Klystron Industrialization Strategy for ILC

Our Klystron Industrialization Strategy for ILC is currently based on an assumed competitiveness in the klystron industry. It may well be there when we need it, but to what degree? How will that affect price?

For the EDR, a model could be developed which evaluates the risks of our underlying operating assumptions we are currently using to allocate resources to maximize competitiveness.

For example, an analytic hierarchy process (AHP) based model[1] could be designed to explore varying degrees of importance of indicators and drivers of ILC Klystron competitiveness. One would hope that this type of model would be predictive in nature.

Here are some examples of drivers and indicators in the reference paper:

Drivers:
For the manufacturing sector, there are five generally accepted types of external market forces that set the price of a commodity (profit potential of firms):

1. Bargaining power of buyers
2. Bargaining power of suppliers
3. Threat of new entrants
4. Threat of substitute products
5. Rivalry among competitors

And five internal manufacturing operations strategies to reduce costs (performance of firms):

1. Quality management
2. Process efficiency improvement
3. New process technology
4. Customer-supplier collaboration
5. Uses of benchmarking

Indicators:

1 Manufacturing excellence
2 Value-added of product
3 Market expansion
4 Financial returns
5 Intangibles

[1] "Industrial competitiveness analysis: Using the analytic hierarchy process"; The Journal of High Technology Management Research; Sajee Sirikrai and John Tang; Vol 17 (2006) pgs 71-83.

As a start, here is a partial list of our current operating assumptions and knowledge base:

1. There exist today three major suppliers of klystrons who have the technical know-how and management expertise to eventually meet the ILC's klystron specifications.
2. We are relying on ILC's bargaining power and rivalry among the three competitors— Toshiba, CPII, and Thales—to control the cost of Klystrons to the Main Linac Systems.
    a. If the number of competitors is reduced, the ILC's bargaining power will be reduced and cost of Klystrons will increase (Bargaining power of suppliers goes up).
3. We also have in hand, a potential substitute product in the sheet-beam klystron (SBK) (Threat of substitute products).
    a. If the SBK is a substitute product, it will be cheaper to build.
    b. There is sufficient time in the overall program schedule to transfer the SBK technology to at least one major supplier.
4. There must be more than one supplier for ILC Klystrons. This means:
    a. CPII solves their design problems.
    b. Toshiba builds more of the same.
    c. Thales solves their design problems.
5. Suppliers building full-spec tubes for XFEL will implement internal manufacturing operation strategies to reduce costs. (Rivalry among competitors?)
6. For those suppliers not having a full spec tube for ILC, it is assumed that each new Klystron built will be better than the last one built. (benchmarking)
    a. Time between iterations is sufficient to produce effective failure analysis and corrective actions.
7. Suppliers with full spec tubes will be able to add capacity at a rate sufficient to meet ILC construction schedules.
8. ILC will have bargaining power related to meeting their klystron needs. (Bargaining power of buyers?)

For the EDR this list would be added to and amplified by the experts in the various regions. It's not clear that the AHP model is the best, maybe there are better models. But this would be a start for a critical analysis of our underlying assumption of competitiveness for ILC klystrons.

If there is no competition and no substitute technology, maybe the Klystron cost doubles?