

The Cost of Buffer and Process Liquid Preparation

An outsourcing guide

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INTRODUCTION

Buffers and process liquids are used across the entire bioprocessing workflow, to equilibrate pH, wash, and elute, and for liquid media, feed and supplement needs during upstream bioreactor maintenance. Because they are frequently used and may scale-up over time and in conjunction with the addition of new products and processes, the question that is sometimes hard to see is at what point does outsourcing become right for you.

OUTSOURCING

Let us start with what you will gain by outsourcing. Benefits to outsourcing liquid manufacturing include:

- Better product consistency
- Fewer contamination risks
- Eliminate need for mixing suites
- Reduce Supplier and Raw Material Management
- Time and labor-intensive steps eliminated:
 - QC of salts, liquid preparation, filtration, quarantine, finished good testing, documentation, procedures, validation
- Improved safety due to less handling
- Just-in-time logistics solutions
 - ThermoFisher cGMP warehousing (in US and Ireland)
- Returnable containers provide environmental solution

Outsourcing offers the following benefits:

- One predictable cost
- Frees up resource constraints
- Increased facility flexibility
- Reduced contamination issues, quality problems, buffer preparation failures, and spills
- Bioprocessing becomes less complex for planning
- Increases speed to market

Concerns or issues in any of these areas may be enough motivation. For others, it is a simple question of economics.

ECONOMICS

Consider the resources, time and space available in your facilities today as compared to what it would look like if you were not manufacturing buffers and process liquids. How would you use them differently?

We considered three major economical areas to evaluate total costs related to buffer preparation.

- Fixed—Capital equipment, utilities, facility
- Variable—Labor, repairs, and quality
- Consumable—Raw materials and disposal

In these areas, we evaluated 28 different categories as shown in Tables 1–3. Typically, small-scale production is less economical than large-scale and lends itself well towards outsourcing. Large-scale buffer management is often more cost efficient than smaller scale, but even at these lower costs large-scale manufacturers are outsourcing because of the benefits they receive.

DATA

The data in this section was generated from interviewing 10 biopharmaceutical companies and should not be treated as a representative of all buffer manufacturing facilities in each respective category. The data should be treated as examples for evaluation.

Table 1. Examples of the average annual fixed costs by production volume

Element	<100,000 L/year (n=2)	100,000 to 500,000 L/year (n=6)	>500,000 to 1,000,000 L/year (n=1)	>1,000,000 L/year (n=1)	All Systems (n=10)
Capital Facility Expenses (Excluding equipment and HVAC)	\$1.41	\$2.54	\$0.82	\$1.39	\$2.03
Water-For-Injection (WFI) skid, tanks and piping	\$0.28	\$0.21	\$0.04	\$0.05	\$0.19
Mixed buffer-only storage and holding tanks	\$1.96	\$0.95	\$0.08	\$0.31	\$1.00
Classified Heating, ventilation, and air condition (HVAC) systems	\$0.17	\$0.11	\$0.02	\$0.03	\$0.11
Refrigerated storage unit	\$0.00	\$0.03	\$0.00	\$0.03	\$0.02
Rehousing and facility operations	\$0.29	\$0.14	\$0.02	\$0.56	\$0.20
Utilities, electric, and gas,	\$1.17	\$0.21	\$0.07	\$0.50	\$0.41
Other buffer preparation equipment	\$0.87	\$0.14	\$0.02	\$0.05	\$0.26
Other facilities construction	\$0.13	\$0.01	\$0.00	\$0.01	\$0.03
Automation of equipment for mixing	\$0.26	\$0.02	\$0.02	\$0.08	\$0.07
Filtration (Equipment only, excludes filter cost)	\$0.23	\$0.06	\$0.02	\$0.10	\$0.09
Other equipment	\$0.01	\$0.07	\$0.00	\$0.00	\$0.04
Total fixed costs per liter	\$6.78	\$4.49	\$1.11	\$3.	\$4.26

Table 2. Examples of the average annual variable costs by production volume

Element	<100,000 L/year (n=2)	100,000 to 500,000 L/year (n=6)	>500,000 to 1,000,000 L/year (n=1)	>1,000,000 L/year (n=1)	All Systems (n=10)
Validation and documentation	\$0.07	\$1.43	\$0.25	\$1.25	\$1.02
In-house logistics	\$0.20	\$0.04	\$0.33	\$0.08	\$0.10
Quality control laboratory	\$1.14	\$0.12	\$0.18	\$0.15	\$0.33
IT system setup and GMP	\$0.01	\$0.03	\$0.02	\$0.03	\$0.02
Labor operations (annual)	\$2.40	\$1.81	\$1.47	\$0.56	\$1.77
Regulatory, QA, documentation	\$1.78	\$0.32	\$0.47	\$0.38	\$0.64
Repairs and labor	\$0.68	\$0.10	\$0.03	\$0.11	\$0.21
Other general and administrated labor	\$1.26	\$0.26	\$0.09	\$0.63	\$0.48
Total variable costs per liter	\$7.54	\$4.11	\$2.84	\$3.19	4.57

Table 3. Examples of the average annual consumable costs by production volume

Element	<100,000 L/year (n=2)	100,000 to 500,000 L/year (n=6)	>500,000 to 1,000,000 L/year (n=1)	>1,000,000 L/year (n=1)	All Systems (n=10)
Buffer ingredients	\$3.15	\$5.31	\$4.00	\$1.75	\$4.39
Other ingredients	\$0.20	\$0.29	\$0.08	\$0.00	\$0.22
Filters and related consumables	\$3.35	\$1.11	\$0.58	\$1.113	\$1.51
Single-use devices (Bags, tubing, connectors, manifolds)	\$5.85	\$0.77	\$0.58	\$0.13	\$1.70
WFI costs, consumables, not elsewhere noted	\$1.18	\$1.83	\$7.08	\$1.38	\$2.18
Disposal	\$0.57	\$0.10	\$1.67	\$0.50	\$0.39
Other consumables	\$0.57	\$0.28	\$0.00	\$0.00	\$0.28
Total consumable costs per liter	\$14.87	\$9.69	\$13.99	\$4.87	\$10.67

FIXED COSTS

Overall, the average fixed cost per liter is \$4.26. Table 1 shows the breakdown by each category of the fixed costs. All costs were based on those allocated specifically for buffer preparation.

VARIABLE COSTS

The average variable cost per liter is \$4.57. Table 2 shows the breakdown by each category of the variable costs. All costs were based on those allocated specifically for buffer preparation.

CONSUMABLE COSTS

The average consumable cost per liter is \$10.67. Table 3 shows the breakdown by each category of the consumable costs. All costs were based on those allocated specifically for buffer preparation.

DISCUSSION

In the examples shown, the costs at smaller scales were higher, where the benefits of outsourcing buffers may be more of interest when looking at a straight cost comparison. Even when the cost of outsourcing doesn't appear to be more economically beneficial, outsourcing will free up resources spent on buffer preparation (raw material control, quality control, space, etc.) allowing those resources to be focused on your core capabilities.

CONCLUSION

Outsourcing works when your supplier is able to meet your requirements:

- Expertise
- Scalability
- GMP-level processing
- QA/QC and documentation handling
- Just-in-Time solutions and warehousing; reducing handling and storage complexities
- Seamless customization and manufacturing

It gets the products you need when you need them, allowing you to work quicker and more efficiently.

Other important factors such as cost, space utilization, labor, and regulatory management need to be considered as well. Outsourcing allows those resources to be freed up to focus on your core capabilities.

REFERENCES

1. Langer, E.S., "Economics of In-House Buffer Preparation," Contract Pharma, Sept. 8, 2016.
2. Langer, E.S., "Outsourcing of Buffer Preparation Activity is Increasing," BioProcess International, Nov. 14, 2016.

TRADEMARKS

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