Engineering Subject Centre Case Studies:

Four Mini Case Studies in Entrepreneurship

February 2006
Authorship

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Published by The Higher Education Academy - Engineering Subject Centre

ISBN 1904804438
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Foreword

The four case studies that follow each have a number of common features. They each illustrate the birth of an idea and show how that idea can be realised into a marketable product. Each case study deals with engineering design and development issues and each highlights the importance of developing sound marketing strategies including market research. The importance of appropriate support mechanisms for young entrepreneurs is also covered. The case studies illustrate how successful entrepreneurs deploy a range of entrepreneurial skills and know-how. Above all, the entrepreneurs are seen to have the capacity to innovate and exercise vision.

We are grateful to Liz Read, Development Manager for Enterprise and Entrepreneurship (Students) at Coventry University for providing these case studies.
1 Bowzo: a Case Study in Engineering Entrepreneurship

"Bowzo would not be where it is today had I not met Larry Treanor when I was in a playful mood" comments Jim Oswald, joint inventor of a product which, it is anticipated, will dramatically change the way the violin is learnt.

Jim is a career inventor and design engineer who, having left Rolls Royce after 25 years in the world of engine components specialising in heat exchangers, was ready for something new.

It is fair to say that Jim found the first few months after his ‘release’ uncomfortable. He had spent years working on major projects involving teams, many of which he had led himself. He missed teams, and he missed the challenge of project management. Fortunately, Bowzo arrived out of nowhere and provided what he needed.

Both Larry and Jim were attached to Coventry University’s Vision Works in order to get help in developing some new business ideas. The Vision Works provides accommodation, telecommunications and computer facilities, plus, perhaps most importantly, mentoring and coaching services for start-up businesses. When Larry and Jim met, Larry was planning the launch of a multi-media design business but he had also been a professional musician and violin teacher. During a discussion about product ideas Larry revealed his thoughts about a device for helping novice violin players to learn faster and play more accurately by ‘bowing’ straight from the moment of the first lesson. The device fixes to the neck of the violin and offers precise control to students developing their bowing technique.

The Idea

Larry understood precisely the problems many students have in ‘bowing’ straight. The idea was to design and manufacture a simple device that controls the bowing technique by helping the student keep the bow straight at all times. Given Jim’s background in product development and Larry’s specialist knowledge both could see the potential of a collaboration. It worked and one year later the first prototypes were finished and market testing was underway.

The Market

To help explore the initial reactions of violin teaching professionals across the world, to what appeared to be a brilliant solution to a longstanding problem, both Larry and Jim felt that independent marketing expertise was needed at an early stage. Some staggering facts emerged, not least that more than half a million new violins are bought throughout the world each year. This probably means that almost another half a million second hand violins are bought too, leading to lots of lessons for many students keen to learn fast. The most likely route to market was identified as via the traditional wholesaler/distributor to retailer network.
Initial research indicated that there was a market for a low cost, easy to use device and thus the design engineering and manufacturing priorities were set.

**University support mechanisms**

The market research was supplemented by further inputs from the University's Design Institute which provided a specialist support programme for small to medium sized enterprises. This included a comprehensive range of services featuring marketing advice, product design and innovation processes as well as financial management and technology transfer.

Jim was impressed. “The range of services available from the Design Institute is fantastic; we were able to put the engineering issues on the table and deal with them in a wider team context with inputs from experts as required”.

The issues were clear:

- **Styling and design values.** The first handmade prototype was certainly functional but needed more work. Soon a more aesthetic shape was created that added a great deal to the presentation and packaging of the product.
- **Durability.** New materials were tested and the best of a number of options selected, we will have to wait until the launch to know more on this point.
- **Manufacturing options.** Low volumes could be laser cut but high volumes needed a more appropriate technique for cutting and forming. Which would be best at launch?
- **Production costs.** How fast would sales grow and what would be an acceptable pricing structure for customer and distribution chain alike?

**Progress to date**

The excellent teamwork involving the inventor, musicians, design engineers and marketeers has resulted in pre-production prototypes that are working well in field testing. Seed capital has been secured on the back of this positive market research findings and the formal product launch is scheduled for early in 2006. The team are determined to bring a product to market that offers excellent design, practicality and the highest quality. To this end attention to detail is critical as are methodical engineering processes.

**Enter the entrepreneur, then exit**

The ‘collision’ between entrepreneur and inventor/engineer was brought about by the realisation of the existence of a market need. They met by accident and the inventor in Larry awakened the entrepreneur in Jim, and a new position for Jim, the inventor/engineer. He admits that he was feeling more open to other people’s ideas at the time of meeting Larry and since then has probably reverted to type as he waits for “the next awakening”.

**Conclusions**

- Stay awake for new opportunities by not always being yourself
• Build a wider team to bring in new thinking on product development issues - you might be too close to the opportunity to see its full potential.
• Engineers and entrepreneurs are interchangeable when they each see the market need clearly.
2 Daniel Platt Limited: A Case Study in Engineering Entrepreneurship

Introduction

William Wilkes, Roof Tile Technical Manager at Daniel Platt Limited and an experienced brick layer and roofer, recognised the problem precisely. “Builders using clay roof tiles often find that they cannot get the roof tiles they need when they need them, especially when working on the valley area of a roof where two pitches meet.” During 170 years of manufacturing natural clay floor tiles Daniel Platt has had to adapt to market needs in an entrepreneurial way on many occasions and this problem for builders presented an opportunity to create new customers.

The move into the niche market for clay roof tiles was one such entrepreneurial response when the wider market for ceramic products became increasingly competitive. Having made the move, maintaining a strong, distinct position in the selected niche was vital in order to maximise the value of the opportunity. The introduction of a flexible product design would enable the right products to be available ex-stock.

Routinely builders might have to wait for up to eight weeks because a particular specification to fit the pitch of the roof they were working on was not available. The implications in terms of time lost and negative cash flow are significant as jobs cannot be completed within contractual terms. Producing only one type of fitting instead of three would reduce stock levels and improve product availability resulting in more satisfied customers and increases in sale revenue.

The Engineering Issue

Roofs are constructed with different levels of pitch (slope), most commonly 40, 45 and 50 degree pitches, each one requiring a different ‘fitting’ which is in fact the term used to describe the angle between the two wings of a valley tile. The task was to design a single tile that would fit all three angles. “It was relatively easy to get it right for two angles but all three required more consideration to ensure the aesthetics and the functionality of the tile were right”, William Wilkes explained.

The process began with a cardboard template, progressed to a metal angled support plate and then to a piece of extruded clay placed on the support plate and cut to required shape. Different angles were tried and tested on a metal frame roof construction fitted with boards and tile laths and located within Daniel Platt’s manufacturing facility. The selected best fits were then fired and place on to the test roof. It was a long and meticulous design engineering process. As the valley tiles do not feature the ‘nibs’ that hold regular roof tiles on the laths, precision engineering was essential as the valley tiles at every angle must be supported by the regular tiles.
Innovative Actions Support

Daniel Platt’s capacity to exploit the opportunity was considerably enhanced by the support of the Innovative Actions Programme, West Midlands. This regional development agent provided a mechanism for encouraging companies to think differently and for making innovation ‘real’ and effective. Daniel Platt’s entrepreneurial skills and engineering capability were boosted and a product that may have otherwise never reached the market was successfully created. The team provided David Platt with funding to support the research and product development processes including a coaching and mentoring service.

The universal valley tiles are currently on test with the building trade and positive feedback is already being received. Sales of roof tiles are now providing customers for one third of the company’s total output.

Conclusion

- Employ design engineers who really know their markets
- Entrepreneurial characteristics can be handed down from generation to generation if the culture is right
- Keep ahead of the market
- Aim to diversify, building on core competences when the market moves.
3 Hidden Nation: A Case Study in Engineering Entrepreneurship

The Journey Begins
Lee Prescott’s journey into entrepreneurship began with his passion for BMX (Bicycle Motor X). He graduated from university with a BSc in Product Design 10 years prior to establishing Hidden Nation. The company’s product range is centred on high quality, specialist BMX frames and components which Lee learned all about during his early career in specialist bike design. Lee knew from personal experience that those who compete at the highest level in the BMX circuit worldwide demand only the best frames designed and manufactured to the highest standards.

The Market
The market is mature and populated by discerning buyers. The BMX market has waxed and waned since the 1970s, but throughout the racing circuit has remained strong, featuring a number of racing styles and classes whether it be flatland or trail competition.

First and foremost Lee is an engineer who has learned and understood exactly what the market wanted and could not get. The realisation awoke the entrepreneur in him but first he had to get the product right, both in terms of design and performance and brand values. The customers not only wanted high performance but also wanted to be associated with a distinctive and unique niche brand where the best buy only the best. Furthermore in such an ‘elitist’ market customers become sales representatives because they are proud to be associated with the brand.

The Design and Engineering Issues
Customers in this niche specify their own bike design in great detail encompassing every major and minor component and assembly. The bike must be durable, safe and fast. Therefore every engineering decision Lee made was market driven from the outset in order to meet the performance objectives.

Heat treated, (853) lightweight, hardened tubing was selected and supplied by Reynolds Tubes in the UK and a partnership established with a Czech company in order to achieve the required manufacturing standards within a marketable cost/price structure. Equally as important as the frame were the stems and posts that link the frame to the rest of the bike. These were designed to specific criteria too, with the avoidance of thread stripping, minimal slippage and safety as priorities. The number of components was reduced to minimise possibilities of failure and avoid unnecessary production costs.

Marketing Strategy
Now the engineer became even more of an entrepreneur. Having seen the market opportunity the engineer had to get the product to market. Until this moment in his career Lee had worked in large organisations alongside sales and marketing colleagues but now it was up to him to take the product to market.
Firstly the brand had to be considered and the first steps taken to establish its position in the marketplace. Careful research showed that a connection with an ‘alternative’ style and off-beat innovative solutions offered the right values. The name ‘Hidden Nation’ implies difference and mystery, but for the frame product something more was needed to do it justice in the marketplace. The name ‘Akira’ was chosen. Akira Kurosawa was a renowned Japanese filmmaker whose work features Samurai traditions. Akira produced his storyboards as full-scale paintings. These paintings are works of art in themselves and given Japanese sword making traditions the inherent precision was transferred to Hidden Nation’s brand values.

The exclusivity of the brand was carried through to the sales and marketing strategy. To date ten dealers have been appointed in the UK, one in Ireland and recently one in Australia with negotiations underway in Germany. The customers have become sales people because they value the exclusive association. The website is an information site only with sales activity being undertaken exclusively by the dealers, supported by trade advertising and targeted editorial coverage created by a public relations campaign. Word of mouth endorsements have also become a significant route to new sales. In the second year of trading sales were double that of Year One and growth continues for what is still a one man business.

Finance
All of the above had to be funded. A Business Plan was created and shown to a variety of traditional funding sources; banks, venture capitalists, business angels and business advisors from several institutions. Offers of funding did not arrive because Lee was too young, too optimistic, wrong about the product, wrong about the market. Lee got used to rejection but carried on regardless. He backed his own belief by remortgaging his house and investing £30,000 of his own money. He remains in full time employment as Head of Design for a queue management system company, working on Hidden Nation in the evenings and reinvests all the profits from trading activity.

A Supportive University
As a provider of Lee’s early Product Design education, his university was involved at the start his career. Much later, when Lee conceived his idea and grew the desire to run his own business, he was able to join the university’s Vision Works unit which supported embryonic start up businesses. Vision Works provided office accommodation, telecommunications and computer facilities and, most importantly for Lee, a coaching and mentoring programme. He received the advice and encouragement essential to enabling him to complete the Business Plan and develop the confidence he needed to make his personal investment.

As Lee says “Vision Works gave me someone to talk to at a time when I had to become an entrepreneur as well as a design engineer”.

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Conclusions

- Market driven engineering fuelled by a passion for the product and the market meant the product became exactly what the customers wanted
- Being an entrepreneur can be a very lonely role and so an objective mentor is valuable
- Entrepreneurs make markets and engineers can make entrepreneurs.
4 The Narrow Car Company

The Entrepreneurial Itch

After 25 years of being involved in developing and selling engineering solutions in the motor industry, Hugh Kemp had had enough.

"Despite being involved in engineering and manufacturing for all that time, I still felt that I wanted to make something, something whole and complete and mine".

Hugh had been a member of umpteen teams but was never the sole owner and champion of a complete product.

"My first idea was to get as far away from the motor Industry as possible so I decided to build boats, especially as I love sailing. However, I knew very little about building boats but I did know about making cars so power won over sail in this case."

Fortunately, Hugh had been working on a new narrow vehicle concept towards the end of his seven years as Director of Engineering at Prodrive Automotive Technology in Warwick in the UK. When the entrepreneurial itch became too much to bear and he decided to move on, the moment of truth coincided with Prodrive's decision not to pursue the new vehicle concept which became the Naro Car. With a license from Prodrive to develop the product from his own resources, Hugh set up The Narrow Car Company.

The Entrepreneur

With long experience of the corporate world at a senior level, including time at Lotus Cars designing and building engines for GM and Chrysler, Hugh felt confident of his ability to present his ideas to any audience.

"I'd got technical knowledge, commercial nous and presentation skills but what I did not have was enough money to take the Naro car from an idea to a working prototype. There's money around for the back end, such as pre-production prototypes, labour, capital equipment, once you have proved the concept with something that works and looks like the real thing but there's little money around at the risky end, the beginning, for what is a very new and different car concept."

As a client at Coventry University’s Vision Works Business start-up programme and also a partner of the University’s Engineering Faculty, some good advice and practical design engineering support was on offer which included information on funding options.

Hugh tried a number of potential corporate partners for equity based arrangements, and sought support from supplier networks and the European Union’s Innovative Actions.

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programme. Prodrive were willing to provide engineering capacity at low rates but cash was needed. After eighteen months Hugh was able to secure a UK Government SMART grant of £57,000 - a programme that supports innovative ideas at the early stage of development. This will be sufficient to enable a static rig to be built to test the steering system and also a ‘mule’ vehicle, a moving but frame-only prototype.

“The entrepreneur bit, where I focus on an idea and see an opportunity to develop it has not been too difficult because of my all-round experience but when it came to applying for funding I had a bit to learn.”

The Naro Car
Narrow became ‘Naro’ when naming the vehicle, which features a narrow-track, offering the traffic evading agility of a motorcycle with the comfort, safety and load capability of a car. One or two person models are possible with flexible capacity for carrying loads. It’s tall and visible and narrow, it’s light and efficient and the really clever bit is in the steering system which features roll-control capability that enables stability to be achieved automatically even though the vehicle leans like a motorbike.

“The software that controls the steering system has many other applications. For example, we are looking at applications to improve transport options for the disabled.”

Funding the front-end
The front-end of the vehicle became a two-part issue for Hugh Kemp. He had already learnt that funding for ‘proof of concept’ was hard to achieve and it was very much the front-end of the car that needed funding in order to prove its worth.

“The main issue was that I found it was vital to tailor my application precisely to the particular funders themes and interests. It can be frustrating having to bend your own priorities to fit someone else’s but if that’s what it takes I would advise any entrepreneur to do so.”

Markets
The potential markets are many and varied and with proof of concept, it remains to be seen how each niche can be developed.

A number of markets could benefit, including: the end customer who could enjoy a step change in personal transport; a new vehicle market segment for niche manufacturers; and new system technology for suppliers of systems such as the roll-control and steer-by-wire systems. Not least of course, The Narrow Car Company itself.

The vehicle concept will provide alternative choice for personal and city transport. There is a segment of the market where currently nothing is offered from today’s automobile manufacturers and this is where the Naro is pitched. There’s a short car such as the Smart, but not a narrow vehicle unless you shift to a motorcycle, which is unacceptable to many for a variety of reasons. It is therefore important to realise that the products emerging from this
project could help to launch a whole new business stream for the UK automotive manufacturing sector as well as licensing opportunities overseas.

As a commuter vehicle the product could provide travel in comfort at normal motorway speeds and then find gaps in the city traffic to maintain a sensible speed to complete the journey. Once at the destination, parking in a third of the space occupied by a conventional passenger car is possible. As journeys can be achieved with 30% of normal fuel consumption, the Naro car also provides both cost and environmental benefits.

As a taxi the Naro car could provide an alternative for those individuals who value time and need to travel around our cities to tight schedules. Virgin Limo Bikes provide a service in the city for those who don’t mind getting wet as a pillion rider on a motorcycle. The Naro vehicle will provide the ideal platform to expand this service for a fainter hearted passenger. Statistics show that City of London vehicle speeds at peak times are; passenger cars at 3 mph, buses and conventional taxis at 5 mph and dispatch riders at 15 mph. As the Naro has the same ‘foot prints’ as dispatch bikes, a three fold reduction in journey times could be achieved. As the taxi industry progresses to hailing by mobile phone, the opportunity for the appropriate size vehicle to be dispatched to the caller would make significant reductions in congestion, gaseous emissions and CO2, and provide shorter waiting and journey times for single passengers.

The final application as a city delivery vehicle would help cut costs and pollution caused by oversized vans used by logistics operators. Initial designs range from a flat bed for carrying awkward shape loads, to a box van concept for the Royal Mail. There is even a bike rack attachment for the outward-bound couple.
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