



DEARMAN

United Kingdom, dearman.co.uk

After a long journey of R&D the inventor of a revolutionary engine and the company he co-founded sought help from open innovation partners. This led them to modify their product so that they could address a promising market and to work with an end user in testing it in their fleet of refrigerated trucks

Executive Summary

Dearman is a company that produces cooling engines that run on liquid nitrogen. The main selling point of the engine is that it is both energy-efficient and provides what they describe as "Cool cooling power". The technology behind the Dearman Engine was developed by Peter Dearman who then went on to license it to the Dearman company that now manufactures the engine. The company has since worked with industry experts and their customers in order to fully develop their ideas. At this moment, Dearman is in the process of further refining their innovation and marketing it to supermarkets in the UK.

CASE N° : UK125

SECTOR: MANUFACTURING

TECH INTENSITY: HIGH-TECH

LIFE CYCLE STAGE: ESTABLISHED

INNOVATION VECTORS: PRODUCT

01 PARTNERS: PSR, OTHER SME, LEAD USERS/
CUSTOMERS, CROWDFUNDING

KEYWORDS: High technology, licensing,
experts, marketing, client involvement

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The Dearman logo features the word 'Dearman.' in a white, bold, sans-serif font. A horizontal teal bar is positioned above the 'D' and extends to the right, ending under the 'n'.

BACKGROUND

The company was founded by three partners in late 2011. Prof. Toby Peters, one of the named inventors of Liquid Air Energy Storage, Michael Ayres and Peter Dearman. The first recruits of the company were engineers, and at that time they were dedicated to understanding the technology and its applications. The technology was developed by Peter Dearman 10 years before the creation of the company. Dearman developed a novel engine concept, and with the help of a former oil-gas executive he filed his patent.

During this time, Dearman engaged with the University of Leeds and other academics in order to identify applications for the technology which was under development. They also worked with an engineering consultancy, called Ricardo, which specializes in the technical aspects of fuel injection for combustion engines. Finally, they worked with E4tech Solutions, an international strategic consultancy focusing on the commercialization of green technology.

The engine technology has a number of applications in different markets. The SME's open innovation collaborations have allowed it to trial its first product, a transport refrigeration unit running on liquid nitrogen, with a major UK supermarket chain. The company's next target is to develop a second generation unit and in the next two years to have developed a volume production capability of several thousand products per year.

It also aims to enter other markets with this technology. After the launch of their first product, the company will continue to position itself as a clean cooling and power technology provider. It will consider partners who could undertake the manufacturing of the products that the SME develops and will weigh the pros and cons of developing an in-house product manufacturing capability vs. outsourcing it to a partner.

INNOVATION CHALLENGE & MARKET OPPORTUNITIES

One of the initial challenges for the company was the fact that their engine concept was completely new. At that point, the company faced difficulties in finding investors because no one was sure whether there would be a market for the product. Moreover, the development of the product needed a lot of

capital investment. In order to achieve its long term vision, the company decided in the initial stages of capital seeding to divide the whole process into smaller, more manageable tasks, setting different phases of development for which investors would be more willing to invest.

Another challenge was the lack of existing expertise in the new engine technology; this was resolved by engaging third parties to help develop the engine – which could also prove useful for the company in the future.

The market opportunity was one of the main drivers for working with E4tech Solutions (another SME). E4tech developed the commercial technology strategy and identified potential markets where the developed technology could be useful. Moreover, E4tech Solutions assisted the company in identifying shorter routes to markets. On the strength of its engineering development strategy, the company was able to identify sources of revenue which led the company to focus on the targeted markets and potential customers.

OPEN INNOVATION TRAJECTORY

Concept development

The initial concept was developed in the early 2000s by Peter Dearman. He had the idea of creating an engine using liquid nitrogen as a fuel after the oil crisis in the early 1970s. He started developing a prototype after a presentation from a US-based professor, who had developed a new engine concept closely similar to his own initial idea. This concept was about recovering energy by expanding liquid nitrogen in a separate engine. This original concept, however, was neither practical nor viable as Dearman discovered that, in order to be more efficient, the engine had to be submerged in a pool of water.

Peter then had the idea to develop a prototype in which the water would be injected directly into the engine. In the end, he succeeded in developing an engine that worked with liquid nitrogen, which he tested in an old car. No external partners were involved in creating his prototype.

The development process, IPR and competition strategy

One of the challenges in the actual development of the engine was that the liquid nitrogen was transforming to air in low temperatures, so it was

difficult to maintain nitrogen in a liquid form until it reached the relevant chamber of the engine where it would be transformed to gas. A number of universities and technology consultancies were involved to solve this problem. A solution was identified, but the proposed R&D project was very expensive, and was therefore abandoned.

At that point, with the assistance of E4tech Solutions, a more market-driven approach was followed that did not require the nitrogen to be injected into the engine as a liquid. Moreover, the technology consultancy Ricardo came up with a simpler solution, although not as good as the previous one.

As a consequence of this change, the company identified a different application for the engine. When liquid air is injected into the engine, a substantial amount of cooling power can be extracted in addition to the mechanical energy produced. In this form, the engine technology offers considerable savings in applications where power and cooling are required. The company's vision changed as a result of this development and the decision was taken to deliver clean cooling power to markets which require power and cooling.

Peter Dearman, who initially developed the new engine concept, licensed out his patent to the Dearman company giving it the right to exploit any potential commercial opportunity. The company has already been granted two additional patents based on the initial patent, and has filed for two more.

The unique selling point of the company is the technology that combines clean energy and cooling. At the beginning, the company was not yet focused on cooling, remaining more interested in Dearman's initial engine concept. They tried to figure out which markets would be suitable for the company's engine products and they set out to find other technologies that could complement the Dearman engine.

A business unit was created to identify other technologies and concepts that are relevant to the cold economy. The company is following a holistic approach in introducing new clean technologies to their customers. The competition strategy of the company is not yet clearly defined. Dearman wishes to work with other companies which specialize in green technologies in order to provide a more complete solution to their customers.

Commercialization and follow-up

The main challenge that the company discovered in developing their product was that their clients wanted first to test their product before

committing to buying it. This proved tricky, as producing prototypes for customers in low volumes is very expensive. However, it is the only way to attract clients in order to achieve economies of scales. It is also difficult because the company's investors have to be convinced that spending large amounts of money to attract customers is important for scaling up.

Another challenge for the company in scaling-up is that their potential clients are large companies with different departments for innovation, purchasing, sustainability, etc. Trying to sell a clean technology in an engineering purchasing department is difficult, because although they appreciate the value of the clean technology, the new technology is expensive for their budget. The best way to attract these customers is to try to align all the departments of the potential client so they are better able to identify the product's benefits.

To overcome these challenges, the company has developed collaborative projects by attracting new partners through crowdfunding initiatives, thereby helping to support their industrialization phase.

The development and commercialization of their new product resulted in an organizational restructuring of the company. At the beginning, top management controlled finance, communications and the collaborations between the commercial department and the engineering department. The engineering department was divided into three teams: long-term innovations, short-term engine development and short-term developments – not only on the engine but in other aspects of the solution being sold.

This original structure did not allow the teams to communicate between each other. Some of the outputs from the short-term development team were contradictory to the outputs from the long-term development team. In order to resolve this situation, the company's structure was changed to become more fluid. Now everyone is assigned to a team to work on a three or six-month-long project in line with the objectives of the company. This new structure prioritizes the short-term plans over the long-term plans. As a result of this new structure, the company's performance has become more efficient.

The marketing strategy of the company is to promote the company as a solution provider that delivers clean cooling technology – as opposed to a manufacturer of products. It promotes its products as an innovative and improved solution, which maintains the operational flexibility of existing products, without costing more than competing products. The marketing strategy was developed with an equipment manufacturer which assembled teams with members from both companies to

work on the strategy.

One of the challenges of working with external partners is coping with organizational differences. Dearman company sees itself as a disruptive, innovative and modern company. The refrigeration company with which they work is an established large company. The refrigeration industry does not seem open to disruptive innovations so this is an issue that has to be taken into account in their marketing strategy. The challenge is to marry the two aspects of the proposed solution, the reliability of the established company and the disruption that Dearman's products bring. Moreover, the refrigeration industry has been dominated by two large American companies for the past forty years. If Dearman's partner increases its market share, the two large companies may react and, given that they have more resources, this could pose a problem for the company.

The company plans to develop a second generation cooling engine within the next two years. Moreover, after the launch of their first product, the company plans to step back from manufacturing and become the technology solution provider which corresponds more with its initial objectives. The company plans to find partners who will undertake the manufacture of its products as long as it brings benefits for both sides.

BUSINESS IMPACT

In terms of new outcomes, this project led to the company being granted two patents and it has since filed for two more. As this project was the first that the company developed, the whole process was new, from the actual development of the company to the efforts to scale-up the final product.

Through this project the company has learnt to align their strategy and products with the needs of their clients. Furthermore, the company has learned to work with them and to find ways to involve them in the development of the product. It is therefore important for them to engage with the client through the innovation process.

The company is still commercializing their first product, The Dearman Transport Refrigeration Unit. In 2016, they obtained £16m from Park Vale Capital, £15.5m through government funding and consortium members, and £850 000 in the form of a Government Innovation Grant.

LESSONS LEARNED

This case presents three interesting facts. First, the inventor did not establish the company; instead he licensed the technology directly to a new company and became a minority stakeholder. Second, the initial product (an engine) was modified in order to suit available solutions and to focus on a market (cooling engine). Third, while the SME sought a number of different partnerships in order to identify a solution to a technical problem, some of those partnerships did not offer viable options (the only option that was viable required a change in market).

Main lessons learned:

1. If the technology is new and no external sources of expertise exist, it may be necessary to give third parties access to the technology in order to generate network effects.
2. Although the technology and the solution were partly finished, it was the external partners that helped adapt them to make them better suited to the market.
3. Selling innovative technology to large companies can be challenging because bigger firms have different departments for innovation, purchasing, sustainability, etc. This may create difficulties for SMEs when the large company is evaluating the technology.
4. Organizational restructuring can help firms to increase compatibility between their long-term and short-term innovations.