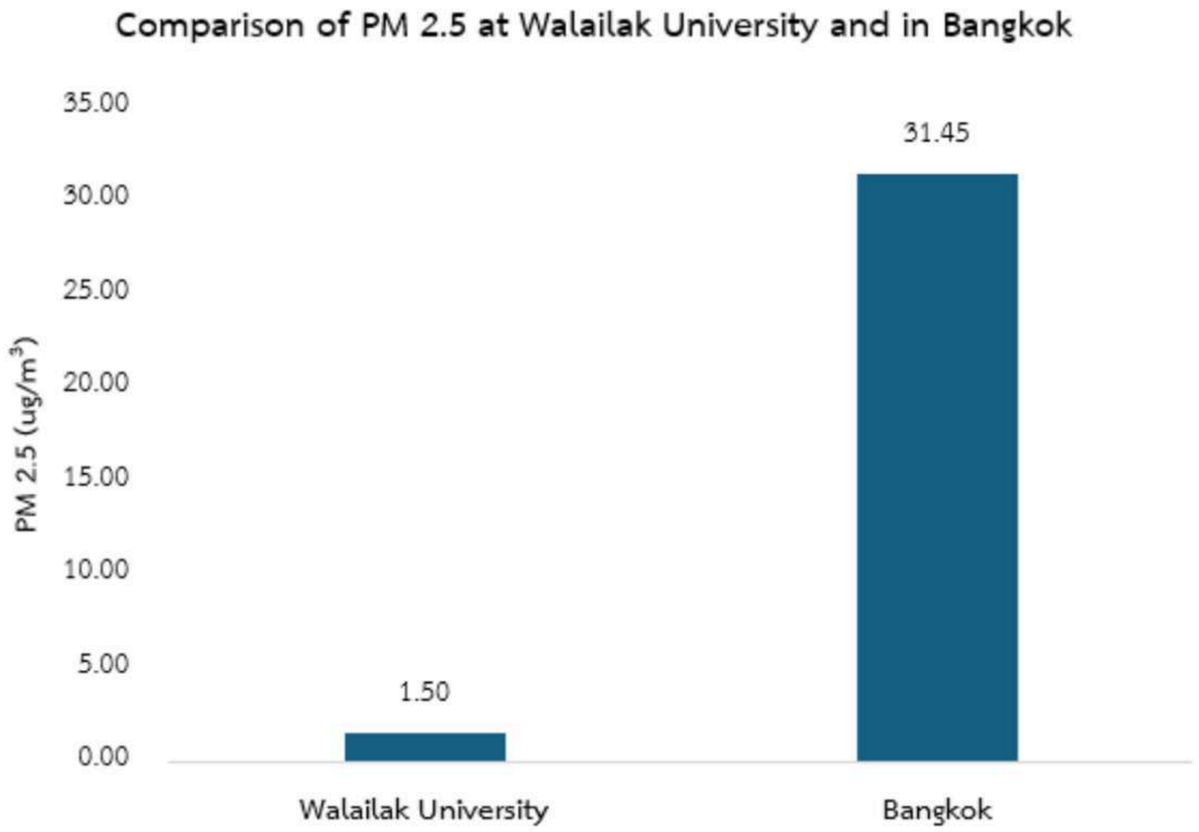


Figure 3.1 PM2.5 Concentration between Walailak University and Bangkok sites

- Between Walailak University and Bangkok, there is a significant difference in PM2.5 concentrations between the two areas (linear regression: F61 =-14.156, P>0.001, Figure 3.1)
- Walailak University has an average PM2.5 concentration of 1.50 ug/m^3
- Bangkok has a significantly higher average PM 2.5 concentration of 31.45 ug/m^3.
- Therefore, the differences in PM2.5 levels between these areas may result from varying human activities and environmental conditions.

Results and Discussion

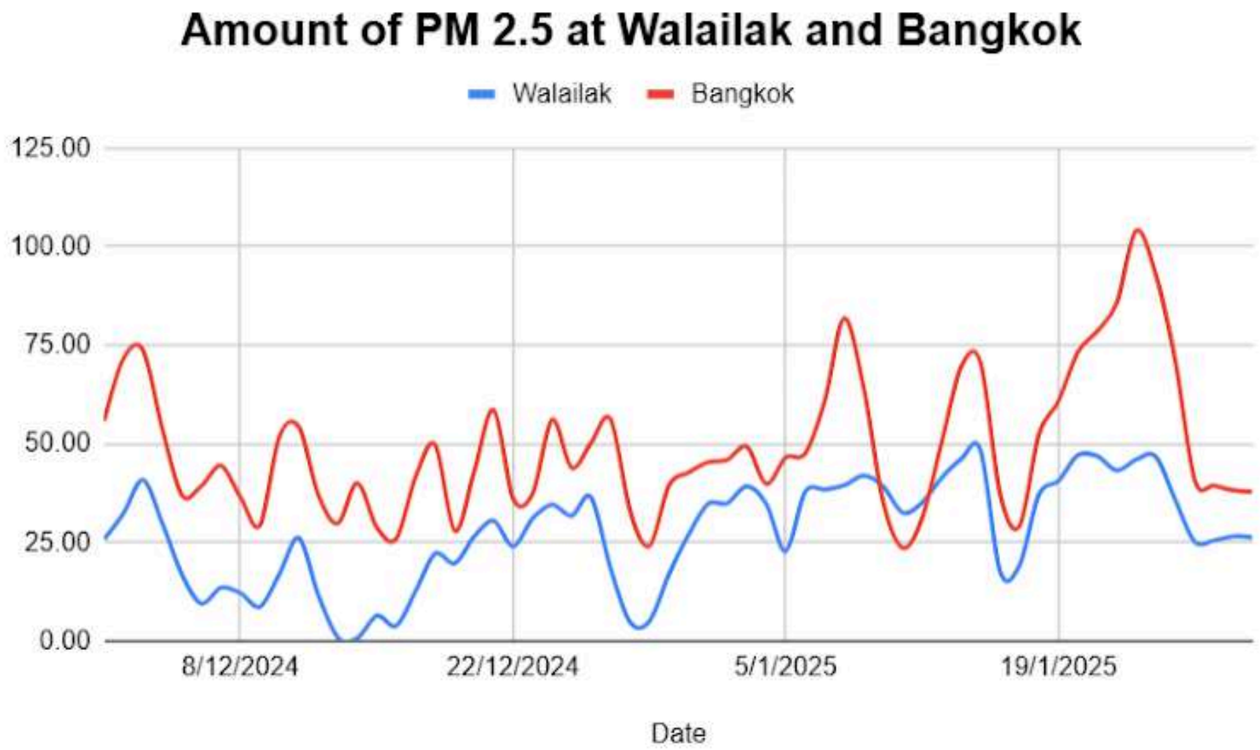


Figure 3.2 Comparison of PM2.5 at Walailak University and Bangkok

- The highest amount of PM 2.5 in Bangkok is on the 23rd of January 2025
- Walailak University is on the 15th of January 2025
- It can be inferred that the lowest amount of PM2.5 in Bangkok was on the 11th of January 2025 while at Walailak University on the 14th of December 2024

Results and Discussion

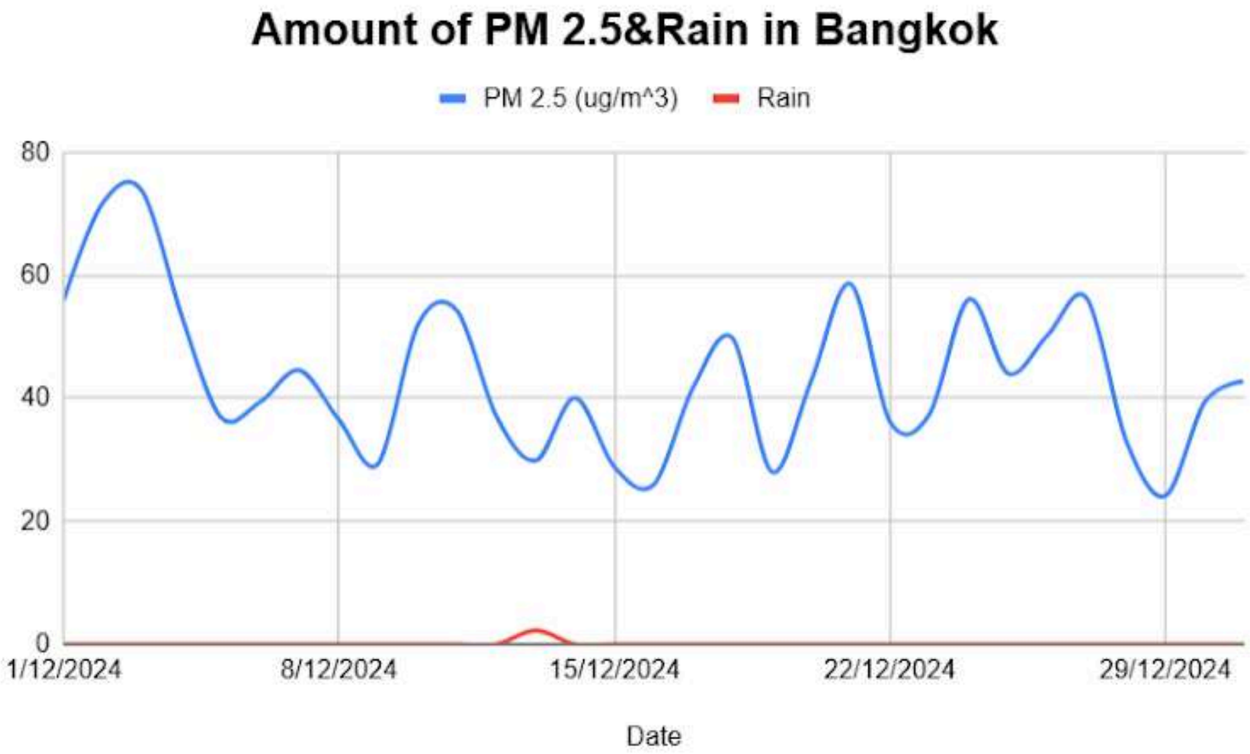


Figure 3.3 Amount of rain and PM 2.5 in Bangkok

- Highest amount of PM 2.5 within the first week of December.
- Within the mentioned month, the amount of PM 2.5 ranges from 20 to 75 µg/m³ - **NOT SAFE!**
- 15 µg/m³ - **SAFE!**
- Level of PM 2.5 in Bangkok did not significantly change, even there was rain.
- Traffic emissions, industrial activities, and weather conditions- air pollution GOES HIGH.
- A short rain cannot quickly decline the level of PM 2.5, especially when the dry season comes.

Results and Discussion

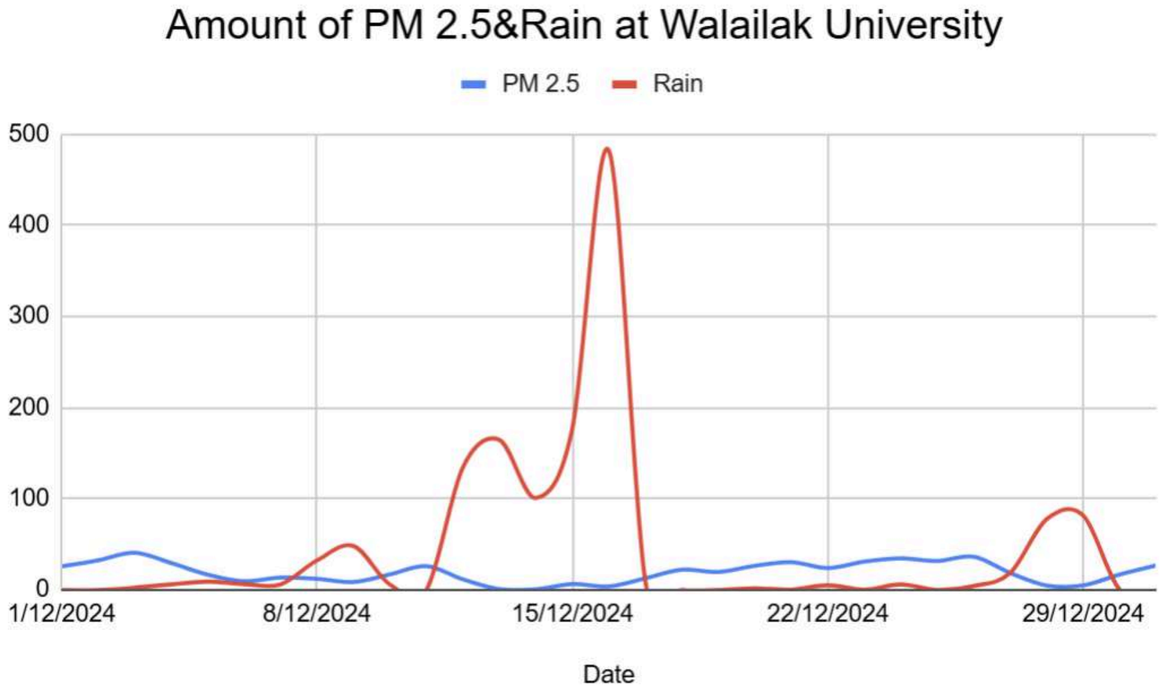


Figure 3.4 Amount of rain and PM 2.5 in Walailak University

- PM2.5 levels and rainfall at Walailak University in **December 2024.**
- The blue line shows PM2.5 levels, which are relatively **low and stable**
- The red line shows rainfall levels, which **increase rapidly**, especially in mid-December, when rainfall quickly reaches 450 mm.
- After this, rainfall decreases to **zero**
- less rainfall occurring at the beginning and end of the month.
- There is no direct relationship between rainfall and PM2.5 levels
- PM2.5 remains relatively constant regardless of rainfall changes.

GLOBE Protocol

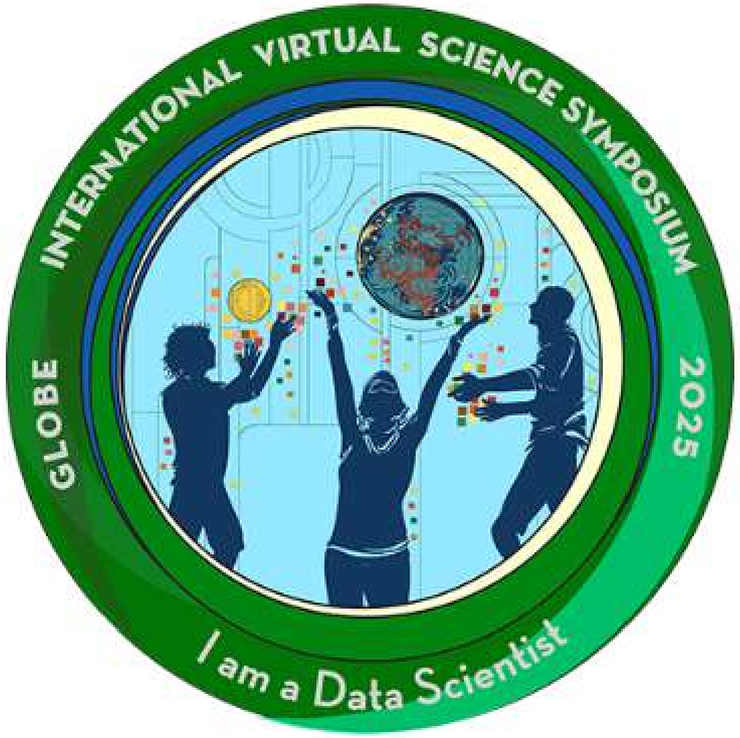
Clouds influence air quality by affecting:

- **Sunlight**
- **Temperature**
- **Wind**
- **Relative Humidity**
- Help reduce PM2.5 by trapping and washing away particles.
- Cloud data, collected via the **GLOBE Cloud Protocol**, is
- Crucial for understanding weather patterns and their effects on air pollution.

CONCLUSION

- The research provides valuable insights into the current air quality situation, serving as essential information for developing air quality improvement programs.
- Data analysis reveals that Bangkok experiences extremely high levels of PM 2.5, regardless of the amount of rainfall it receives.
- In contrast, the abundant rainfall at Walailak University significantly reduces PM 2.5 levels.
- Urbanization in Bangkok is identified as the primary factor contributing to fluctuating PM 2.5 levels, especially during the dry season.

IVSS BADGES



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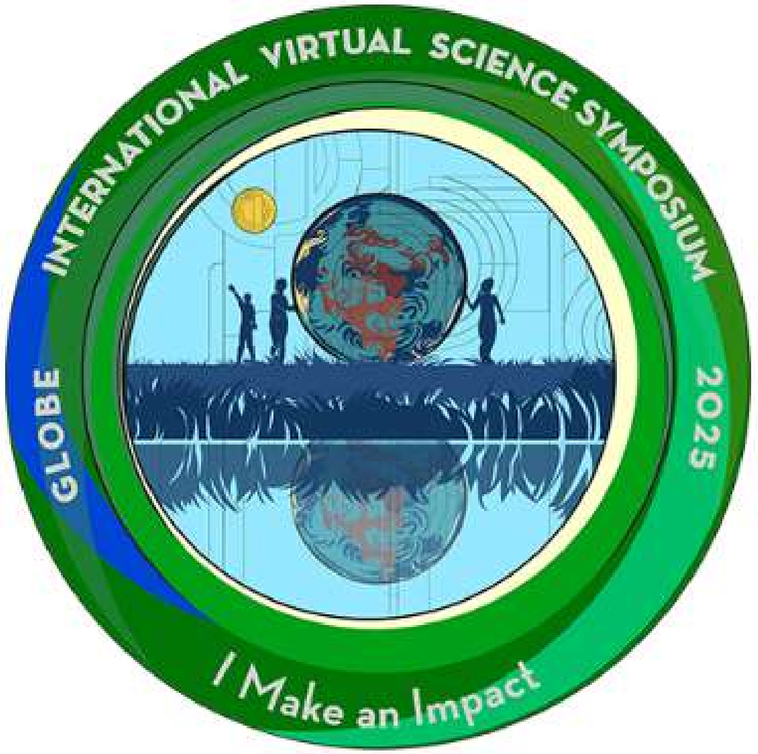

I make an impact

I am a STEM professional

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Thank You

For Your Attention