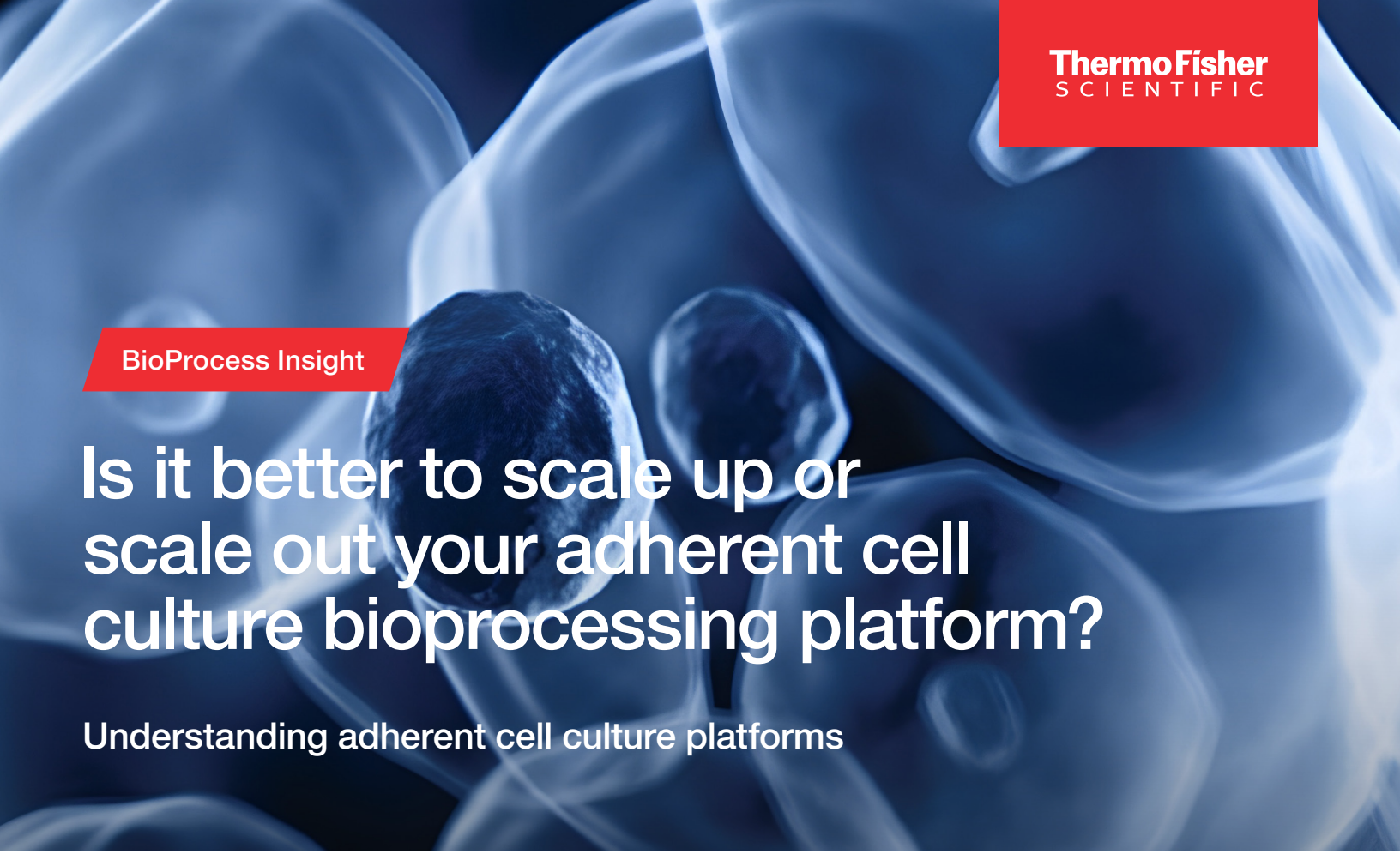


BioProcess Insight

Is it better to scale up or scale out your adherent cell culture bioprocessing platform?

Understanding adherent cell culture platforms

Introduction

With the growing demand for animal and human vaccines, expanding adherent cell culture production facilities can be complicated. Efficiently transferring technology to CDMO partners can add complexity while alternatively, expanding capacity within existing or newly constructed spaces can require substantial investment. For instance, space costs can range from $500 to $1,000 per square foot (1). Additionally, logistical planning can take 12-18 months, from initial design to operational readiness (2).

Choosing the right adherent cell culture platform for vaccine production is crucial for scalability, cost-effectiveness, ease of use, and productivity. Two commonly used platforms are roller bottles and cell factory systems. Roller bottles, well-suited for scale-out, are often valued for their low cost, familiarity, and ease of transfer. In comparison, cell factory systems, designed for scale-up, provide user-friendliness, space efficiency, and the added advantage of reduced contamination risk through closed-system capability (3).

This article will compare the workflows scaling out with roller bottles versus scaling up with cell factory systems, focusing on space requirements, investments, and environmental sustainability.

Differences in scale up and scale out

When expanding vaccine production, deciding between scaling out (using roller bottles) and scaling up (using cell factories) is essential to optimize resources and facility space. Scaling out roller bottles increases production by adding more bottles due to the limited surface area of each bottle. This approach requires extensive space and labor. In contrast, cell factory systems are designed for scaling up, offering higher surface areas per vessel and increasing output within a single unit. This distinction can lead to more efficient resource utilization and potentially maximize production capacity.

Here are three considerations when it comes to deciding between scaling up and scaling out:

1. Space requirements: The space requirement of each method is vastly different due to the number of vessels and equipment required. A facility dedicated to producing 850,000 cm^2 cell culture batch using the scale-out method with roller bottles requires approximately 2620 ft^2 of space to house 1,000 roller bottles, 24 racks, 4 seed incubators, and 8 biosafety cabinets whereas, to produce the same cell culture batch using the scale-up method with the cell factory systems, only approximately 970 ft^2 is required to house 34 units, 3 incubators, 1 manipulator, 2 seed incubators, and 1 biosafety cabinet. The scale-up method with cell factory systems saves approximately 1650 ft^2 of space compared to the scale-out method with roller bottles.

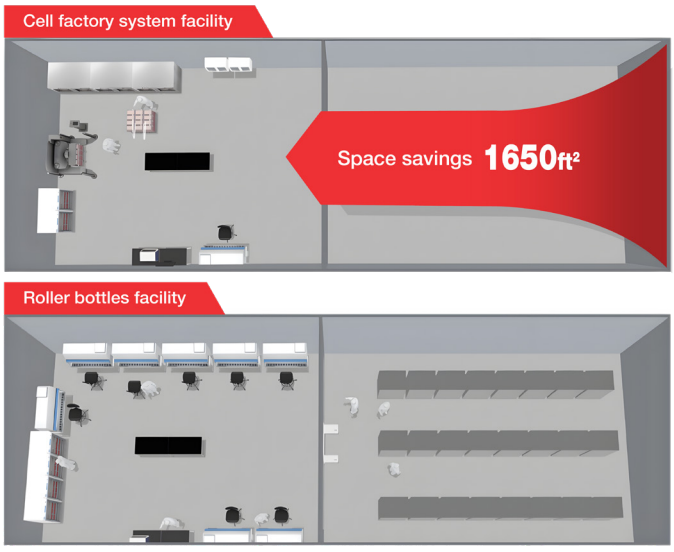
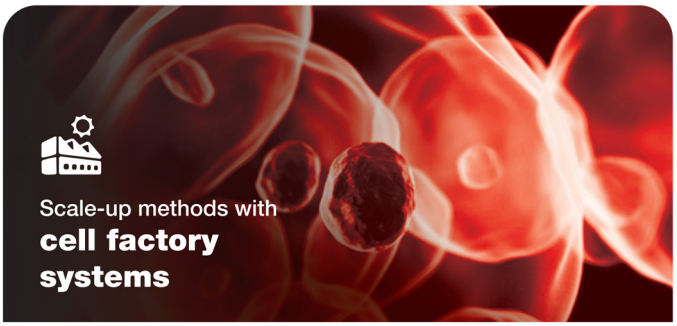


Fig. 1 compares the facility layout for cell factory systems and roller bottles.

2. Investments: Regarding the investment to expand vaccine production through adherent cell culture, we examined the direct and indirect costs using roller bottles and cell factory systems. The direct costs that include labor, materials, and consumables are approximately 16% lower when using cell factory ystems rather than using roller bottles. In terms of indirect costs from equipment capital and facility, they are approximately 11% lower when using cell factory systems over using roller bottles. These costs can increase further if bespoke robotics is integrated to manage the high volume of roller bottles.



16%
Lower
total direct costs with cell factory systems (includes labor, materials and consumables).

11%
Reduction
total indirect costs from equipment capital and facilities with the use of cell factories.

3. Environmental sustainability: Sustainability is also a huge factor in modern vaccine production. Choosing between roller bottles and cell factory systems can impact the environment and resource use. Roller bottles need a bigger facility footprint and volume for the scale-out method, which contributes to a higher carbon footprint. On the other hand, scaling up adherent cell culture using cell factory systems requires a smaller facility footprint and fewer consumables, which makes it more eco-friendly. Cell factory systems can be made with biobased feedstocks, further decreasing the carbon footprint from production making them a more sustainable choice.

up to
45%
Reduction
with cell factory systems made using non-biobased feedstock

up to
67%
Reduction
with cell factory systems made using biobased feedstock

Summary

With growing demand for vaccines, identifying scalable and efficient methods for adherent cell culture is increasingly important. Roller bottles are a good option for lower-scale production environments. When the need to scale arises, they present many operational and process challenges such as labor, footprint, and issues associated with handling high volumes of open system vessels but can be challenging when scaling out due to contamination risks and inefficiencies.

Conversely, cell factories offer a lower footprint, standard automation allowing for reduced labor, and a closed system environment, reducing risk of contamination. Cell factory systems take up less space, use fewer consumables, and can lower labor costs. Adopting cell factory systems can provide a more viable solution for large-scale vaccine production.

To determine whether scaling up is a better option for your process, speak with a specialist **Single-Use Technologies—Request more information | Thermo Fisher Scientific - US** or visit our website **Nunc cell factory system.**

References

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