

Industrial Biomaterials Start-ups: Technology Selection

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Transforming an innovation into a start-up company can be highly rewarding to the technologist. This editorial considers technology selection for a start-up company. A simple system for screening initial technologies is given. This editorial is based on years of experience working in translating technologies into start-up companies by the author. These companies have approached their start-up strategies in a variety of different ways. It is important for the technologist to enter into a start-up venture with an understanding of how their technology is positioned both technically and from a business perspective.

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Technology and Business

A start-up company can be one of the most rewarding ventures from the perspective of a technologist. The chance to see one's idea become an invention and ultimately translate into products found in the store is highly rewarding. The path from idea to innovation may be the focus of the technologist. The innovation starts as a spark in the mind of the technologist. The spark is initially conceptual, a mere thought or concept. The work then begins, with the transforming of this idea into experiments, data, and verification. From this point, the idea has become something real and measurable. Translating this materialized idea into something of commercial value makes this an innovation. This innovation can take the form of a patent, trade secret, or other intellectual property. Once, the innovation has been protected, then there is a chance it can be a founding technology for a start-up company.

As a technologist it is important to have a conceptual understanding of the start-up world. In the industrial biomaterials and bioproducts space, start-up companies face a set of unique challenges. To understand the role of a start-up, it can be helpful to consider the different perspectives of the stakeholders in a start-up. Figure 1 shows two conceptual images. The image on the left shows how a technologist might perceive the world. On the x-axis is the degree of innovation. This is the level to which the innovation may transform the area of endeavor. High levels of innovation have the potential to fundamentally transform the way in which an industry works and/or values various product characteristics. These types of innovations may be game-changing and lead to new platform products that shape the future of an industry. Low levels of innovation are incremental changes with modest improvements. Most technological innovations fall in between these two extremes. The level of risk on the y-axis takes into account a number of factors including the difficulty of executing the innovation, the costs of putting the innovation into practice, the chances of being able to scale up the innovation, the impact on an industry, *etc.* The figure is divided into four quadrants. Innovations that fall into quadrants three and four are typically supported by established firms in an industry. These are relatively low risk and have a high chance of deriving value for the company. This aversion to risk in established companies

has been well documented in the business literature. Large industrial companies have significant capital assets invested that ought not to be jeopardized by high risk innovation even if they could deliver industry-changing developments. Thus, established companies typically avoid these types of projects. Innovation falling in quadrant two are of little innovative value. They provide both high risk and relative little innovative power.

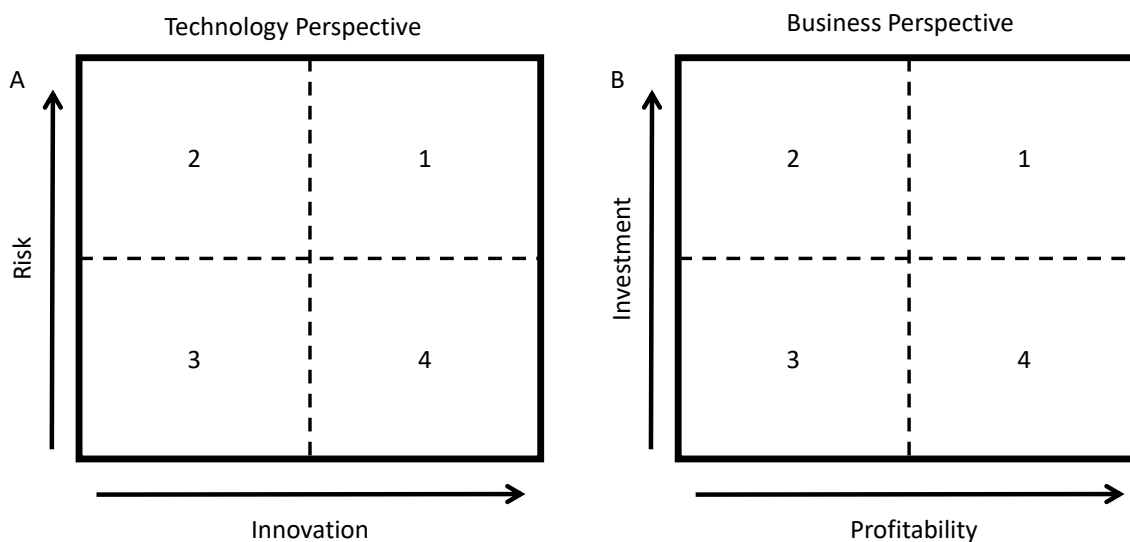


Fig. 1. Technology and business perspectives for innovations and how they can be evaluated for a start-up company

The innovations found in quadrant one are ripe for becoming a start-up company. These types of innovations can become new platform technologies, change the way we manufacture, or revolutionize a way of doing business. Many established companies are not attracted to these types of high risk innovation due to the risk involved in executing the technology. A start-up company is ideally suited for attacking these types of innovations. The goal of the start-up company then is to “de-risk” the innovation and to move it into quadrant four where there is relatively little risk but a high level of innovation.

For the technologist thinking about a start-up company, they should consider where their innovation falls within Fig. 1A. The technology may be better suited to be housed in an established company if it has already been substantially de-risked and provides a suitable level of innovation. The level of technology innovation is only one way to evaluate an innovation’s suitability for a start-up. A start-up “lives” off of funding from outside sources until a repeatable business model can be established. To attract funding, the technologist must also consider the view from a business perspective.

Similar to the innovation/risk plot, a profitability/investment plot can be created, *i.e.*, Fig. 1B. It is important to note that the quadrant an innovation falls into within Fig. 1A may not be the same quadrant it falls into within Figure 1B. Thus, one must consider both plots together when considering the suitability for a start-up. Ideally, a quadrant one technology will fall into quadrant four business. Thus, with modest investments the technology can be de-risked and high profits can be realized. Too often, quadrant one technologies fall into quadrant two or three in the business matrix and although they provide high technological innovation, they provide relative little chance for high profitability. Such technologies provide interesting innovation that can capture the

imagination of the technologist, but they offer little interest to the business world as they do not have a path to profitability.

Approaches to Innovation

In the world of forest-based materials start-ups, these considerations must be closely examined. Many materials-based business ventures require long development times, slow adoption rates, and large investments. Many of these businesses are highly competitive with low margins and are driven by volume. Thus, to create an innovative start-up in this space, one must choose technologies having high innovation, a path to growth, and manageable investments.

To break through as a start-up one must clearly be able to articulate the utility of the technology, the pathway to production and growth, the hurdles to adoption, and potential profitability of the innovation. It is important to remember that if the profitability is high and the risk is low, established companies in the field are likely already pursuing the technology. Thus, one needs to be ready to innovate in many aspects of the supply chain beyond your initial innovation to change the dynamics of the industry.

While one cannot predict when, where, or who will supply the next big innovation, we can examine one well known challenge involving materials innovation. The ability to make low-cost high-strength carbon fiber would be of very high innovation in terms of manufacturing. This could potentially revolutionize materials and allow for the use of these materials in a wide variety of new applications. However, for decades technologists have pursued methods to reduce costs by using forest-based resources. Where should we be searching for the innovation in this area? We need to look in quadrant one of Fig. 1A. Things with a very high level of innovation, taking new approaches that are very risky. Work in this area should focus on reducing the critical areas of risk and to make this more profitable. This innovation will require years of investment to develop methods for production, breaking into the marketplace, and leading to wide-spread adoption.

A start-up company is no longer a “start-up” when it is able to successfully execute a repeatable business model. This is the exchange of goods or services for monetary value that exceeds the cost associated with providing those goods or services. For many start-up companies, this can be a long journey. The world of industrial-based biomaterials start-ups have taken three primary paths. The first is to develop a high-value product. The difficulty associated with this is typically that as the value of a product goes up, the volumes of those products goes down. This renders these types of innovations as relatively unattractive from an investment standpoint, as the ability to generate sufficiently large profits is limited by volume. The second approach is to innovate in an area where large volumes and lower margins are to be had. This offers the opportunity to create large profits with improved margins when compared to existing solutions. This approach is filled with challenges in trying to displace existing infrastructure investments and convincing customers that switching to a new solution would be a good option. The third approach used in industrial biomaterials start-ups is to leverage the bio-based raw materials source as a unique way to gain market share. This option has the advantage that if the products address a highly competitive consumer marketplace, even providing similar performance and margins may be incentive for customers to switch to the new technology, as it allows them to maintain or grow market share. The difficulty with this approach is that unless the innovation makes a substantive change to the product that is recognizable by the consumer, it may be of little value. “Deep greening” – making things incrementally

“greener” far from the consumer – is difficult to articulate and monetize for a start-up company.

No start-up of a company is easy. Any approach that is used has its potential benefits and drawbacks. The key to selecting an innovation for a start-up company is understanding not only the technological challenges but also the business challenges. Throughout my career I have had the chance to invent the founding technology for a number of start-up companies. These companies took different paths. The first, when confronted with an impossible technological challenge, was able to pivot to a new business model and leverage their “de-risking” work in the area of manufacturing to create a new product that was distinctly different from the original target product. This shift allowed the company to take advantage of the bio-based raw materials being used to attract the attention of customers that can sell this to consumers. The company took the third strategy of delivering a competitive “greener” solution to the marketplace. Another company decided to pursue an innovative manufacturing technology to provide more consistent, and cost-effective products to the marketplace. This company was able to deliver its first product to the marketplace within six weeks of inception. Within two years of the founding of this company, products can be found in stores nationwide including large multi-national retailers. This company took a disruptive approach to an established industry, eliminating supply chain barriers and delivering product at scale in record time. A third company, decide to tackle a high-volume high-margin marketplace with lower volumes. Their technology, while conceptually innovative, struggled with technical issues, and scale-up for production. This company is still today working to bring a product to the marketplace, and its innovative approach may make it successful.

If you have an interest in exploring a start-up, I would suggest you consider whether the technology is suitable for a start-up in terms of both technology and business positioning. If you find a high risk technology that could deliver profitability with a proportional investment, then this may be an ideal technology for a start-up. As a technologist, you will learn more than you can imagine about challenges of transforming an innovation into a business.