

Light Harvesting Special Interest Group

Scalability of new technologies – going from ‘lab’ to ‘fab’ 7 Dec 2022

Panel

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- Centre for Process Innovation (CPI) was set up to translate good science to something that is industrially ready and credible from an engineering point of view. Bridge the gap between academia and industry. From an initial idea, CPI help people effectively know what to do, what sort of systems you need in place to develop the business, techno-economic analysis, and how to raise funding.
- Often academics do not look up patents. Incubators can often be a good first port of call to help with this.
- The value chain needs to be understood well to develop a product that is useful. Very easy to scale without relevance to cost and complexity. Complexity always comes with extra cost. Consistency of performance, 45/50 yield on devices may be good enough, you cannot get to 100% on day 1. Learn from feedback loop and continue your process. Scale up in volume terms and not just in size or function terms.
- In terms of optimisation loops, once a company has made the manufacturing tool, it goes back to academia, e.g. at IMEC or Fraunhofer, but we don't have something like this in UK. Why are IMEC and Fraunhofer so successful? Is it because there is a roadmap, where everyone's on the same page, e.g. with perovskite PV?
- Research institutes need to make themselves easier to work with for companies. Not requiring substantial models with upfront payment, rather an easy 2-page model/proposal for engagement.
- On to the topic of ownership, for UK universities and their spinout models, often the ownership of the university can be quite significant, usually 10, 20, 30%. US universities (Stanford or MIT) often take small parts of 'lots of pies' rather than taking a 'big part of a few pies'. This creates more incentive and learning opportunities for the inventors. Often having companies that fail is part of the process. Should the model be raise money, spend it as fast as you can, raise more money if it successful? Major universities in the US have changed their models to suit.
- A sustainable business needs to be a sustainable business even in the early days. This needs to be looked at up to the terawatt scale of production. One of the first questions to ask startups is where do you want to get to? Is there enough raw materials in the world to get where you want to?

Challenges

- Many impressive research projects on renewable energy are carried out without taking scale-up challenges into account. They are fantastic in the lab, but very often the materials chemistry at lab scale may change when going to larger scale e.g. how will the material be coated down? Should it be encapsulated by glass or a sealant?
- Very often joining dissimilar materials, e.g. organics marrying into metals or glass can cause major problems, or taking UV photons and down converting to infrared photons that must be coated on a piece of glass.

Discussion Points

- Stay small as long as you can to allow relevant experimentation whilst you can. Make sure you are learning relevant things and understand limitations (stress test).
- A reason for failure of those who go to the commercialisation stage is being too technically competent. For the technology, it is better to be 80% efficient and be profitable than 99% but at a loss.

Opportunities

- The University of Cambridge has been discussing building a scale-up centre especially for energy projects. For example, fuel cells, batteries, PV, and other technologies. How do we make that work effectively? The University currently has the IFM, but can we do more?
- Academics need to take a step back. There is nothing worse than developing a technology in the lab at the university step, but not considering factors that disallow for scale up. E.g. in the perovskite field, non-green solvents (e.g. DMF) are still being used in the university environment, but they will not be used in a commercial environment. It is important to get that training and raise awareness in the researcher and University environment.
- Set up a sandpit lab where there are process tools that can be scaled up. Not just for 1 PI, but equipment shared by multiple groups. An example, is NREL in the US, with many tools and suites, used by many competing parties. An opportunity would be to have a dialogue with such institutes to see what they do well on.

