

# Sales, Inventory, and Operations Planning Supports the 3Rs

Terrance J. Receveur, MBA; Noah Bartlett; Jeffrey Lohmiller, DVM, MS, DACLAM; Eric Zyryi  
Taconic Biosciences, Inc., Rensselaer NY

## ABSTRACT

Vivarium managers, principal investigators, and outside animal vendors are challenged with balancing the number of animals to be produced with the anticipated demand. Forecast too low and there are unhappy customers; forecast too high and there are animal waste and unhappy institutional officials and veterinarians. Additionally, institutions have the moral and ethical responsibility to follow the tenets of Russell & Burch's 3Rs. One way animal model producers (internally and externally) can mitigate the risk of overproduction is by implementing a robust Sales, Inventory, and Operations Planning (SIOP) process to align animal production with demand. SIOP is an integrated business management process, through which an institution continually achieves focus, alignment, and synchronization among all functions. SIOP can be applied to animal production colonies of any size and type. The goal of SIOP is to honor the value of researchers' lab animals through a disciplined approach to production. A properly implemented SIOP process for research animal production involves routinely reviewing customer demand (by animal model, sex, age, and zygosity) and production supply resources (e.g., required breeders, space for breeding and holding cages, and genotyping) and re-planning quantitatively across an agreed-upon rolling time horizon. A key input with production is a regular assessment of the actual production performance of each colony with action items to address under or over production. When SIOP is applied to animal production, the overall output of the process is an animal production forecast that is updated monthly leading to a use plan, animal production plan, holding and euthanasia plan, new animal model development plan, strategic initiative plan, and resulting financial plan. The development of several key performance indicators is vital to understanding and measuring SIOP impact. Measures of forecast and production accuracy, on-time to receipt (OTTR), overproduction, and product level profitability are all indicators of success. However, the true value of SIOP is exemplified by a reduction in the number of animals overproduced. A well-executed SIOP process enabled one animal provider to reduce overproduction by 38%, a phenomenal result that aligns with the 3Rs. The guiding principles of the 3Rs, in place for over 35 years, are intended to evolve and improve tools for responsible animal use. SIOP is such a tool, capable of helping ensure animals are produced responsibly.

## METHODS

W.M.S. Russell (1925–2006) and R.L. Burch (1926–1996) originated the concepts of replacement, reduction, and refinement, which they published in their 1959 book, *The Principles of Humane Experimental Technique (Principles)*<sup>2</sup>. They introduced and defined the terms replacement, reduction, and refinement. *Principles* was presented not as the final word of this science, but as a foundation for future developments. The 3Rs, as Russell and Burch first called them, were put forward not just to assist investigators in finding and using currently available techniques but also to encourage the development of as-yet unknown tools and methodologies.



Figure 1: R.L. Burch and W.M.S. Russell

Animal models and science continue to improve and in the spirit of Russell and Burch's 3Rs are developing new tools and methodologies in alignment with the 3Rs. Unbeknownst to Russell and Burch the tool of using "SIOP" has provided significant contributions to the 3Rs.

### What is SIOP?

SIOP is an integrated business management process developed in 1983 by Oliver Wight, through which a company continually achieves focus, alignment, and synchronization among all functions. SIOP can be applied to animal production colonies of any size and type, including genetically-modified rodent colonies that exist at many research institutions.

### How is SIOP Performed?

SIOP is a monthly five-step business process (Figure 2) that may take up to four weeks to complete (Figure 3).

### Step 1 - Data Gathering/New Product Planning

A successful SIOP demands clean, current, and accurate data. The data-gathering process begins at month-end, based on that month's data for animal use and production supply, including breeding colony output, cages in use, and available cage capacity, among other parameters. A critical component of this step is to identify where the prior animal sales and use forecast had the greatest degree of variance. The focus is not on models used as expected, but on those that experienced the greatest amount of variance. The updated actual demand data is used for forecasting the future demand.

### Step 2 - Demand Planning

Demand planning involves converting a sales and use forecast for each animal model into an actual demand plan for the model by sex (Figure 4); A sales and use forecast is generally what is expected to be sold or used by an external entity. A demand plan is a real assessment of model demand (not simply a statistical forecast). It includes all potential uses and accounts for defects/non-conformance (expected and unexpected clinical and/or phenotype issues), attrition/obsolescence (animals no longer usable due to age), internal consumption (future breeder needs), and safety stock (animals to support spot orders or unplanned research needs) (Figure 5). Also considered are lost opportunities or modified requests for animals (Figure 6). These are indications of unfulfilled needs. The product-level sales forecast is shared with all stakeholders affected by the demand plan. For animal suppliers, this includes the sales force, marketing, customer service, finance, and operations. In small labs, the stakeholders could be the lab manager, post-doc researchers, the principal investigator, and facility animal care staff. Stakeholders consider the forecast and provide feedback; then they meet to reach consensus on the demand plan.

### Step 3 - Supply and Resource Planning

The operations side of the business now does its best to develop a production/supply plan to meet the demand plan on time, in full every month, at the individual model level. If there are issues that could keep the demand plan from being met in full (e.g., inadequate breeders available or inadequate capacity), those issues need to be identified at this stage. Operations takes into account known constraints, whether internal or external, in developing this first-cut production/supply plan. The operations team then matches the proposed plan against the key resources to identify whether the plan is feasible, to highlight which resources may cause issues, and to determine whether adjustments can be made. This leads to the development of a feasible operations plan to meet the proposed demand plan for each animal model.

### Step 4 - Reconciliation & Integration Meeting

Stakeholders come together to discuss issues, agree on recommendations, and turn the sales and operations/supply plans into financial numbers to be reconciled with the budget and business plan. They review the balance of supply and demand for each model, consider whether adjustments in animal production levels are needed to mitigate overproduction, and assess the outcome in terms of finished goods inventory or orders booked. Stakeholders agree on recommendations for each animal model, which are carried forward to the executive team.

### Step 5 - Executive SIOP Meeting

During the final step in the process, the executive team meets to review the SIOP recommendations. This is where management has clear control on the business numbers; they can turn the production control knob up or down and can demonstrate adherence to the corporate culture of supporting the 3Rs. The output of the meeting is a defined operational plan and consensus on financial expectations.

### How Does SIOP Contribute to the 3Rs?

Lab animal providers help scientists save lives and improve human health by providing high-quality animal models. The challenge is trying to forecast the demand for these models — a fine balancing act between the need for immediately available animals that require speculative production and the desire to reduce the number of unused animals. Lab animal providers use SIOP as a tool to more effectively predict demand for their models, with a goal of reducing overproduction in keeping with the 3Rs. While SIOP is a methodical, process-focused approach to production, which can seem cold when it comes to dealing with animals, the goal is to honor the value of researchers' lab animals through a disciplined approach to production. SIOP allows for under-utilized products to be offered at a discount as well as the opportunity to plan for lower forecasted demand periods by offering date range specific discounts to drive higher utilization.

Research institutions are equally concerned about responsible animal use and employ the 3Rs as a guiding principle, enabling a synergistic relationship between animal model providers and researchers to openly discuss future model needs and refine the animal production plan. The result is a more customer-focused plan versus a historically algorithm-driven forecast, which ultimately yields greater production accuracy and less overproduction.

### How is Success Measured?

The development of several key performance indicators is vital to understanding and measuring the impact of SIOP. Measures of forecast and production accuracy (how close to the target the actual performance was using bias and Mean Absolute Percentage Error (MAPE)), on-time-to-receipt (OTTR, Figure 8), is the percentage of animals that are delivered on time and at the exact customer specifications), overproduction, and product level profitability are all indicators of success. However, the true value of SIOP is exemplified by a reduction in the number of animals overproduced. **A well-executed SIOP process enabled Taconic to reduce overproduction by 38%**, a phenomenal result that aligns with Russell and Burch's 3Rs.

Awareness of the incalculable value of research animals in improving human lives inspires those who use them to aggressively pursue any means possible to ensure animals are used responsibly and ethically. The guiding principles of the 3Rs, in place for over 35 years, are intended to evolve and improve tools for responsible animal use. SIOP is such a tool, capable of helping ensure animals are produced responsibly.

## DISCUSSION AND CONCLUSIONS

Most organizations track the number of animals produced, used, and not used. The goal is to balance production to use as closely as possible. A decrease in the number of animals produced, but not used, is the target for success. A consistent downward trend in animals euthanized for non-use is a phenomenal result that aligns perfectly with Russell and Burch's 3Rs.

The 3Rs were put forward not just to assist investigators in finding and using currently available techniques but also to encourage the development of as-yet unknown tools and methodologies. SIOP is a new tool to support the 3Rs.

## ACKNOWLEDGEMENTS

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Figure 2: SIOP is a 5-step business process

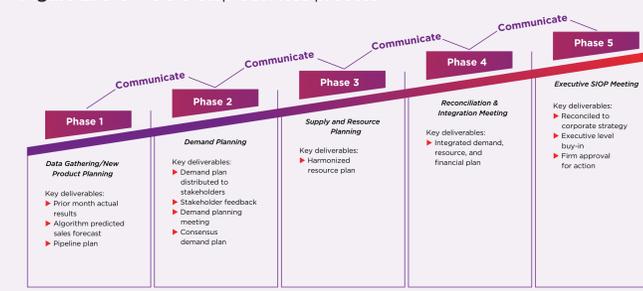


Figure 3: SIOP repeats monthly and can take 3–4 weeks to complete a full cycle

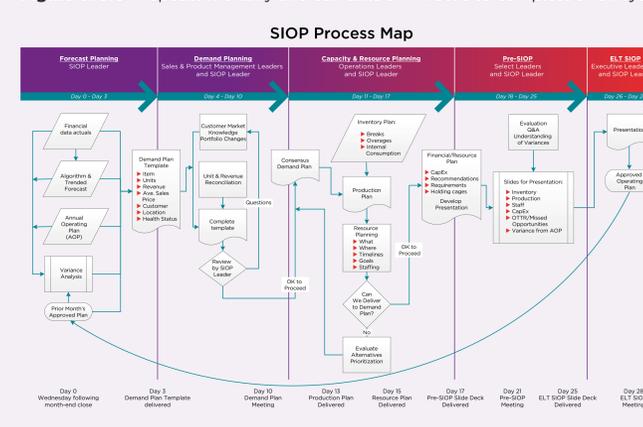


Figure 4: Demand plan inputs



Figure 5: Demand planning chart

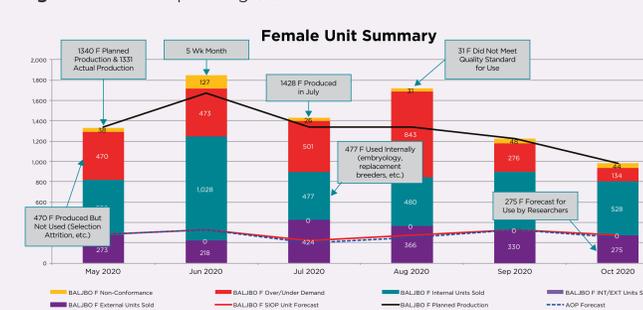


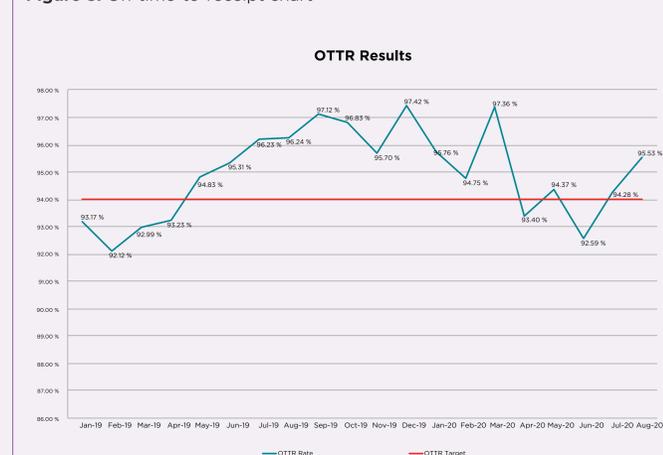
Figure 6: Animals unavailable (lost sale) or negotiated



Figure 7: The 3Rs



Figure 8: On-time-to-receipt chart



## References

- <https://3rs.ccac.ca/en/about/three-rs.html>
- Russell WMS, Burch RL. 1959. (as reprinted 1992). The principles of humane experimental technique. Wheathampstead (UK): Universities Federation for Animal Welfare.