Optimal Excavator Efficiency on Building Demolition Sites

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INTRODUCTION

Within construction and demolition sites, measures are put in place in order to ensure an efficient and accurate process of waste sorting. Previous studies within the construction and demolition industry highlighted the issue of recyclable material being sent to landfill sites which invokes the question of "To what extent do excavator number and orientation contribute to the efficiency of a demolition operation?". This study aims to conduct small-scale experiments to find optimal methods of operating heavy machines to effectively and thoroughly recycle debris and allows for the analysis of waste sorting to recycle a greater number of waste to promote sustainability.

METHODS

- Utilizes small-scale excavators with remote controllers, small rocks in two different colors and small pieces of metal to simulate debris, tracking software, stopwatch, and a camera.
- Each participant in the experiment first completes a solo experiment to gauge productivity and efficiency alone before participating in group experiments.
- Using the tracking software and the camera, the distance and orientation of the excavators were able to be measured to find the optimal location as well as optimal number of excavators.
- Values derived from the experiments are used to determine the productivity from the expected productivity.
- Expected productivity is the volume of debris an individual can separate within an hour. This ratio is then analyzed with the number of excavators, orientation, and mean distance.
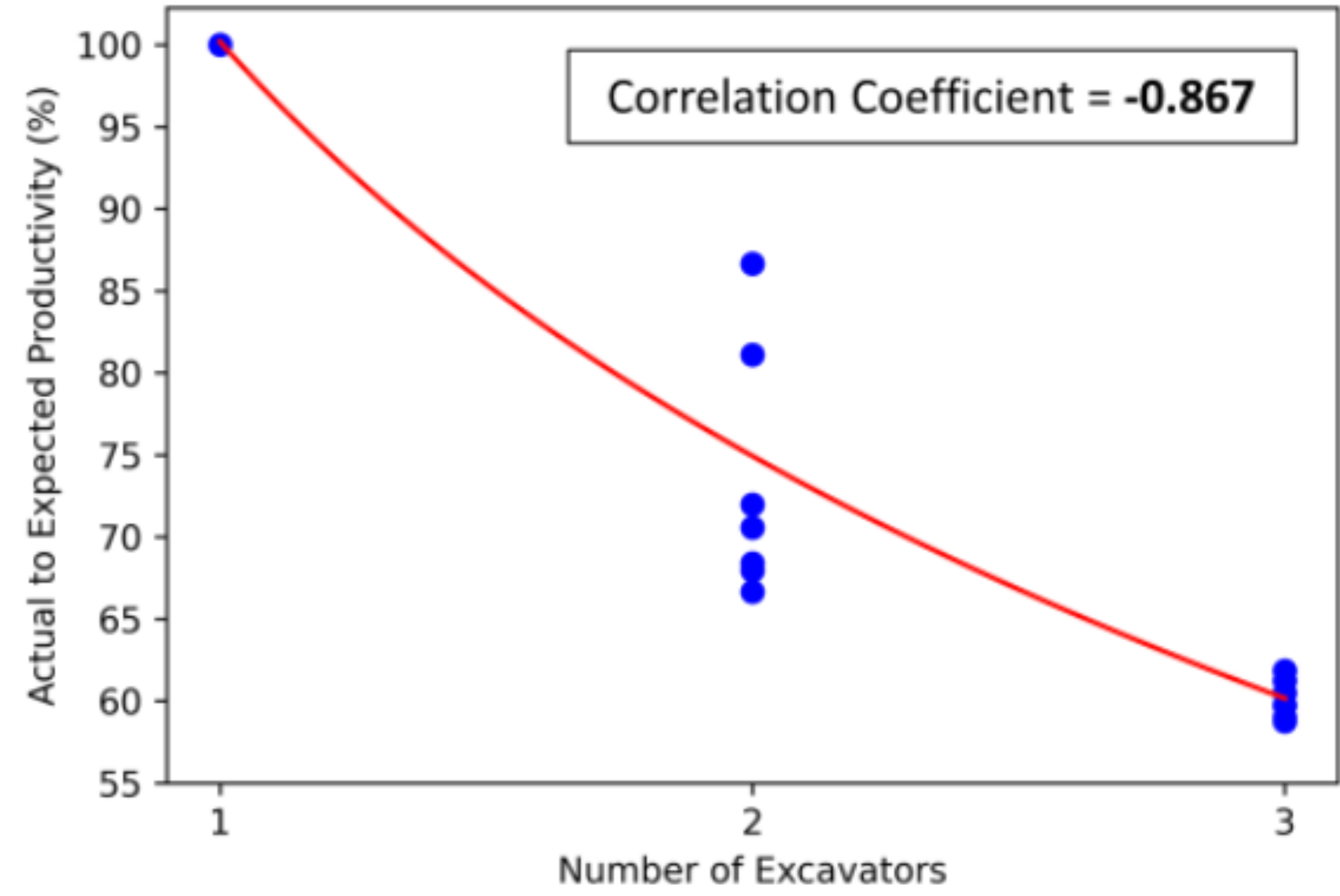
RESULTS

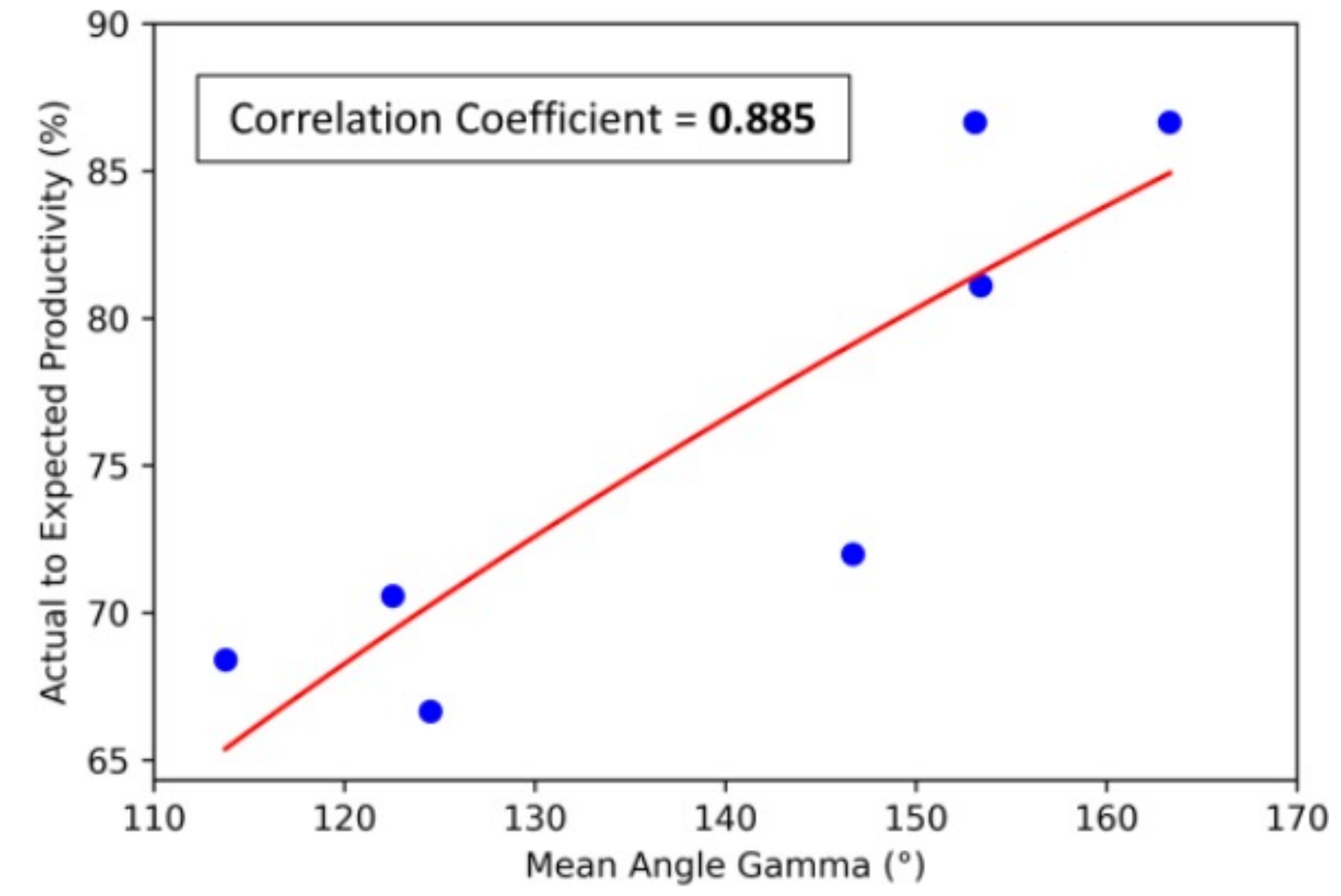Table A. Compares the number of excavators to actual expected productivity.

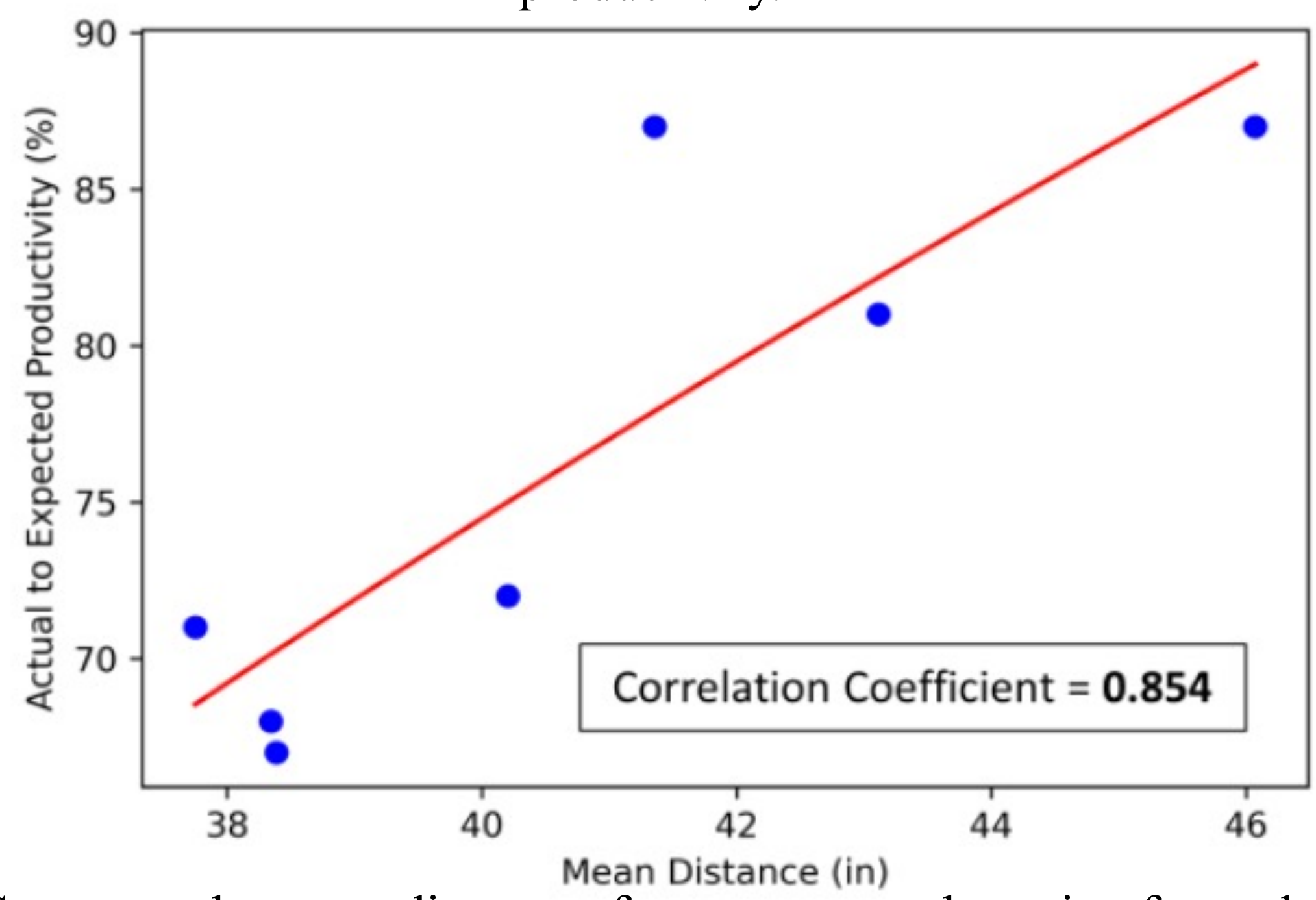Table B. Compares the mean angle of the excavators to the ratio of actual to expected productivity.

Table C. Compares the mean distance of excavators to the ratio of actual to expected productivity.

DISCUSSION

While data is still being collected and results are still being analyzed, some conclusions have already been made aware of. Table 1 shows the negative correlation between number of excavators and expected productivity, meaning as more excavators are added the expected productivity is not proportional -- it also shows that two excavators is more efficient than both one or three excavators. Table 2 depicts the results of a positive correlation between mean angle and expected productivity -- meaning that as excavators are angled toward each other at a 180-degree angle, the closer the productivity is to what was initially expected. In Table 3, it shows that the excavators are more efficient the farther away they are from each other. As we uncover more about these findings, companies can have a better understanding of how to approach the calculation of excavators and workers needed for optimal operation within the industry to maximize efficiency and profits.

REFERENCES

Elsayed, Moustafa, and Juyeong Choi. 2024. "A Small-Scale Simulation Approach to Educate the next Generation of Engineers about Sustainability Challenges in Building Demolition," March. https://doi.org/10.1061/9780784485293.037.