BIOTECHNOLOGY COST DRIVERS

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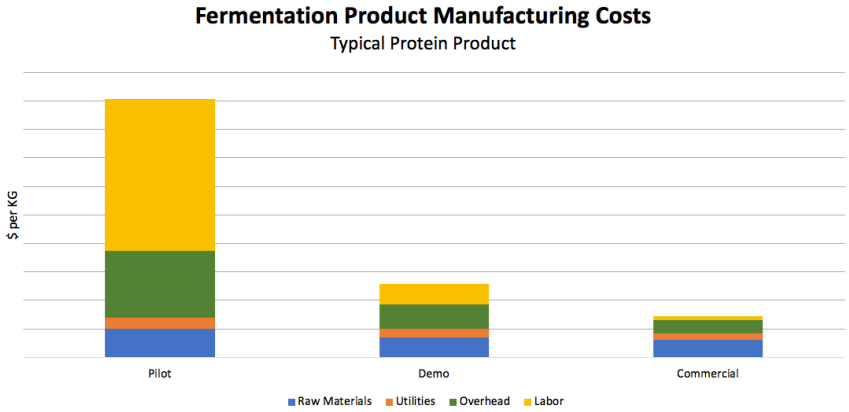
As advanced biotechnology begins to ramp up process development efforts and deploy the next wave of first-of-a-kind biorefineries, the subject of accurately forecasting commercial facility cost drivers comes to the forefront. Understanding what will make a technology economically viable is key to focusing development efforts to areas that will drive ultimate success. Having the opportunity to support many technologies path to commercial operation has provided the following insights from both the benchtop looking forward and commercial operation looking backward:

Breathing your own exhaust is harmful to company health - Optimism is abundant within advanced biotechnology and it has the beneficial effect of keeping many of us in the fight, through a long and at times, challenging journey. The downside of optimism is when evaluating the reality of economic challenges. Raising capital usually involves putting forward a favorable economic model and sales pitch supporting why it is achievable. I often advise investors that a proposed plan is "possible, but not probable", meaning it can be achieved, but if far from a clear path to success. It is hard for companies in this mode to retreat to fairly assessing the challenges that lie ahead for the technology. The challenge is best summed an industry executive upon finding out that technical challenges his team had incorrectly "assumed" some challenges were solved: "just because risks are assumed away in a financial model, does not mean they actually go away"

Focus on what matters – techno-economic modeling is a key offering of my consulting practice and clients are often surprised at how streamlined my models are. I would argue that a good first pass can be done with a calculator and whiteboard, as the key criteria are easily identifiable. My approach is simple for a reason, once you get past the top 5 costs factors (product yield on carbon source, labor, depreciation, media costs and utilities for example), not much else matters in the early phases of development. These will typically represent over 90% of manufacturing costs and significant efforts at modeling minor variations is usually a waste of valuable resources. Focus on the big items and factors that make a material change in then.

Challenge historical perspectives, but don't ignore them – Worked in many early stage biotechnology for many years has provided a broad perspective on commercialization approach. One underlying factor that is common is to challenge the status quo, which I fully support. What causes problems, is when there is a lack of understanding current practice and a broad, un-substantiated assumption it can be done differently. Change often should happen, but it requires a plan backed by a solid technical approach. If the reasons for taking a non-traditional path cannot be clearly articulated and justified technically, pick another area to focus change efforts on.

Benefits of building large facilities – One of the most common lessons learned from the last round of biotechnology commercialization was that companies built too large and too fast. While I agree, there were reasons for going big that need to be understood. Building smaller plants requires less capital, but brings with it inherent production cost disadvantages shown below. Labor is the most common example. While a commercial facility often has production levels 25-50 times larger than its demonstration scale equivalent, it would normally only require 5-10 times as many staff. The end result, much lower unit costs as the capacity of production increases.



Downside of being sensitive – Detailed sensitivity analysis of early stage financial models are often not a good use of resources. I have seen significant workups with waterfall charts and tornado diagrams for models that have an overall accuracy of +50%/-25%, where the individual components do not vary within the accuracy of the analysis. It at times has reminded me of a cat chasing a laser pointer, tons of activity, but no tangible result. Meanwhile, limited resources are spent on the technical issues like yield improvement, that drive the highest impact on cost. This is a point where the 90/10 rule applies, the vast majority of the early resources should be placed on verifying and supporting the key technical assumptions that go into the economic model and limited effort towards doing deep sensitivity analysis of.

Make sure the levers you plan to turn actually work – reviewing many models over the years, I am familiar with the concept of levers, technical inputs that can be changes to improve performance. Key items like alternate feedstocks, byproduct valuation and product specifications that will allow for improvements to the economic model if performance is less than projected. Looking back from the perspective of having built and operated commercial scale facilities, I can advise that many of the economic levers assumed in the early stages do not turn out to be an option at commercial scale. Early work to identify factors that will have a material impact on ultimate facility operations is effort well spent.

Following the basic principles outlined above will produce techno-economic models that more accurately represent commercial reality and improve probability of success.

Mark Warner is a registered professional engineer with 30 years of experience in process commercialization, focusing for the last 10 years on taking first-of-a-kind-technologies from bench-top to commercial operation. He is the founder of Warner Advisors, providing consulting services and acting in interim engineering leadership roles for advanced bioeconomy clients. He can be reached at mark@warneradvisorsllc.com or visit www.warneradvisorsllc.com.