

Evaluating the Impact of Semi-Autonomous Auto Scrubbers

Findings from our pilot locations



BACKGROUND

Robotic equipment has the potential to transform the facility management industry by providing safer, more efficient methods to perform facility services. However, many of these machines are still in the early phases of adoption. While robotics continue to advance, commercial offerings are still early-stage with limitations.

In particular, the machines remain semi-autonomous with oversight requirements. Operation of the machine is also limited to repetitive movement in an unchanging, consistent environment.

Quick Stats

5 diverse sites incorporated in the pilot

2 Machines sizes leveraged during the pilot

0.47 average stoppages per mapped run

34 minutes on average required to support machine along route

37% average time savings when compared to equivalent ride-on machines

However, the question remained: what is the impact is of leveraging semi-autonomous equipment in its current state? One use case we explored was semi-autonomous scrubbers.

Read about our approach, findings, and conclusions below.

OUR APPROACH

Leveraging our ABMNext pilot processes, we studied the impact and value of semi-autonomous scrubbers through rigorous field testing. In particular, we focused on:

Market Scanning: Before starting any pilots, we first performed a market scan to evaluate the vendors and machines available. One product line, Tennant's semi-autonomous scrubbers, stood out due to its mapping technology and commercial build. Within the product line, we piloted the T380 due to its smaller size and

turning radius that could be applicable to a wider range of spaces, as well as the T7 due to its higher reported run rate.

Structured hypotheses: After selection of the vendor for the pilot, we organized detailed testing plans. In particular, we focused our testing on determining the effectiveness of the machines, the environments where they work best, and the efficiency impact from utilization.

Multi-location Approach: Pilot locations were selected across multiple facility archetypes to ensure we could see the impact of facilities on the machine usage.

Collaboration with Vendor: During the pilot, we scheduled feedback sessions with the software developer and manufacturer of the machine to ensure the pilot was structured appropriately and the findings could shape future product roadmaps.

RESULTS

Reported Data – Tracked KPIs

0.47

Average reported stoppages of the Tennant machines per mapped route

16,890

Average running efficiency of the T380 machine in practice in square feet per hour

18,192

Average running efficiency of the T7 machine in practice in square feet per hour

As part of our pilots, we documented KPIs around the machine performance through both vendor-provided reporting as well as manually tracked metrics. We saw that the Tennant machines performed lower than the reported run-rate. For instance, the T7 has a reported maximum run-rate of 28,600 square feet per hour when used in the semi-autonomous mode. In practice, we only observed a run-rate of 18,192 square feet per hour. The decrease was unsurprising due to the practical challenges that occur in a real-world environment instead of an idealized lab environment.

One of those challenges was stoppages. We observed on average that the Tennant machines had a stoppage occur along approximately every other route. Stoppages were most frequently due to rays of light or reflections that were perceived by the machine as obstacles. However, some stoppages did not have an obvious root cause. With every stoppage, the supporting team member would need to come and reset the machine along its mapped path.

This played into both the observed run-rate as well as the resulting efficiencies from implementation. In order to quantify the efficiencies, we conducted time studies at each pilot site. The baseline was considered the equivalent ride-on scrubber. For instance, the baseline for measuring efficiencies of the semi-autonomous T380 was leveraging a ride-on T380.

We saw that five additional minutes are required to start-up the machine when using it autonomously, which is due to the need to start the machine along the mapped route. Additionally, we observed an average of 34 minutes required to support the semi-autonomous scrubbers along its route. The high support time was due to the volume of stoppages, the need to perform

additional manual floor cleaning, and the need to clear all obstacles for the mapped route. When a ride-on scrubber was used, the operator could navigate the machine around obstacles that may have moved slightly day-to-day. When a mapped route is used, however, any small shift in an object's location could result in a stoppage. This not only resulted in team member timing removing or moving obstacles, but also meant that mapped routes generally covered less floor space than the machine used in ride-on mode. As such, team members often needed to dedicate additional time to performing manual floor cleaning in spaces that the Tennant machines could not cover.

TIME STUDY FINDINGS



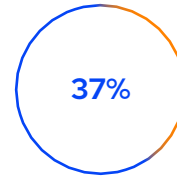
Additional minutes on average to set-up the semi-autonomous Tennant machines



Minutes on average to support the machines during the mapped route



Minutes on average to move the machine between mapped runs



Average time savings when compared to equivalent ride-on machines

OBSERVATIONS

- The machine cannot differentiate between true blockages and light reflections from mirrors or sunlight. This becomes a challenge in facilities with a large number of windows.
- Given the size of the machine, it becomes challenging to move between locations if not connected by continuous hard flooring or via an elevator. This limits the range of the machine's usage within a facility or series of buildings.
- The T380 is often the preferable option compared to the T7 due to its more nimble size and turning radius. While there is a minor reduction in run-rate productivity, this is often offset by the increase in floor coverage that is feasible. The T7 or T16 models could be leveraged effectively, however, in larger spaces that have wide corridors or rooms and a need for greater run-rates.
- Training of multiple team members on performance of the machine is critical. The semi-autonomous scrubbers available today only function in a co-bot model, and training multiple team members allows for usage in the event of call-outs.
- Maintenance needs can occasionally take machines out of operation for a few days at a time.
- Implementation can have positive perception impacts. Occupants tended to stop and observe the machine running. Utilization during occupied hours, however, will result in lower efficiencies and higher stoppages.

CONCLUSION

The data from our pilots aligned with the current maturity of commercial robotics. Tennant's semi-autonomous machines still require a high amount of supervision to function. The machines will perform a repetitive task (scrubbing) effectively but there are limitations in where they can perform this activity.

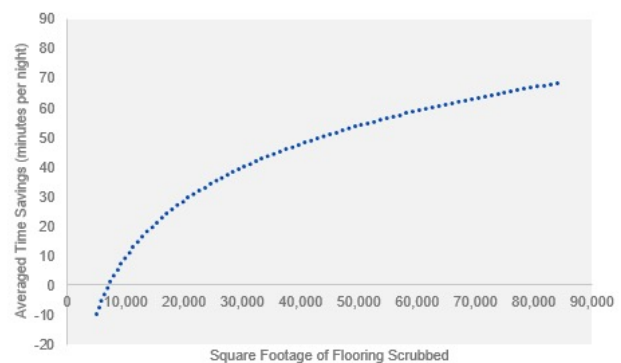
Both the T380 and T7 will only function in wide, open, hard surface spaces. The T7 has more limitations due to its size and turning radius, making the T380 a more viable choice for most facility archetypes. Regardless of machine selection, any change in the space layout will result in stoppages. All stoppages will require manual resetting and support, as the machines are not yet able to move around obstacles or restart when one is encountered.

Collectively, this means that the Tennant semi-autonomous scrubbers can result in some efficiencies but that they are limited due to the current technology maturity. When the time study was analyzed, we observed that the average time savings per night is quite small. For instance, if the T380 model covered 20,000 square feet of hard-surface floor, the average time savings for scrubbing would only be approximately 25 minutes. In practice, this means that approximately 25 minutes could be freed up for higher-value tasks. It is not efficient enough, however, to result in labor savings.

Given this, the main application for Tennant's semi-autonomous scrubber in the current state is to provide labor augmentation in facilities with wide, open, hard-surface spaces. The efficiencies, though small, can be used to support high-value activities like disinfection. The semi-autonomous machine is thus a good option to consider if already exploring a ride-on scrubber. Implementation, however, will not result in any labor savings and will not be able to add scrubbing to the SOW without introduction of labor to support the addition.

We expect that the robotic landscape will continue to change and mature. As such, we will continue to monitor the available offerings and partner with developers and OEMs to discuss our recommendations for how their machines could be more beneficial to facility services.

Time Study Impacts (T380)



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