

Engineering Innovative Products

A Practical Experience



EDITED BY

Roger Woods • Karen Rafferty • Julian Murphy • Paul Hermon

WILEY

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The authors dedicate this book to the many students who have actively engaged in the company and product creation activities described here.

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Foreword

Engineering Innovative Products is more than just a description of the innovation process. The book is based on experience of running an inspirational and popular course which takes students through the process of starting a new company. A number of ventures that have come into existence through the course are described, with the twists and turns of their journey demonstrating the culture required for success.

The topic of innovation has attained much importance with universities and governments in their quest for economic growth and wealth creation. This is because the pace of technological change has accelerated, precipitating further acceleration in the development cycles of products and consequently in the changing shape of industrial sectors. Hence, what were established models of innovation are being replaced by new ones, with even large enterprises having to adapt and change. New opportunities are frequently based on new business models for getting product to market, something a startup company is able to do easily. This is particularly true in sectors where digital technology either makes up the product itself, or is used more generally as a means of marketing and selling it. At the same time, the barriers to starting a new venture have much reduced, not least because of the training, support and incentives offered. New ventures are a prerequisite for a dynamic economy and now is the time when they have an excellent chance of success.

This book takes the reader through all the essential steps in creating a successful business. Practical insights are given about how new product concepts can be identified and prototyped. The role of product engineering and marketing is discussed. What makes a good business plan is described, alongside illustrations of successful elevator pitches to communicate it succinctly. Teamwork and the roles of each team player are presented. At the same time, the role of finance and raising investment capital is described. Sections on marketing, branding and intellectual property are contributed by expert practitioners. Finally, and of most interest to educators, suggestions for exercises and assessments when running a course are presented.

But there is more. The creation of a new venture is a process of discovery as much as of academic study, and the authors demonstrate this through a number of case studies. The benefit of a cluster with inbuilt experience, partners and competitors is made clear. Members of the cluster can mentor and present critical advice from the earliest stages. The need to respond to critical input and be prepared to significantly adapt the venture is shown by example. The role of crisp presentation and description of the most important components of the new venture is emphasized, particularly when seeking investment. Finally, the benefit of a competitive element at all stages – including assessment by an expert panel – completes the excellent formula.

I warmly recommend this book to the reader for both information and inspiration. Educators using it as the basis of a course on business creation will be well served. The individual reader will become familiar with what it takes to be an entrepreneur. The chances of successful innovation in engineering will be much improved. The book is timely because the opportunities for success are there to be grasped.

Andy Hopper
University of Cambridge, UK
24 February 2014

Preface

Innovation is currently a hot topic and is related directly to economic development. The creation of companies resulting from innovative projects and processes is seen as central to the economic development in many countries. Like many governments worldwide, the UK government's main industry division, the Technology Strategy Board, uses the 'innovation' word all over their web pages and highlights that their goal is 'to accelerate economic growth by stimulating and supporting business-led innovation'.

Whilst most university management schools have embraced the concept of company creation and innovation, some engineering schools have still to incorporate product design as a core element in their courses. This is probably because it represents yet another module amongst the increasing number of technical subjects that need to be covered in the degree programme. We would argue that it is now becoming a core topic and, combined with engineering skills, represents a very interesting skill set for engineers to develop.

A number of years ago, the Schools of Electronics, Electrical Engineering and Computer Science and Mechanical and Aerospace Engineering at Queen's University Belfast embarked on separate activities to introduce students to the concept of product design, company creation and commercialization. However, rather than just create a series of talks to introduce the students to the topic, both schools introduced hands-on practical courses which acted to get the students engaged in developing their own product ideas and then building on this work to create a full commercial proposition. The course has matured to such an extent that the students are now getting shortlisted for, and indeed winning, local and national commercialization competitions.

The purpose of this book is to capture the process, and provide examples of best practice and insights into the practical experiences and development that have been undertaken over the past three years. It is based on the material that has been developed in the courses by topic experts external to the university, whom we engaged to interact with the students; topic areas include finance, marketing, branding, presentation and intellectual property. Also, two of the authors have founded their own companies and brought this experience to bear on the enclosed material. For completeness, two of the groups that undertook the course have provided detailed insights into their practical experience of going the full distance and creating their own companies. In addition, the text builds upon the experiences of some 12 business propositions that have been created during this time.

Throughout the book, the authors have relied on their own experiences and student examples to emphasize the points made and illustrate both good and poor approaches. In addition, the text

includes a number of exercises entitled '*Try this*', which stretch the reader to apply directly some of the material covered in the various chapters; this acts to help future students and readers who are engaged directly on the commercial activity.

The activity has been rated highly by external organizations which are involved in linking entrepreneurs to commercial opportunities, such as the Northern Ireland Science Park. The Institution of Engineering and Technology, a professional organization which undertakes evaluation of degree course material (termed accreditation), highlighted the activity as 'exemplar' on their most recent visit. It is hoped that lecturers interested in developing their own courses will find this text invaluable; we also firmly believe that any budding entrepreneur will find valuable lessons contained within this book, as the example business plans developed by the groups have stood up to commercial scrutiny.

List of Abbreviations

API	Application Programming Interface
BIL	Business Innovation Link
BS	British Standard
CAD	Computer-Aided Design
CATS	Credit Accumulation and Transfer Scheme
CEO	Chief Executive Officer
CES	Cambridge Engineering Selector
CFO	Chief Financial Officer
CMO	Chief Marketing Officer
COO	Chief Operating Officer
CTO	Chief Technology Officer
DFMA	Design for Manufacture and Assembly
DIY	Do It Yourself
EN	European Standards
EPSRC	Engineering and Physical Sciences Research Council
EU	European Union
FEA	Finite Element Analysis
FMEA	Failure Mode and Effects Analysis
GPS	Global Positioning System
GPU	Graphical Processing Units
IAESTE	International Association for the Exchange of Students for Technical Experience
IET	Institution of Engineering and Technology
IP	Intellectual Property
IPC	International Patent Classification
IPR	Intellectual Property Rights
ISO	International Organization for Standardization
LLP	Limited Liability Partnership
LVCSR	Large Vocabulary Continuous Speech Recognition
MBTI	Myers–Briggs Type Indicator
MIM	Metal Injection Moulding
MVR	Multimedia Voice Recognition
NDA	Non-Disclosure Agreement

NISP	Northern Ireland Science Park
PDS	Product Design Specification
PLC	Public Limited Company
POC	Proof of Concept
PPC	Pay per Click
PSL@Q	Programmable Systems Laboratory at Queen's University
QR	Quick Response
QUB	Queen's University Belfast
QUBIS	Queen's University Belfast Industrial Services
RFID	Radio-Frequency Identification
SEO	Search Engine Optimization
SME	Small to Medium Enterprise
SWOT	Strengths, Weaknesses, Opportunities and Threats
TDI	Technical Development Incentive Scheme
TPMS	Tyre Pressure Monitoring System
TSB	Technology Strategy Board
US	Uniform Resource Locator
US	United States
USP	Unique Selling Point
VAT	Value Added Tax
VIP	Very Important Person
WFST	Weighted Finite State Transducer

Introduction

Roger Woods

1.1 Introduction

Over the past 30 years, there has been a shift in the world's economy which has occurred for a number of reasons. Large-volume manufacturing has moved from the West to the East due to much cheaper production costs, largely because of cheaper labour and the optimization of the value chain (Zhu *et al.*, 2006). In addition, economies such as those in Canada and Australia have been buoyed by the availability of natural resources such as the supply of phosphorus and, of course, oil and natural gas. In the absence of these resources, the remainder of the Western economy has looked to rely on the *knowledge-based economy*; one route has been to exploit much of the knowledge that exists in universities and research centres to either undertake technology transfer into industry or to create spin-off companies.

The Bishop William Lawrence University Professor at Harvard Business School, Michael Porter, famously said that 'innovation is the central issue in economic prosperity', a vision to which the West would appear to have been fully committed. For example, the strap line of the UK's Technology Strategy Board (TSB) is *Driving Innovation!* and the recent focus of the UK higher education institutions' upcoming Research Excellence Framework on *Impact of Research* suggests a direct link between research innovation and commercialization. One UK funding agency, namely the Engineering and Physical Sciences Research Council (EPSRC), now has a clear message on 'fueling growth and prosperity' on their main web page; a clear indication that the work funded in universities should have an impact on the economy.

This approach is being adopted more widely. For example, the EU's Horizon 2020 programme is described as the financial instrument implementing what they call an *Innovation Union*, a Europe 2020 flagship initiative. It is described as 'securing Europe's global competitiveness' and sets the agenda for involvement of small to medium enterprises (SMEs) in EU research.

All of these factors send a clear message to universities about commercializing research, either through the development of spin-off companies which look to directly commercialize the output of university research, or other approaches such as spin-in activity or technology transfer schemes. Indeed, many governments will provide incentives in the form of grants, subsidies and tax breaks to encourage business creation in certain areas of the economy. This has resulted in a clear shift in policy ‘to encourage investment and exports as a route to a more balanced economy; and to create a more educated workforce that is the most flexible in Europe’ (HMG, 2013). Coming on the back of the economic strife of the past five years, the ability to innovate and bring to market new forms of technology becomes increasingly attractive for many governments.

1.2 Importance of SMEs

It has been recognized that the creation of innovation is directly linked to the commercialization of university research. This can come about either as a result of direct collaboration with large industry in sponsoring university research and then commercializing it, or by undertaking technology transfer by direct partnering with companies with specific expertise. However, the culture also exists to create spin-out companies from research teams wanting to commercialize a specific aspect of their research and for individuals or teams in an external company to get direct access to university technology with the aim of possibly looking to spin into the university.

In any case, many countries now place a high level of importance on the existence and promotion of SMEs. Indeed, it is clear to anyone reading the European Commission’s 2011 Factsheet on *SMEs in Horizon 2020* (EC, 2011) that there is an urge to get SMEs involved in EU research and to exploit innovation. The TSB has a clear strategy of innovation (Nicholas *et al.*, 2009; TSB, 2012) and we clearly see that SMEs are the life blood of the future economy.

Many universities, such as Stanford University and the University of California at Berkeley, have clearly demonstrated their intention to exploit research for commercialization. In the UK, the University of Cambridge stands out in its capacity to be able to commercialize university research, although the host university of the authors, Queen’s University Belfast, has managed to ‘punch well above its weight’ in terms of spin-out activity.

1.3 Inspiring Innovation for Engineers

In many cases, innovation and the concepts of startups have been seen as the *bread and butter* of management and business school courses. Many of the processes involved – such as financial planning, business development and marketing and sales – are seen as central to what is taught on the courses in these schools. Once the innovative idea or product has been created, the key challenge is to look at the development of the business from this initial concept. This is a skilled step and requires a detailed understanding of marketing sales, product development and the company creation process.

The authors fully acknowledge the importance of the business expert in this process, but this approach has major limitations in the creation of technology-driven SMEs for a number of reasons. With many innovative industries linked closely to technology, the scientific understanding of engineering students puts them in an ideal position to create innovative,

hi-tech businesses. With resources limited, they will have limited scope to employ the business expertise and will have to engage in a do-it-yourself (DIY) approach. Moreover, the marketing of many of the aforementioned investment agencies (e.g., TSB), suggests that commercial support is there to assist the entrepreneur to achieve this exact goal. Therefore, we would argue that there is a strong case to bring the company creation expertise to engineering students, who have the ability to create innovative products. The objective is therefore to determine the best way to educate and invigorate engineering students with the necessary skills to do this.

1.4 Rationale

The question is how to apply this knowledge in engineering and science courses in a highly practical and realistic manner. How do we introduce engineers to the issues of product design and company creation to commercialize this product? This has been the driving force behind a three-year effort in the university which has been highly successful, as evidenced by the numbers of students who have been successful in competitive funding schemes. It was felt that this was a very important activity but had to be carried out in a highly effective and practical manner. There were many examples of business and professional development courses trying to educate students in the business processes, but given that there was no directly practical exposure to company creation in the course, it was clear that a new approach was needed.

A number of methods were developed to meet these challenges and they have been evolved based on staff and student experiences, including the creation of material with a number of innovative aspects. A key feature was to ensure student engagement in the development of a commercial product, along with experience of the processes needed to create a company to commercialize it. This includes the preparation of a full business plan and commercial pitch.

The text outlines the detailed processes involved in creating the business idea, advising students on branding, marketing, sales, finance and intellectual property (IP) issues and developing a feasible commercial demonstrator leaning towards product. It also reflects the experiences of the students who have undertaken this activity by including two chapters from teams who have experienced the courses and who have had a successful output from applying to funding competitions. The development has been identified as *exemplar* by the Institution of Engineering and Technology on a course accreditation visit by its accreditation panels in 2010.

1.5 Focus

Many texts have been created around commercializing technology, using innovation in product design and in the creation of spin-off companies. We would not suggest that this book supersedes these excellent texts, but should be seen as a complementary text aimed at undergraduate and postgraduate engineering and science students involved in commercializing early ideas. The text takes a hands-on approach which allows students to apply all of the processes and then experience the pressures of taking an idea all the way to actual commercial product.

We believe that the focus of this book is very different from any previously published text. It covers how engineers can create and develop innovative products and then allows them to marry effectively the costs, sales and marketing needs of business creation with the practical realizations of creating the product; in particular, it allows them to experience the fine

balance between these competing aspects. The overarching objective is to realize a product which can be created within the realistic timescales of a one-year module and without the need for advanced technology which might involve detailed research; the result is the creation of startup companies involving students which could realistically create revenue from the proposed solution not long beyond the time period of the course.

The book content has come from two highly successful and innovative courses undertaken by final-year engineering students in the Faculty of Engineering and Physical Sciences at Queen's University. The courses provide groups of students with key skills and gives them all of the essential background and insights to allow them to organize themselves into teams (effectively companies), identify a key market need, create a realistic product to address the issue and then develop the full business proposition to create a successful company. Fundamental to the approach is that the resulting products are both technically and commercially viable, as students have been guided along the process by a combination of engineering faculty and experienced external practitioners.

We highlight the processes involved in achieving this and the experiences of both the students undertaking the course and the staff organizing it. The work has been based on the practical experience of several generations of students coming up with business propositions and then creating their own companies. The book also presents the views from the student perspective by including written experiences from previous student teams. In addition to generating the business aspect, the students have to consider all of the engineering aspects in producing a feasibility study which typically includes the generation of a working prototype.

The intention of the book is to capture this process, provide a checklist of best practice and relate to practical experiences and developments that have been undertaken over the past three years. This should provide the basis for both students and staff in universities to create activities in their own engineering faculties, but we believe that a lot of the ideas and information provide a detailed treatise for young entrepreneurs in creating their own companies by highlighting pitfalls and insights, based on real examples.

The material created to support the course is innovative and different in that the students are exploiting their technical knowledge to undertake a genuine product validation in a highly practical manner. The course involves the teams working as a group and associating roles in the form of Chief Executive Officer (CEO), Chief Financial Officer (CFO) and Chief Technical Officer (CTO), etc. with the aim of producing a slick, 15-minute *Dragon's Den*-style pitch, a full business plan to outline the commercial potential of the project and a preliminary concept prototype.

1.6 Processes and Organization of Course

The complete activity is given in the flow diagram of Fig. 1.1. There are a number of key features in the processes that the students go through. These include:

- **Generation of ideas.** A key differentiation of how the course is organized is the development of ideas by the students to form their own product. This is a carefully orchestrated process where the course developers apply encouragement, honest feedback and engagement to the students and the sales and marketing, IP and business experts help them hone

the development of an idea (or ideas) that have commercial viability. The students also have to utilize their engineering skills as this provides both a basis on which to develop the product and a commercial advantage in pushing the business case. The processes by which students are encouraged to generate novel ideas are covered in detail.

- **Interaction with business experts.** In the development of the course, we have instigated a number of interactions with business experts with expertise in branding, marketing, IP assets and finance. These experts act in confidence, providing business advice and guidance initially through tailored presentations and then in one-to-one clinics to provide detailed advice to the students.
- **Business creation.** The groups are encouraged not only to create a product for a critical need, but also to undertake a detailed exercise in creating a company to support the development, marketing and sales of the product. This course provides all of the background to the students to create a professional commercial pitch which in many cases can be used as the basis for their final pitch in a business competition.
- **Technical guidance.** A clear need is to ensure the students can provide enough evidence to show that a product is viable. This not only garners confidence in their idea but also provides a focus for a *wow* factor in their presentation. This process involves interaction with technical experts, that is engineering academic and technical staff within the faculty, to iron out any technical issues with regard to creation of their product.
- **Product demonstrator.** The development of a working prototype ensures a practical validation and confirmation of their business projections. It also provides an initial cut-off point for their course but also a starting point for any future business development.

1.7 Breakdown of Book Material

The material for the course has been organized into separate chapters which act to cover each of the topics illustrated in Fig. 1.1. The organization for this is demonstrated in Fig. 1.2.

Chapter 2, entitled *Idea Generation, Filtering and Development*, gives an outline of the processes and mechanisms by which the critical ideas are identified and refined by the group. As Fig. 1.2 shows, a number of possible ideas are created and the group go through a series of examination processes based on market potential, standards and regulation, morality issues, protection of ideas and future product options. This rigorous, demanding approach allows the students to identify if their initial ideas are promising. The chapter outlines in detail the steps taken, including examples of both potentially excellent ideas which can fall short because of a single critical issue in sales or commercialization or which can only benefit from detailed scientific knowledge. Given the length of the exercise and the experience of the students, projects with detailed scientific knowledge are therefore beyond the scope of the exercise. The text covers the process by which students come up with initial ideas, receive detailed feedback and then look to brainstorm to generate new, better ideas that will stand up to increased scrutiny.

The next stage of the book gives details on how to develop the necessary business material and comprises two chapters, namely *The Ideal Pitch* (Chapter 3) and *Creating an Effective Business Plan* (Chapter 4). In Chapter 3, we demonstrate how market potential, sales, finance and IP issues can be vital in determining the product pitch and give an example from which

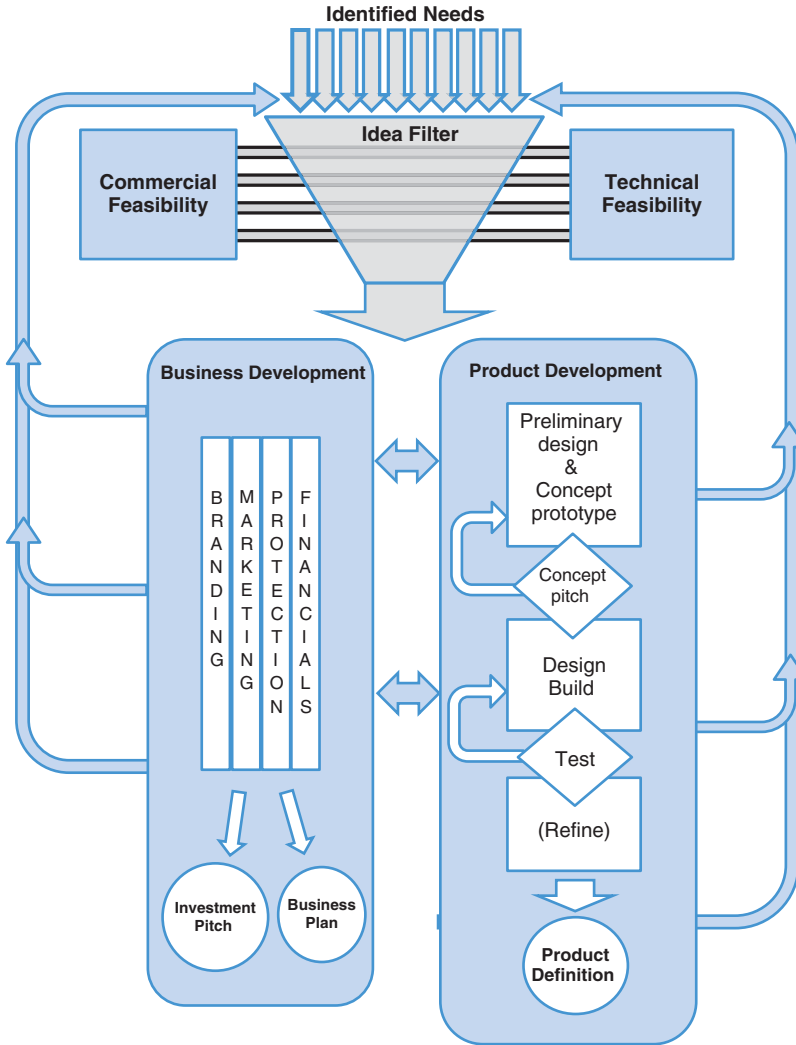


Figure 1.1 The commercialization process

students can produce their own presentation. The students are encouraged to try to put this pitch together as early as possible in the exercise; this allows them to quickly identify their best product idea by highlighting any possible areas of weakness. The 15-minute pitch unashamedly builds on the highly successful CONNECT programme developed in San Diego and now organized in the Northern Ireland Science Park. The detail in the business plan in Chapter 4 demonstrates to prospective company creators how they should identify a market opportunity and develop an engineering solution with the aim of creating a viable product. It highlights the need for consideration of branding, marketing, IPR and finance, which form the material in the next group of chapters.

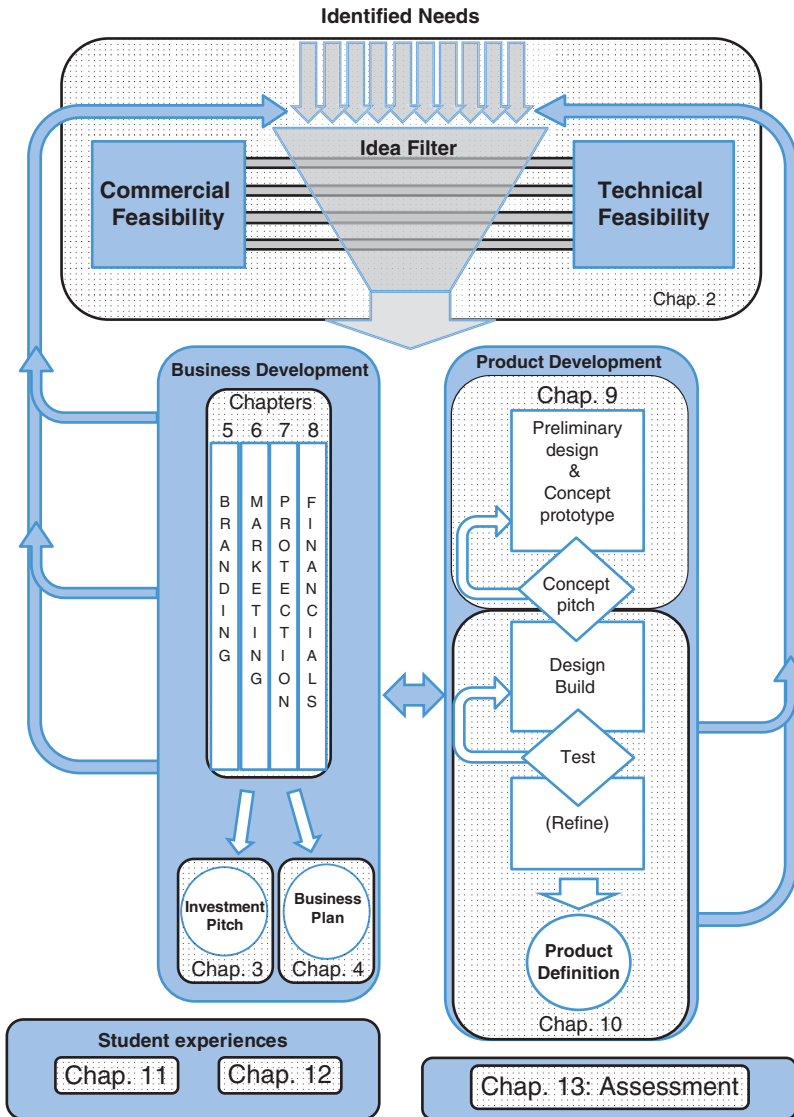


Figure 1.2 Commercialization process related to each chapter

These aforementioned key elements are discussed in detail in the next four chapters. They have been identified as core topics in which the students need schooling as they usually have not covered them in their engineering courses. They include:

- Chapter 5, entitled *Brands that Connect Create Differences that Matter*, written by Gillian Colhoun, Director at Designwriter, who has written numerous articles on branding.

Through examples, she challenges the students to identify the importance of branding and its application to a wide range of company identity.

- Chapter 6, entitled *The Marketing of your Business is your Business*, written by Graeme Roberts, who is the co-founder and VP of sales and marketing of several companies. Graham's strength is that he views marketing as a wide-ranging approach that seeks to use all forms of technology and sales techniques.
- Chapter 7, entitled *Intellectual Property*, was created by Rosi Armstrong who owns her own IPR firm, Armstrong IPR Ltd. She illustrates the various ways of protecting company ideas and explains the implication of each.
- Chapter 8, entitled *Finance*, was written by Kirk Shilliday and outlines the core elements needed in preparing financial plans.

A key aspect of this commercial engineering activity is the creation of a product and so two chapters are dedicated to this process. The first chapter, *Preliminary Design and Concept Prototype* (Chapter 9), outlines how a product definition is created and covers the processes by which the students give details of the innovation; it outlines how the product differs from competition, describes a working or proposed prototype and shows how the work is innovative and offers technical advantages over competing products. Chapter 10, *Full Product Development*, outlines the steps involved in the next stage of technical product development. This includes the detailed design process leading to the building of a prototype capable of achieving full service testing; it covers the iterative refining process leading to the development of the final product definition.

It is important to hear from the students, and so two chapters are dedicated to their experiences. In Chapter 11, Judy Black outlines the learning experience in creating a novel product for hitching caravans and trailers and in Chapter 12, Kyle Crawford and Stephen Dowling outline their experiences of working on a product which represents a new innovative means of pouring stout beers at lower dispensing pressures. The assessment process is covered in Chapter 13 and final comments are given in Chapter 14.

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Idea Generation, Filtering and Development

Karen Rafferty

PURPOSE

This chapter introduces all the elements of the Industrial Project module and its associated learning outcomes. All the key aspects associated with establishing a team, generating the ideas necessary to produce an exceptional product and bringing it to market, along with the timeline, are outlined.

TOPICS

- Timeline for all activities associated with the Industrial Project module
- Establishing student teams and generation of product ideas
- Evaluation of product ideas
- Work necessary to bring the product to market

The chapter is organized as follows:

- The **timeline** for the **complete module** is given in Section 2.2, which gives a general idea about the **timescales** involved in various aspects of the module.
- In Section 2.3, we review **team working** and the **individual roles** that students must adopt within the team.

- The process by which individuals generate **potential ideas**, the **roles** of the team and the **academic mentors** in assessing these ideas are detailed in Section 2.4.
- The reasons for **filtering** out potential ideas are outlined in Section 2.5.
- Having decided upon the best idea to bring forward, the team must then carry out further **technical, market** and **business** analysis as highlighted in Section 2.6.
- Throughout this chapter there are numerous examples of ideas that former teams developed further and those that were filtered out for various reasons.

A key aspect in developing a hi-tech company is the generation of technical ideas, which form the core of the product created by the company. This will influence all aspects of the company operation as well as more importantly, the potential of the product and thus the financial possibilities of the company itself.

2.1 Introduction

How do you generate ideas? When will inspiration strike? How can you manage this process? There are different answers for different people and circumstances. Therefore, how well can you force and manage idea generation, especially within a very tight timescale and with very specific requirements? For example, the overarching goal for a student involved in this module will be a high mark. For the lecturers, they will likely be satisfied if the teams work well and produce all the required documentation and information to a high standard. The investors, in contrast, want a niche or unique idea, which has the potential to scale to a fully operational and profitable company.

In this chapter, we attempt to document the procedure followed to aid in the idea generation and refinement process in order to satisfy all the stakeholders within the context of the Industrial Project module. We do not attempt to detail all the theories on management, creativity, innovation and team work. There are many other texts available covering this, which it is recommended you consult should you wish to investigate any topics more thoroughly. Hence, this chapter is a description of the process we follow in this module, which has evolved from numerous experiences of working with student groups with differing ideas, products and creation of companies.

In essence, in this module, students are asked to form their own teams, generate ideas regarding innovative products or services, settle on one idea based on preliminary market research, expand upon this idea to generate a product and form a company, create a business plan and pitch to investors. In this chapter, we aim to formalize the process by which individually generated ideas are evaluated and the process by which the team will decide upon the best idea to bring forward.

In order to do this, we describe our experience of how the teams initially generate ideas which are very technology focused. That is, typically they target a technology and concentrate on generating ideas around that technology. In general, this technique does not work well in the generation of innovative or creative products. Having gone through this process, the individuals start to move forward and generate more innovative ideas based on either personal

experience or the experiences of close family members or friends. Then they have to consider what technology could be used for or targeted at this idea. So, it is really a complete reversal of how they began the idea-generation process. From the initial seed of an idea, the team then grow it into something that they can proceed with after some initial market research. Whether it needs to be evolved, modified or even abandoned for various reasons will be outlined in Section 2.5.

Of course, a lot of management or creative theories could be used within this module in order to build teams that have a balance of personalities and are more likely to succeed. However, we have opted for self-team selection and because of that many different teams and team types evolve, all of which tackle this process in different ways. So again, a note of slight caution before you proceed with this chapter, we do not attempt to cover team selection or the best methods by which to generate exceptional ideas. Rather, based on experience, we document the procedures that we followed to help each team generate and develop the best ideas within their abilities.

2.2 Timeline

At Queen's University Belfast (QUB), most undergraduate (primary or first) degree courses are composed of 18 modules, totalling 360 units (also known as CATS points). Students studying full time take modules totalling 120 units per year, so a degree will normally take three years to complete. A full-time workload is normally 6 modules (each worth 20 units) per year, or 3 modules per semester. The Industrial Project module is run in pre-final year over the course of two academic semesters. In its current form the module is worth 1.5 modules or 30 CAT units. Thus, the workload associated with the module is high and demanding!

The timeline in Fig. 2.1 outlines all the major activities associated with the Industrial Project Module. Most of the major team activity will be spent expanding and refining their chosen product, and preparing for the investor pitch. Once this pitch has been through several iterations, the team will be in a stronger position to: refine their business plan, develop the technical prototype and complete the technical feasibility study. Generally, by the mid-point of the first semester, most teams will have selected their final idea or product. For those teams that are struggling, more engagement from the mentor will be required. However, final decisions about the product and the team composition must be made before the end of the first semester. It must be emphasized that this is really a *final* deadline, and even waiting until this point will see the team struggle to catch up with their peers, who made the decisions much earlier in the semester. Speaking of peers, one interesting observation about this process is the degree of secrecy that envelops each team once they decide upon a product. In most instances, each team will refuse to tell the other teams about their product or company. Competitive spirit naturally develops and can actually be harvested by the mentors to ensure all teams are working to the best of their abilities.

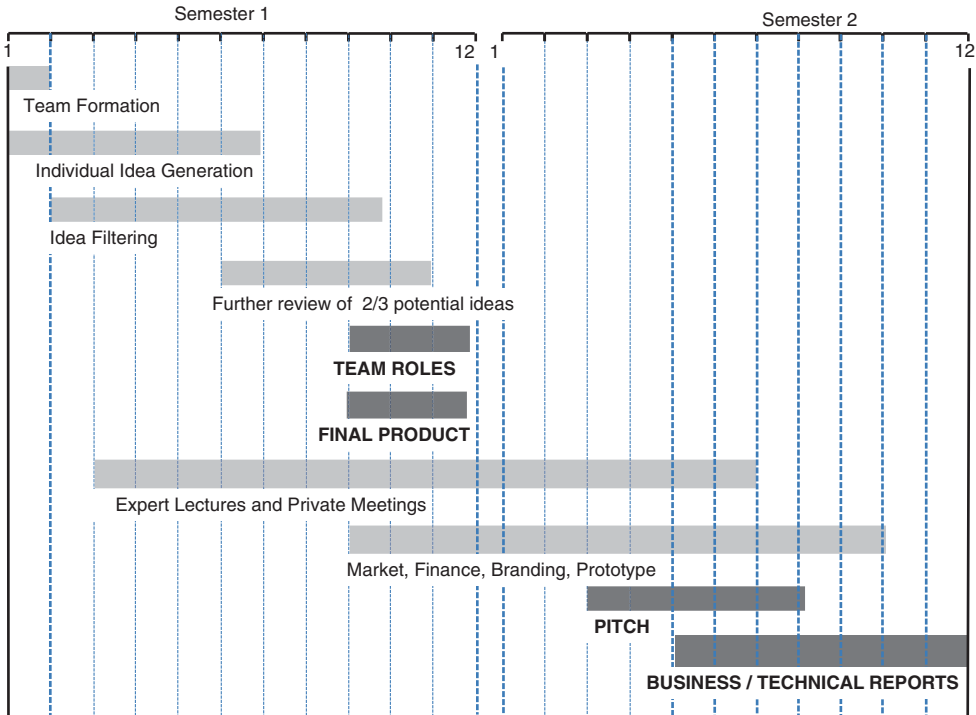


Figure 2.1 Timeline of main activities in the Industrial Project

Throughout the semester, experts are invited in to talk to the students as a whole cohort and then meet with the groups individually. Fields of expertise include investment pitches, business finance, intellectual property and marketing.

Many of these experts have contributed to later chapters of this book and outline the information they present to the teams. The first expert to be invited to talk to the students is Mr Steve Orr, who is a startup specialist in the hi-tech industry. He motivates the teams by introducing them to the concept of the perfect pitch, which really motivates the teams to begin thinking about their potential ideas as an angel investor would, and how best to get the main aims and concepts of their product across in 10 minutes. This is reviewed in much more detail in the next chapter. However, the timeline presented gives a rough estimation of when each of the processes described in the remaining parts of this chapter should reach a natural conclusion.

2.3 Team Structure

The main outcome of the Industrial Project module is a business idea and accompanying material to create a startup company. Students need to organize themselves into teams of five

or six people. As a team, they must investigate the business, financial, marketing and design aspects of a product idea, leading to an investigation into the organization of a company startup strategy and product demonstrator, arrangements for seed and venture capital, development of marketing strategies and plans to expand the operation into a profitable business.

By the end of the module, the core deliverables will be a detailed business plan and a technical report at a standard expected by investors such as banks, venture capitalists and government funding agencies. Each team will give a presentation outlining their business proposition to a select panel of people with relevant experience in the processes of setting up companies, as explained in more detail in Chapter 3. In Chapter 1, the structure of the module was given in Fig. 1.2. This chapter deals particularly with the idea funnel. That is, the process by which individuals and teams generate and refine their ideas. However, before this can happen the students must self-select teams. So, within this section a more detailed team structure is given along with the associated roles that individuals need to assume once they are part of a given team.

2.3.1 Team-Working Theory

The teams develop their product ideas by carrying out detailed literature and technology research and feasibility studies. Each team must demonstrate that the suggested product is feasible and can be built according to the proposed development route. So how best to select the teams? There are many wonderful theorems and studies which advise on how to put together a successful team, most of which agree on the fact that there should be a balance of personalities, expertise and skills. For example, Von Stamm's book *Managing Innovation, Design and Creativity* (2008) has a great chapter on team working in which they review common tools for determining and understanding team diversity such as Belbin, Myers–Briggs and CARE. This is really interesting reading, but it is worth noting that in the context of the Industrial Project there is not a diverse range of expertise or skills, since all those involved are engineers!

According to the Myers–Briggs type indicator (MBTI), the engineering profession is dominated by Introverts, Sensors, Thinkers and Judgers, the characteristics of which are given in Table 2.1. The MBTI is considered one of the most reliable indicators of personality and can

Table 2.1 Characteristics of the four MBTI types associated with engineers

Type	Characteristics
Introverts	Enjoy privacy and quiet time. Tend to prefer fully developed ideas.
Sensors	Look at what is known and real. Rely on actual experience and proven results. Approach change slowly, carefully, incrementally and critically.
Thinkers	Use the process of logical and impersonal decision making. Apply logical analysis to weigh facts and examine consequences objectively.
Judgers	Convergent, driving forward, closure and results. Organization, schedules, plans and priorities are important.

be used effectively to pull together strong teams. Of course, it cannot be used in this module to bring together a range of types, but it is interesting to know the general type of the teams involved. This is particularly important for the academic mentors as, based on experience, it is initially very difficult for the team members to be open about their ideas for fear of dismissal or ridicule.

TRY THIS

Using the MBTI, can you identify which type you are? Can you identify the type of everyone else in the team? If each team members does this, will you all agree?

In fact, this extract from the psychology literature tends to sum up our experience when working with teams of engineering students (Gossem, 1954):

The engineer's most obvious characteristic is his precision, his meticulousness, his attention to detail and accuracy, or his perfectionism. Another striking quality is his intelligence. Once we get to know an engineer better, we appreciate that his intelligence tends to be used in a very specialized way. There is a very obvious lack of broadness in point-of-view, so that the superior intelligence he has is restricted to a narrow field, with the result that he is likely to know a great deal about a little bit, but knows only a little bit about the world He seems to exhibit an enormous need to *be right* As a result he demonstrates an outstanding sensitivity to criticism.

Something that we have learnt during the module is the sensitivity of the team to criticism. And as an academic mentor, one needs to tread carefully at the start with regards to negative comments but the team need to realize that negative feedback has to be part of the process and, in fact, will prepare them for company life! Of course, it is a simple statement of truth that people (not just engineers!) don't like being told they are wrong and that their ideas are anything less than inspirational. But another fact of life – the truth usually hurts! In the world of fast-paced technology and innovation, managers want ideas and they want them yesterday. So everyone needs to develop a second skin and get on with the process. There is no room for egos in this module – from either the students or the mentors. Of course, beyond the engineering-type personality traits, there are other indicators that could be used to try to put together successful teams. However, to date, our experience has been that the students will form their own teams very quickly and naturally those teams will be based on existing friendships. That is something we are actually more than happy with, because the essence of a strong team is members who are deeply committed to one another's growth and success (Von Stamm, 2008).

Since the core aim of every single student will be a high module mark, people are less likely to not contribute to their friends' ability to achieve goods marks. Thus we have found that teams based on friendships do work well. Indeed, this relates back to a trust issue; a person

is more likely to be open with friends regarding the idea generation process, which is the building block by which to succeed in this module. Thus, teams are self-forming and there is no overriding need to change this. Of course, some teams are more successful than others and occasionally some teams are simply formed by default rather than by choice. However, one of our more successful teams started out life in the default lane but actually quickly came together to deliver an excellent product and a great business plan. It only takes one person to come up with a great idea, and that idea can carry the team to a successful conclusion.

2.3.2 Team Roles

As the team begin to gather an identity in terms of product ideas and company profile, it is necessary to formalize the structure of the team and assign specific roles typical of any industry to the team members. Again this tends to be a natural process rather than roles being forced upon team members. Typical roles are Chief Executive Officer (CEO), Chief Operations Officer (COO), Chief Financial Officer (CFO), Chief Technology Officer (CTO) and Chief Marketing Officer (CMO). Typically, and because this is based within an engineering context, for larger teams there can be two technology officers (CTO1/CTO2).

The roles and their specified activities will vary depending on the specific project. However, a generic guideline of typical activities is given in Table 2.2, with more information in the following subsections. Students are presented with this information during the introductory lecture for the module, so they are fully aware of the competencies required for each role; they can then make an informed decision regarding the assignment of each role within the team.

Table 2.2 Typical roles within the team

Title	Role	Attributes
CEO	Key person, main author of business plan	Dominant personality, can get things moving
COO	Heir apparent to the CEO, will work closely with CEO and CFO	Intelligent and capable of analytical thinking and creativity, trustworthy
CTO1	Key technical person, helps create demo, main author of technical report	Techie, good technical vision of how the final product should look/ behave
CTO2	Main demo person, co-author of technical report	Techie, probably needs specific knowledge (e.g., software)
CMO	Creates company image, product definition, logistics of operation, plans market aspects	Helps if can be innovative and artistic, thinks outside box!
CFO	Creates finance vision for company, finance plans, market info, plans product generation	Needs to understand finance, to be good with numbers

It is also important to note that the assessment of the student is dependent upon the team role selected. Once again, students are made fully aware of this at the start of the module and more information on how the outcomes of the module are assessed is given in Chapter 13.

2.3.2.1 Chief Executive Officer

A CEO is the highest-ranking corporate officer or administrator in charge of total management of an organization. An individual appointed as a CEO of an organization will typically report to the board of directors. Within the confines of the Industrial Project module, the CEO will report to the academic mentors until such point that the company have appointed a board of directors, which is usually (if at all) towards the later stages of the module.

Generally, the CEO will naturally emerge from the team as the person who has the most dominant personality and has the trust of the other team members.

This person needs to be able to evaluate the team's progression independently and determine if the team needs to be pushed to achieve more. In our many years of delivering this module the academic mentors have only really come across one case where the team most definitely selected the wrong person as their leader. They did this against the advice of the mentors, who tried to influence the decision without seeming overbearing. As a result, the team performed quite poorly throughout the process.

The CEO needs to be active in calling meetings both with the team and the mentors, making sure these meetings are minuted and the actions carried out. The CEO needs to quickly identify any team member not contributing, and if this cannot be fixed within the team, then the mentors need to be alerted. The CEO needs to be aware of every decision being made within the team and that the different officers of the team are communicating such decisions to each other. Sounds obvious, but on one occasion with a team it became blindingly obvious that half the team were not aware of a decision made by the CTO and CEO to change the direction of their product. This meant that the CMO and CFO had been working with wrong information, which made their work redundant. Thus, if someone does not naturally seem an obvious choice for the CEO within the team, choose someone organized!

The COO needs to be someone that is organized and can motivate people and will work closely with the CEO to make sure the team/company are progressing as necessary.

2.3.2.2 Chief Operations Officer

The COO will also be responsible for working out the logistics of how and where products can be made, liaising with potential suppliers for off-the-shelf components or negotiating with suppliers of specialist or custom-made products. They also need to determine the location

and needs of the startup company. At the start of the module, the COO can also be used in a freelance role to help other areas when required.

There always seems to be confusion as to what this role involves. Mentors need to emphasize the importance of the setup aspects, logistics and general detail that the team need to give to the running of the company.

2.3.2.3 Chief Technology Officer

Since this is an engineering project with a significant engineering element in terms of product research and development, we have found that two CTOs tend to work well. Of course, this really depends on the product or service that the team are offering. If it is predominately software based with no actual physical product prototype, two CTOs may not be necessary. Again, it has been the mentors' experience that the CTO roles will be filled by those people whose idea the team have decided to follow. Essentially, it is our experience that engineers want to take ownership of the product development and the person who is a software or hardware guru will want to develop some very interesting technology.

The key roles of the CTOs are to produce a prototype, prove the validity of the idea or concept and produce a technical document which explains the product and the technology it encompasses.

Future product evolutions would also be included. This is covered in detail in Chapter 9, which covers the development of the demonstrator and Chapter 10, which gives details of the process of product development. The main role of the CTO in the Industrial Project is to create an innovative demonstrable product that captures the imagination of the 'possible' investors.

2.3.2.4 Chief Financial Officer

The CFO and especially the CMO are probably the most difficult roles for engineers to take on within this module because they are out of their comfort zone and also because they use expertise not covered in detail in engineering degree programmes. Whilst company finances and marketing are taught as part of a professional studies module, there is a big difference between learning how to do something and actually having to do it, especially when people have little or no background in the area. The mentors organize for accounting professionals to talk to the teams. The details of the information supplied to the teams is summarized in future chapters; it provides a baseline of information which each team can fall back upon. However, it should be noted that the academic mentors really need to monitor the progression of the marketing and finances.

The CFO is responsible for putting together a three or five-year project for the startup company.

Typically, people that take on this role tend to have family or friends who are studying accountancy or are qualified accountants. This can really enhance the financial projections.

On one occasion the CFO had a sibling that was an accountant. The financial projection for that team blew the investors away, as every possible eventuality had been accounted for! Of course, you might argue that this put the team at an unfair advantage; well possibly, but if they did not use the expertise available to them then you could also argue that they did not try to make a success of their company.

For those teams that don't have the benefit of links to accountants, then the advice is to carefully select the CFO. It needs to be someone with a meticulous eye for detail. The CFO needs to take ownership of the finances for the company, but each different officer needs to buy into the process. Without good basic financial projections, the whole project will fail regardless of how good the idea. The mentors also organize for accounting professionals to talk to the teams; the details of the information supplied to the teams is outlined in Chapter 8.

2.3.2.5 Chief Marketing Officer

The CMO is arguably one of the most difficult roles within the team ...

... simply because it takes the individual out of their comfort zone. It requires a whole different attitude and thought process that one would not typically associate with an engineer. The CMO is accountable for determining the potential market for the product, its size and the best way to capture it. Sounds easy, but each successful company has a team of qualified marketing personnel and puts huge amounts of resources into their marketing campaigns.

Coca-Cola spends more money on advertising than Microsoft and Apple combined. The Coca-Cola advertising budget in 2010 was \$2.9 billion, for Microsoft it was \$1.6 billion whilst Apple invested \$691 million in advertising (Bhasin, 2011). The point is that even if you have a fabulous idea with great finances, it will fail if the market don't know you exist.

This role is exceptionally important and it is critical that the whole team buy into the marketing strategy rather than leave it to the CMO.

Again, the academic mentors arrange for marketing and branding specialists to visit and talk to the teams. More details on the information supplied to the groups can be gleaned from the material in Chapters 5–8. In addition, the university allow a modest budget should the teams want to engage the efforts of *artistic* people to generate some initial marketing material such as

a company logo. Indeed, if every member of the team recognizes the importance of marketing then they can get thoroughly engaged in the generation of a suitable company ethos and brand.

TRY THIS

Based on the description of the roles, can you decide which best suits your talents and connections? Does your team agree? A secret ballot of team members can be quite revealing!

2.4 Idea Generation

Idea generation, incubation and refinement is the most *undefinable* part of the Industrial Project module for the very reason that it is simply not possible to define a set of rules or procedures to follow that will result in a fantastically innovative idea. Or is it? Actually, Hunt (2009) would argue that for ongoing success, having ideas must be an organizing principle and not just a Eureka moment.

Whilst innovation can strike at the most unexpected and inconvenient times, this is more to do with the mood in which the innovation occurs.

It is much easier to think clearly when not within a strained environment. Of course, it is possible to lay the foundation upon which it is more likely to generate innovative ideas. The key, do not be critical or overtly so. Allow ideas to be generated and discussed at length before they are dismissed. If they are dismissed, do so nicely. This is something the academic mentors need to take on board! Of course, there is a balance; if the team are not progressing because of casual effort, then some blunt honesty is called for.

Idea generation is generally a process which requires quiet contemplation as well as active team brainstorming. The class are called together at the end of the academic year which precedes the year in which they will undertake the Industrial Project module. They are given an outline of what is involved and one of the student members from the current year's cohort is asked to talk to them about the process and what is involved. This is essential for two reasons:

- Firstly, whilst an academic lecturer can preach that consistent hard work is required for this module, generally the class will take it more seriously if they are warned of this by one of their peers who has just completed the module.
- Secondly, by speaking to the students before their summer break they get the chance to consider potential team members and also potential ideas. We encourage each individual to come back after the summer break with at least 10 potential ideas.

Having established themselves within teams, however, it is necessary for each team to go through the process of trying to be inventive and discussing individual ideas. Within that process the individual, the team and the mentor have important roles to play. The individual will

bring multiple ideas to the team; the team brings a wider skill and knowledge base to the idea generation process that can help formulate individual ideas. During the initial evolution of the team, the mentor will bring a wider range of expertise to the idea generation process and will help the team evaluate individual ideas and also develop group dynamics.

TRY THIS

You may think that idea generation sounds easy, but try this. Can you think of 10 innovative product ideas that you would like to see developed? To help, it is often a good idea to think about the things in life that cause you annoyance. Once you have thought of your ideas, you can do an Internet search to reveal if such products or ideas actually exist. If you go through this process and have found more than one original and innovative idea, then every team needs someone like you!

2.4.1 *Mentor Role*

The academic lecturers for the module need to ensure that the module runs appropriately and all students are contributing to the team and achieving the required deliverables for the module. It is necessary for the academic lecturers to meet with each team member at least once a week, however, this usually increases in intensity towards the later stages of the module when the groups are preparing for their investment pitch. At the beginning, the role of the academic lecturer is very important, especially once the teams are formed and they are going through the *idea funnel* stage.

As previously mentioned, often the mentors need to tailor their natural style of critiquing in order to keep morale high, especially at the start of the idea generation process. However, as students pass through the different stages of the module it is important to be open and step up the critique when they are in a more knowledgeable position to respond to it. This is important as the teams need to develop confidence in defending themselves and the key decisions that they have made.

Depending upon the product idea and company profile, teams may also be assigned a technical mentor who is most likely to be another academic lecturer with expertise in the technology discipline aligned with the product. The technical mentor will again meet with teams when required, and is really on hand at the beginning to ensure the technical validity of the product and then latterly to help with product development. Their expertise is also really useful during the initial market research stage as they may know of similar technologies which exist without the team having to do exhaustive searches of filed patents, etc.

As well as a technical mentor, the teams can also call upon the knowledge of the experts that speak to them throughout the academic year. In addition, QUB is incredibly fortunate to have a Student's Union Student Enterprise Unit (SEU) that is very active in helping teams throughout the Industrial Project by putting them in touch with industry experts, listening and providing guidance in the investment pitch, providing space to work and helping them apply for local and international competitions. Most recently, one of our teams were finalists in the

Northern Ireland Science Park £25k Awards in 2013 and they won the Think Outside the Box Intel Prize of an all-expenses-paid trip to the Intel Challenge Europe Award 2014. In fact, over recent years our teams have been finalists in many of these types of award competitions. If teams decide to enter into these types of competitions they can also receive guidance and support from the SEU.

The university also has an Entrepreneur in Residence who has worked on technology startups/university spin-outs with QUB/QUBIS since the late 1980s with various technology projects. On the strategic and business planning front he has completed plans for many of Northern Ireland's largest and/or fastest-growing companies (mainly engineering led) and many public sector organizations. His mentoring experience includes a variety of both startup and established companies, helping them to understand the practical elements of developing plans for their own businesses.

Thus, throughout the academic year there is a lot of assistance at hand should the teams go looking for it. Some choose not to and this is related to what the student groups get from the activity and, indeed, reflected in the mark awarded.

2.4.2 Role of the Team

Commonly held opinion might suggest that creativity – the act of coming up with an idea – is an inherently individual act. According to Von Stamm (2008), it is the development of an idea and its implementation where the team is needed. Indeed, whilst an individual may have the seed of an idea, it is the collective expertise and skills of the group that can really help develop the idea into something with real potential.

To date, at the beginning of the Industrial Project all teams will have been determined by the student cohort over their summer break. Again, the team formation is generally based on friendship. Obviously, some will be formed based on proxy, that is some people may have no other choice. In this case, these teams may need additional mentoring at the beginning until they build up the level of trust and kinship within the team that the others will naturally have.

The core aim of the team at this stage will be the identification of one or two core ideas from the pool of potential ideas, brought forward by the individuals for review and analysis. As such, the mentors encourage the teams to meet at least once a week to discuss potential ideas along with the mentor. Such meetings, as with all meetings throughout the process, must be chaired and minuted. The role of chairing and taking minutes will generally be shared amongst the groups until the team roles have been formed. At this stage the CEO will generally chair the meetings and the COO will take the minutes and, after agreement by the Chair, distribute them to the team.

At this stage in the Industrial Project module, the role of the team is to provide a sounding board for individual ideas. Neither the individual nor the team will have the experience to evaluate an idea and that is where they rely heavily on the mentor to begin with. However, after a few meetings involving the mentor, the team begin to learn the pivotal questions that need to be asked regarding certain ideas. Knowing the answers to such questions will allow the team to evaluate the idea more fully. However, the process lends itself to idea refinement which is discussed later.

The Wireless Knowledge Provider

Individual A was familiar with WiFi technology and wanted to develop something based on this type of technology. After some thought they decided that this had application in bus stops to tell passengers accurately when the buses were coming by transmitting a signal from the bus to the bus stop. The idea was technically possible, but it quickly became apparent that the cost of implementation far outweighed any benefit of assisting customers; there was no business case to be made as it would not dramatically increase bus passenger numbers and thus offset the installation costs, particularly with a single bus service provider.

2.4.3 Role of the Individual

Whilst the role of the team is fundamental in developing and refining an idea, the individual is key to the generation of the idea. In our experience, individuals tackle the process of generating ideas in a number of ways which evolve and get better with time. To begin with, the individual almost always identifies a technology with which they are familiar and then tries to think about how this technology could be used better. Sometimes this can be successful (as will be discussed in the next section), but in most cases this can really stifle the idea generation process. It is the role of the mentors to try to get the individuals to stop thinking about technology initially and to get them to think about their own life experiences. The following text outlines the different ways in which the individual tackles the idea generation process.

The Vision-Based Trailer Hitch Guide

Hot on an inspirational industrial placement year at Schrader Electronics and originally from a farming background, individual B came straight into his group with an idea for some sort of device to help reverse a car so that it would align perfectly with the hatch for a trailer. For several months, individual B had been working with embedded imaging technology and was also akin to using his mobile phone, so this idea was immediately achievable. At the same time, individual C in the team was really enthusiastic about developing a training technology that would avoid the user injuring themselves. Ironically, this provided the link for the first idea in that the main ‘pain’ was in hitching the trailer; this could cause inconvenience or indeed injury.

2.4.3.1 Technology Driven Ideas

In our experience, engineering students tend to tackle the process of innovation by first looking at a technology and then deciding how it can be applied differently. It is from this aspect that the academic mentors try to change the mindset by challenging individuals to more carefully consider the world in which they live and if they have family or friends who have encountered any problem or situation which could be enhanced in some way. Of course, sometimes brainstorming a given technology can lead to interesting ideas ...

The Musical Potty

One individual D, who was fresh out of training her child, came up with the idea of a musical potty trainer. The idea being that when trying to toilet train a toddler, the musical potty would play some music when the potty was used successfully! The idea had been scrapped before it ever reached the discussion table. During one meeting with the team, the individuals presented their ideas to the team and the mentors. All the ideas were filtered for one reason or another and then ensued an awkward silence when asked by the mentors what other ideas the group had. The silence was eventually broken when someone said that they had an idea but that it was really silly. Now, in the mentor's experience when an individual says that it usually means one thing ... It is likely to be the best idea so far! And so the team heard about the musical potty trainer and the mentors enthused that they loved the idea. Now, the group in question did not pursue this idea because similar products existed but the moral of this little story is that each individual may come up with an outlandish idea, which they may assess as being silly but which other team members might feel could become an interesting product.

2.4.3.2 Personal Experience

Generally, once people drop their fixation with one given technology and then open up to a range of ideas, they start to reflect on their own life experience and also begin to ask the people around them for some ideas based on their life experience. For example, having recently spent the weekend painting and decorating, I am still amazed that in order to get the best join between the ceiling and wall, the best tip I could find is to use a children's paintbrush. And when talking about children, why oh why whenever I buy mine a frozen lollipop do I have to run around looking for napkins to put around the wooden stick at the bottom to prevent sticky hands and clothes! Now, there may be products available to paint corners and prevent drips from lollipops but these are just a few examples of things from my recent experience that cause me *pain*! When I am in a hurry, there is a severe danger that I may think that I have left the front door ajar or even worse, that I have actually left it open. Surely there is a technology that can indicate to me when I have forgotten. Okay, the real question is how can I develop the technology to achieve this? And it has to be done in such a manner that it does not frighten you but at the same time will act to warn you.

So, this is something that the mentors try to get the individuals to think about. What really aggravates you? What could make your life easier? Can technology be used to assist? So, these are some of the fundamental questions that the individuals must try to ask of themselves. And if they can target the right *pain*, and if this is something experienced by quite a few people, then not only will they have a good potential market but they will also be able to explain their innovation easily. The concept of identifying a *pain* and developing a *solution* and then pitching this to investors is covered in Chapter 3. If an individual can tap into their own life experience and develop a product that they themselves would use, then (our experience is that) their enthusiasm for the product will certainly help tremendously with the remainder of the Industrial Project process.

The Sailing Guidance System

After consulting with her father, a sailing fanatic, individual E presented to her team an idea for a real-time guidance system for sailors based on updatable weather information. Generally, when planning a sailing trip, sailors have access to a global positioning satellite (GPS) system onboard but will only investigate the weather conditions prior to sailing. If the crew can get access to weather data throughout the trip, then this may allow them to avoid bad weather. This was driven by a recent alarming experience of individual E's father on encountering this exact situation.

2.4.3.3 Other People's Experience

With the sometimes limited life experience of a student, the individuals will seek opinions and guidance from friends and relatives – sometimes with amazing consequences. This is really encouraged because, remembering back to the team composition and the personality traits of engineers, we see that teams of engineering students will have a given view of the world and certain personality traits. Their friends and relatives will most likely have other personality traits according to the MBTI and this will widen the scope of experience within the group and broaden their thinking on what is innovative and interesting.

2.4.4 Imitation

You may know that it is actually really difficult to have a good idea. Some teams will invariably struggle with this process and will look to products and companies for inspiration. Again, nothing wrong with this technique for finding an idea for a product or solution, just as long as the team can determine differences between the existing products and their potential idea.

2.5 To Filter or Not

To recap, in week 1 the team will have been formed and individuals will have been asked to generate potential ideas for discussion within the team. In week 2 the team will have met with the mentors to discuss potential ideas. These meetings generally fall into two categories: the meeting in which time stands still or the meeting in which time speeds up! Some teams will come into the meeting full of energy and enthusiasm and spill out lots of potential ideas. This is a great meeting to be involved with and, okay, some of the ideas may be quickly discarded, but the key is to do this in a way that will keep spirits high within the team and keep it a safe place for idea generation. In the alternative meetings it will feel like the clock is going 'tick tock, tick tock'. Whilst the natural response of the mentor may be to voice their disappointment, it is usually better to take a more controlled approach.

Try to motivate the teams, agree with them that it is incredibly difficult to generate good ideas but that they need to dig deep. Generally, a good way to start the discussion is to ask about hobbies, interests, family and friends. Try to get them away from thinking about technology and rather think about their life and what causes them annoyance. Is there anything that they can do to change this, etc. Once discussion is generated, it is usually a good idea to

The Sous Chief

The sous chief began life as a hot and cold plate. We have all heard of a hot plate; something which sits on the table to keep our food warm. So, the hot/cold plate can keep items hot or cold, whatever the person requires. However, as the team developed their market research they came across a new trend in cooking, sous vide. It transpired that top-end stores were selling out of high-priced sous vide cookers. The team quickly developed their idea so that not only was their product a hot and cold plate, but the hot plate could also be used as a sous vide cooker.

ask each individual to come up with five ideas for discussion the next week. So, by week 3 the general aim is to have numerous ideas generated by individuals within the team. Based on the knowledge and expertise within the group, some of these ideas can be quickly discarded or *filtered* for a number of reasons as now discussed. If not discarded, the idea will remain within the potential pool of ideas until the team are ready to move on to the incubation process, where only the strongest ideas survive and, as such, the filtering process becomes much more stringent.

There are many obvious reasons why ideas should be filtered at this stage. As with the *musical potty*, a quick search can reveal that such products already exist. By discussing ideas within the team, the collective experience and knowledge of the team can be utilized to assess the idea and its validity. If an idea is not filtered straight away, then it can remain in the potential pool of ideas but the team will likely generate a list of favourite ideas. There may be one idea that will generate excitement straight away and will be the favoured idea because it is easy to explain the concept and to understand that the market potential is huge. But if something is ‘too good to be true’ then there is likely already something similar out there or a patent search will reveal the technology or concept is protected. If not, then the group can take this idea forward. The other potential ideas can remain in the background should they ever be needed.

2.5.1 *Already Exists*

Of course, the most obvious and easiest reason to discard an idea is that it already exists. Or if it doesn't already exist there may be *intellectual property rights* safeguarding the idea. Either the

The Automatic Door Lock

This team came up with an interesting idea of having a key fob which could indicate if your door was locked or not. Being one of those people who frequently gets into their car and then wonders if they locked the door, I thought the idea was great. So the team were dispatched to research the idea and came back the following week with some interesting findings. A similar American product had just launched in the US market and sold out within days. The product itself was slightly different in that it used a smartphone application to actually lock the door from any location. However, it was specific to the US market as it was aimed at a specific type of door locking mechanism. This gave the team the confidence to progress their idea and aim it at the European and Asian markets where no such product existed.

mentor or other team members may know outright if the idea/product already exists. If not, this may be discovered later in the idea incubation process. Of course, if something similar already exists then perhaps the idea is worth further consideration; especially if there is a distinct feature or a difference between the two, or if different market areas exist.

2.5.2 *Market Issues*

There are many reasons to reject an idea based on market analysis. That is, the market may be quite small and limited or it might be very difficult to penetrate or already saturated with similar products. Again, this type of information can quickly be gleaned from a market review or based on the expertise of the mentors or other team members. Sometimes, it will require more thorough investigation. Prior to leading with a product idea, it is imperative that proper and in-depth market research should be conducted to review competitive scenario, pricing, customer base and customer needs. There are a number of ways in which to do this and the teams will be given information on how to search for this type of information by the invited experts. More information on this is given in Chapter 6.

2.5.3 *Technically Too Difficult*

The team may have come up with a fantastic and novel idea but realize that as a physical product or actual service it may be too difficult to contemplate within the timescale of the project. In such cases, it will probably be necessary for the mentors to step in and make a decision on this and advise the group not to continue with the idea. For example, generally any product aimed at health and safety will take a long time to evaluate and bring to market. One group had an excellent idea about how to enhance hygiene within hospitals. This idea materialized immediately after a number of viral outbreaks within the local hospitals. So, whilst it was easy to see how to pitch such a new product, obviously the development time and evaluation protocols for such a product would be lengthy and expensive.

2.5.4 *Beyond Expertise*

For some ideas, it is difficult to make a judgment on whether it will be possible to develop the solution or prototype within the timescale or if it is even possible at all because no relevant expertise exists within the mentor base that is available for the project. If that is the case, then it is probably best to discard the idea for fear that too much time is spent trying to understand the technology behind the product in order to create a prototype that may or may not even work!

2.5.5 *Difficult to Pitch*

Some great ideas are just hard to pitch. They might be so technology focused that it is really hard to capture the imagination of the investors. Possibly it is just such a niche market that it is difficult to portray the need for such a product. Others ideas are just really easy to pitch. Take the wireless tether for children, for example. One video of a lost child and everyone in the

room will be hooked! The automatic door locker – just about everyone must have experienced that moment of panic when they ask themselves did they lock the door? To the other extreme, will everyone have experienced the *pain* of trying to hitch a trailer to their car? Of course not, but that is not to say the idea wasn't an excellent one. Rather, that team had to really focus on how they could pitch their product to potential investors. Judy Black, CEO of Buteos, explains how her team did that and more in Chapter 11.

2.5.6 *No Potential for Future Development*

It is difficult to think of any company that has survived by selling only one product, and if they have then that product will have been innovated and updated during its lifetime to make it different from the previous version. Therefore, not only do the teams need to think of an excellent idea, they also need to think about how the resulting product could be updated and renewed after launch. Of course, this will not be an immediate end to it; it is always prudent to wait until a market has been established for the initial product and learn from any mistakes made along the way. However, there must be potential for future development. For example, one team developed an automatic small pet feeder. Initially the product was designed to dispense only dry food. However, future iterations of the product will look at dispensing fluids as well as dry food as this is what their market research told them their customers would like.

TRY THIS

Using some of the ideas generated by yourself and your team members, can you make a reasoned decision based on the criteria described of whether to filter or not? Do your reasons agree with each of your group members? It is important to have a unified decision.

2.6 Idea Incubation and Development

Numerous ideas have been developed individually and assessed and developed collectively as a group on a very basic level. Now it is necessary to develop a more formative argument for developing a solution or removing the defined problem from the incubation process. This will involve more rigorous analysis of the problem and proposed solution and will involve input from multiple sources. Commercial and technical feasibility also need to be incorporated. The issues of technical feasibility and market will primarily be addressed. When the team are satisfied that there is a market for their product and that the product is feasible and a prototype possible within the timeframe, then some decisions will need to be made. If the team are in the strong position that they still have a number of ideas available, then a judgment call will need to be made on which one to proceed with.

Again, many of these questions are easily answered when market research is undertaken and if there are clear answers to each of these questions then the team are definitely on the right path towards producing a good product and a great business venture.

The questions that need to be answered at this stage include:

- Is the idea clear enough yet?
- Who is your potential customer?
- Do they have a need for this product?
- How much will they pay for it?
- How will you meet your targets?

When there is a clear idea and a clear market then it is time to more thoroughly investigate other issues relating to a successful business venture and these are explored in detail in the remaining chapters of this book. Just a note of warning at this stage. Obviously the team's priority to date is focused on finding that truly innovative idea or product that they all believe in and would like to take forward. Whilst the mentor will also be focused on this, it is important also to monitor the team's development. During the initial evolution of the team, the mentor will bring a wider range of expertise to the idea generation process and will help the team evaluate individual ideas and also develop group dynamics. However, in any strong team the dependence on the mentor will decrease significantly with time. At this stage, the teams should begin to operate more cohesively with natural roles emerging for individuals. However, if the team evolution has been slow and natural leaders or technologists have not emerged then the mentor needs to help or enforce this process.

2.7 Conclusions

The purpose of this chapter was to outline the process by which the Industrial Project is generically implemented across the Engineering Schools at Queen's University Belfast. At the beginning of the academic year, students self-select teams in which to forge their business dreams. Individuals will attempt to generate as many business ideas as possible for further discussion by the team, academic mentor and invited experts. After filtering many potential ideas, the team will select one or two ideas for further investigation and scrutiny. More in-depth analysis of the potential market and company finances will allow the team to determine if it is a viable business proposition. If yes, then the real fun begins of branding, marketing and business planning as well as technical prototyping. If no, then the whole idea generation process will need to begin again.

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The Ideal Pitch

Roger Woods

PURPOSE

This chapter provides teams with insights and guidance in preparing a 15-minute, *Dragon's Den*-style pitch to a group of would-be investors. An example is used to demonstrate how best to use this time to pitch their concept and cover all of the key points. The topics covered include the customer pain, the innovative solution, the value proposition, the market possibilities, the go-to-marketing strategy, company traction and the financial outline.

TOPICS

- Guidelines in preparing a 15-minute commercial pitch
- Derivation and discussion of customer pain
- Articulation of the innovative solution and value proposition
- Coverage of the sales, marketing, traction and finances

The chapter is organized as follows:

- The concept of the business pitch is described in Section 3.2.
- In Section 3.3, the multimedia voice recognition (MVR) case study and two other case studies taken from previous projects are briefly reviewed.
- The presentation of the customer **pain** and the company **solution** is given in Section 3.4.
- In Section 3.5, the **value proposition** and **technology** are covered.
- **Market** and **competition** are detailed in Section 3.6.

- **Company traction** and the **go-to-market strategy** are outlined in Section 3.7.
- **Financial** considerations are covered in Section 3.8.
- The process by which the presentation is generated is outlined in Section 3.9.

A key aspect of any commercial proposition is the ability to sell the product or service that the company is developing.

3.1 Introduction

The commercial potential usually centres on the ability of the company to entice the prospective customer or investor to get interested in the business. The core aspect of this activity is the creation of a short presentation or ‘pitch’ which captures the concept, market, sales opportunity and business and which can be used in an initial meeting with a possible investor. It goes without saying that capturing the excitement and potential of the approach in an effective presentation is harder than it seems.

The need to attract investment to be able to finance company ideas at the correct time is vital to the process of creating and developing many startup companies. Of course, some concepts can be started with a very small investment and grown organically if the setup costs are small but in this book, we have focused on engineering products. This means that investment will be needed to cover development costs to allow the creation of an initial prototype, followed by a full product. Being able to attract investors becomes vital and stresses the importance of being able to communicate the concept to investors.

The ability to get people to engage with your product and become an investor obviously relies on a strong proposition; this is normally indicated by an exciting product, a solid business case and considerable market potential. However, the initial engagement where the teams excite people about the product is key! For many of the product ideas highlighted in this book, this can be very difficult to achieve in a quick and effective manner as many are engineering products which may be convoluted and require a lot of effort to explain effectively; indeed, even the pain that they are addressing may require careful explanation as it may not be obvious. As engineers we tend to get too excited about the technology and sometimes fail to translate this enthusiasm into the business-speak to get investors to commit to the idea. This can be fatal for a company looking to attract funding.

It goes without saying that getting listeners excited about your product or business proposition is critical. The ability to capture the concept, ooze enthusiasm about your product ideas and get investors excited about the possibility of investment is a vital skill; a critical aspect is the creation of a set of effective slides (or pitch) that captures this excitement. This process is something that any company (or in our case the groups) must become acquainted with. In many cases, it is centred on getting a short 15-minute slide deck which best describes the product and/or company; this forms the basis for the initial engagement that the groups will have with possible investors during a formal investment round; however, the slide deck (or portions of it) can also be used in customer engagements organized at short notice, to show company potential.

As engineering products are the focus of this text, it may require a *not inconsiderable* investment to allow the first products or indeed prototypes to be created. Indeed, a particular issue

that the teams have to give serious consideration to is the development of the technology and associated product, and assuring our would-be investors that this does not present any great financial risk. For these reasons, funding is probably essential to many of the ideas highlighted in this text.

The experienced business innovator possesses the ability to communicate their business proposition in any environment whilst understanding the audience's experience and background. The often-quoted objective is the *elevator pitch*, where it is envisaged that the innovator has just stepped into a lift with a single business investor and has only the time for the lift to progress a few floors before the opportunity has passed. Thus, the innovator may have only 30 seconds to pitch the idea and needs to concentrate quickly on the *pain* that he/she is looking at, the *solution* that the prospective company has come up with to address the issue in an innovative manner and the potential value of the proposition. It is not possible to go into detail given the time limitations, and the pitch must be dramatic and impressive with little technical detail in the presentation whilst still pressing upon the listener that it is clever and innovative technology.

This chapter looks at the development of a 15-minute pitch that can be used in a possible *Dragon's Den*-style pitch to investors. We have based the pitch material on that developed by the CONNECT programme, which is a San Diego-based regional programme that catalyzes the creation of innovative technology and life sciences products by linking inventors and entrepreneurs. The process is described in this chapter and demonstrated using an example created by the author when trying to commercialize technology for speech recognition in embedded platforms.

3.2 Business Pitch

Pitching your idea is a key ability of any business startup and the main focus of the presentation is about getting the message right. It may seem odd in terms of the organization of material in this book to have included the pitch presentation before branding, marketing, sales and finance, etc. but this is deliberate. In the exercise developed with the student teams at Queen's University Belfast, it has been found that getting the groups to work on the presentation at an early stage of the project timeline forms a very clear business focus. It makes them consider finances, sales, company organization and marketing right from the start and allows any weaknesses in the proposition to be quickly identified. Consequently, it forms a useful starting point for the development of the business plan and indeed its structure.

The starting point is to communicate the *pain* that the group/company are addressing and then hit the listener with the innovative *solution* that has been developed. This has to be done in such a manner that it creates a lasting impression on the investor that this is an innovative and interesting proposition.

There are numerous strategies for how this can be done: the team can highlight a potential market opportunity, hopefully convincing the investors of the immense opportunity; they can

use empathy or emotion with the problem being addressed, which is very useful if the topic has a medical or a childcare aspect, or the group can simply highlight that they have hit on a novel, innovative solution to a new or existing problem. To a great extent the presentation largely rises or falls on the first few slides, as the team will either have investors very interested at that point or not; it is much harder to get them interested in a considerably large sales opportunity if they did not buy into the original concept.

3.2.1 *CONNECT Springboard*

The presentation builds on the excellent presentation template that has been developed by the CONNECT Springboard presentation. The idea has been adopted by the NISP and from this, they have formed the NISP CONNECT programme. Indeed, NISP staff have been highly supportive of the approach that we have adopted at QUB and have given time and effort to help us understand the key aspects of creating a product. No doubt this is not entirely charitable, as the NISP goal is to create economic value; engineering graduates offer considerable potential in terms of creating a business proposition that is beyond *run-of-the-mill* activities. Indeed, many of the student ideas have come from personal experience of working with advanced technologies in local companies.

The CONNECT programme is a highly successful endeavour that was devised in San Diego, with the aim of promoting company formation by catalyzing innovative technology and life sciences products through linking inventors and entrepreneurs with the resources that they need for success (CONNECT, 2013). The programme has been run from 1985 and boasts the formation of more than 3000 companies.

The NISP Springboard template was used by the companies to generate a 15-minute pitch targeted at investors, and this has been used as the basis for the students' presentations. The overall goal of the presentation of any good proposition is to:

- **Communicate the company story as clearly as possible.** The presenter cannot assume any technical knowledge of the audience and, indeed, it is best to assume that they will most likely be investors and will have little technical background. It is recommended that the students keep their technical description of the project to one slide and avoid technical detail as much as possible.
- **Create excitement for the company.** This is done by persuading the students to be adventurous in their presentation and has seen groups derive a number of innovative ways to demonstrate this, such as humorous videos to illustrate the pain, dressing up in chefs' uniforms (to highlight a cooking-related proposition) and creating ties with company logos (to create a clear togetherness and company focus). It is emphasized to the students that they must generate excitement about their own presentation; also, it is important to ensure that the listeners enjoy the pitch to increase empathy.

At the end of this exercise, the presumption is that the teams will give this presentation to a panel of would-be investors. This seems to work well, as the students have had to do



Figure 3.1 Introductory slide

Table 3.1 Typical roles within the team




Points	Comment
Use of logo	The groups are encouraged to create logos. There is sometimes initial confusion from the groups on whether to use the company or a product logo, which can be confusing. The product logo should be used if there is one product and the company logo if there is a range of products. In the MVR case, it was a licensed model and it was felt that the company logo was more important.
Level of content	The slide should have very little detail unless there is some image that highlights or focuses the listeners on the presentation. In Fig. 3.1, the concept of converting speech to text using an embedded product was the key message that the images tried to convey.

little modification of their presentation when submitting their ideas to outside competitions for possible investment. The general key points in the presentation are:

- **Less is more.** The suggested length of the presentation is 15 minutes and this has been adopted for the assessment period; it is short enough to keep the listeners’ engagement but long enough to allow the groups to provide details of the proposition. Students are encouraged to ensure the text is below 30 words per slide and to keep the message simple. Also, they are encouraged to use graphics as much as possible and modern means of presentation, whether quirky graphics or non-standard presentation tools e.g., Prezi. The presentation is typically limited to 15 slides and students are warned (threatened!) not to go over this limit.
- **To create excitement for the company in order to be able to attract further funding.** To a great extent, the students have to assume that this is a pitch for money and whilst it is not explicitly asked for in the presentation, it is the main reason for the pitch. In addition to the approaches mentioned above, the groups have tended to use design studies, newspaper

MVR

Inputting text on mobile devices

- **Speed:**
 - Keyboard (33 words/min) vs. audiobook(150 words/min)
- **Repetitive strain injury:**
 - Suffered by 38% of people – 3.8m British mobile phone users
(Virgin Mobile survey, Feb 2006)
- **Road safety:**
 - Collision risk becomes 23 times higher when texting
(Virginia Tech Transportation Institute, July 2009)
 - 26 percent of American teens have texted while driving
(Pew Internet & American Life Project survey, July 2009)
 - Speech Sat-Navs reduce reaction time between 24–47%
(Nuance Communication, July 2008)

Figure 3.2 Pain slide

Table 3.2 Pain slide

Points	Comment
Emphasize the pain	It is important to emphasize the pain in a dramatic fashion. In the MVR case (Fig. 3.2), the team were a little conscious of the poor reputation of speech recognition so they pushed the medical aspect (repetitive strain injury), convenience (speed of data entry) and safety, i.e. road crash possibility (but careful to highlight the US situation as using a mobile is banned in the UK).
Don't be boring	Be innovative in the first slide; Buteos (Chapter 8) used a home-made, humorous, black and white video to highlight the issue of hitching a caravan.
Audience engagement	Make sure your pain is understood by an audience who may not have direct experience; this can be done by possibly quoting referenced data as was done in Fig. 3.2 for speed in non-mobile users.

headlines, company and personal quotes and initial market survey results to emphasize the need for their product.

- **Backup slides.** It is always useful to have backup slides which will give additional detail or to have information in order to anticipate questions that might occur. This is particularly relevant for the financial aspect as generally, time limits the finances to one or two slides; moreover, the groups are encouraged to have the backup information to be able to demonstrate clearly to possible investors that they have considered this in detail.

3.2.2 Pitch Outline

The Springboard presentation is based around 15 slides which we have adopted here and structured into five main areas:

- **Pain and solution.** This is the most critical part of the presentation as within the first few minutes, the students will have had to communicate effectively the challenge or pain that they are addressing. This has to be convincing in terms of need, market potential and newness of idea, as it creates the need for the product, solution or service. Then, they have to present the innovation that they have developed to address this. To a great extent, the presentation either stands or falls on the impression created in these first few minutes, and it is understandable that most of the student effort and mentor feedback is concentrated around this.
- **Value proposition and technology.** After selling the pain and the possibility of a solution, it is essential that the team sell the value proposition and give some indication of the technology innovation and viability. Also, they need to give some idea of the business model that will be used to sell the product, which can vary widely. It must make sense for the proposition and given that the group are IT literate, it must have technical nous.
- **Market and competition.** It is great having an innovative product but the real opportunity is the market potential. This can be a large captive market or can be much more targeted, such as at young children or the elderly. For example, a child safety-orientated proposition may appeal to young parents or a specialist ‘must-have’ product may be applicable to young business executives. This will impact the strategy developed to sell their product and models can vary greatly.
- **Company traction and go-to-market strategy.** The business will largely be influenced by the product to be sold, whether it needs to be manufactured by the company or licensed. Also, it will depend on how the product will be sold, for example online or directly marketed. The team need to emphasize the need for technical expertise, but also address the probable lack of commercial expertise. Typically, they have done this through the creation of a *ghost board* with key executives that they have met through the course.
- **Finance.** The finances need to be sound and representative of the product to be sold. One of the major issues with the groups is persuading them to be ambitious enough to see the considerable potential that the product can bring if sold effectively. It is a case of determining the most effective ways of presenting finances.

Emphasis on the *template* as a starting point is key, as groups will end up concentrating on some aspects more than others and should really focus on the pain/solution and the business case to be made. The regular engagement process with the mentors and interactions with the specialist contributors from a marketing, finance and IPR background usually results in a number of iterations of the slides, where some skewing of the content may occur depending of the nature of the product being developed. This interaction is described in Chapter 2.

TRY THIS

Develop the outline for your presentation. Try to keep the slide deck to 15 slides. Choose the slide content to emphasize the message of your presentation.

3.3 Case Studies

A good way to demonstrate how these slides are produced is to use a number of case studies, and a number have been identified. The first case study, MVR, is based around commercialization of an embedded speech recognition product which was developed by R. Woods, one of the authors of this book, and members of his Programmable Systems Laboratory at Queen's University (PSL@Q); it was used as an exemplar presentation for the student groups and demonstrates the various presentation stages. In addition to this, we use two student case studies, namely Nutrifit and Noctua, to represent different propositions for the creation of these slides.

The multimedia voice recognition (MVR) case study involved the development of an embedded system for speech recognition and has application in mobile telephony and some security applications. The presentation has been used throughout the chapter to illustrate one approach.

3.3.1 MVR

The CONNECT Springboard presentation slides were used as a template for each portion of the presentation, as highlighted in Section 3.2.1, and the purpose of using this example is to see how we match the requirements onto this template; however, it also demonstrated how the presentation was skewed to match what was identified – in particular, effort was concentrated on the key aspects of the pitch and also the issues that need to be addressed (i.e., possible weaknesses). This is a large aspect of the work undertaken by the company/team.

The idea of the pitch was a genuine attempt to create a company called MVR. The concept was based on a solution for embedded large vocabulary continuous speech recognition (LVCSR), which is seen as a vital means of interaction. The key aspect was to develop this for an embedded system, and it came from a three-year research project which had created IP in the form of a number of algorithmic optimizations (Aubert *et al.*, 2013) and the realization of an embedded speech recognition platform (Veitch *et al.*, 2011). It showed that it was possible to exploit a technical approach to speech recognition based on the weighted finite state transducer (WFST) concept (Mohri *et al.*, 2002) and then use it to implement speech recognition with as rich a vocabulary as possible on embedded devices with small resources.

The output of the research was the development of hardware design code in the form of a hardware description language (HDL) that could be used to create a processor in a silicon chip; however, it was not a commercial design and the next stage in the commercialization process was to identify the importance of generating other modes of operation with mobile phones and then develop a commercial hardware design. However, it was quickly recognized by the team that it was considerably expensive for a small company to enter into this market, so the company immediately looked to licence the IP and provide the necessary resources (code, engineers) to a limited number of partners to develop the hardware.

This meant that revenue would be provided by royalties from units sold and by customized software support, which is meant to assist device makers in integrating the technology and adding functionality to the system. The objective is to provide device makers with a complete

solution that is flexible and programmable through standard application programming interfaces (APIs).

Thus, the main goal of the presentation was to highlight the importance of the mobile phone market and the need for different modes of interaction, emphasizing the business model as the goal and then pushing the market for mobile phones. Indeed, this comes out in the introductory slide, which gives an impression of converting speech onto mobile phones, trying to give the impression of the company as illustrated by the MVR slide shown in Fig. 3.1.

3.3.2 *Nutrifit*

Nutrifit identified an issue to do with childrens' health. From this, they developed an innovative product to promote healthy eating and a rewards system for the children who engaged with it. Their product was focused around an imaginary character, which would encourage children to eat healthily. The idea was sound and had a very close resonance with parents concerned about their childrens' eating habits.

From this, they created a series of childrens' toys in the form of an online animal to which the children become attached. This is linked to a website, and children enter their meal diets to get reward points; parents can also monitor their eating habits. The key feature here was health for children, and this emphasis in their presentation occupied a number of slides with quotes on UK and EU/international concerns about obesity. Reassurance that the team could ensure the security of the site and that no personal information was stored became an integral part of the pitch, given child protection legislation and parental concerns.

The group spent a considerable amount of effort developing copyrighted characters as they felt that this was the key aspect of their product. In addition, it was important to be able to create a working demonstration as, along with the characters, this presented a clear picture of the students' vision.

3.3.3 *Noctua*

Noctua developed an innovative system for nightclub and bar owners to address the issue of falling numbers of people attending their clubs in the current economic climate. The system that the group developed allowed the nightclub and bar owners to analyse directly how successful their specially organized nights or promotions could be. This was achieved by providing them with reliable information on whether events that they organized had actually attracted more customers.

The system was based on a radio-frequency identification (RFID) technology and on the creation of a website. Users registered with the website and were given (when they registered at the club) a highly attractive RFID tag in the form of a wristband which allowed them VIP access to the club. By recording them via a barcode reader, this provided entry information to the website and gave the company (i.e., the website owners or the company) the necessary information to work out whether the promotion had been successful. It is, in effect, a club which allows nightclubs and bars to alert the website members to special events and offers that members can avail themselves of. The key innovation is the accurate registering of members entering the club.

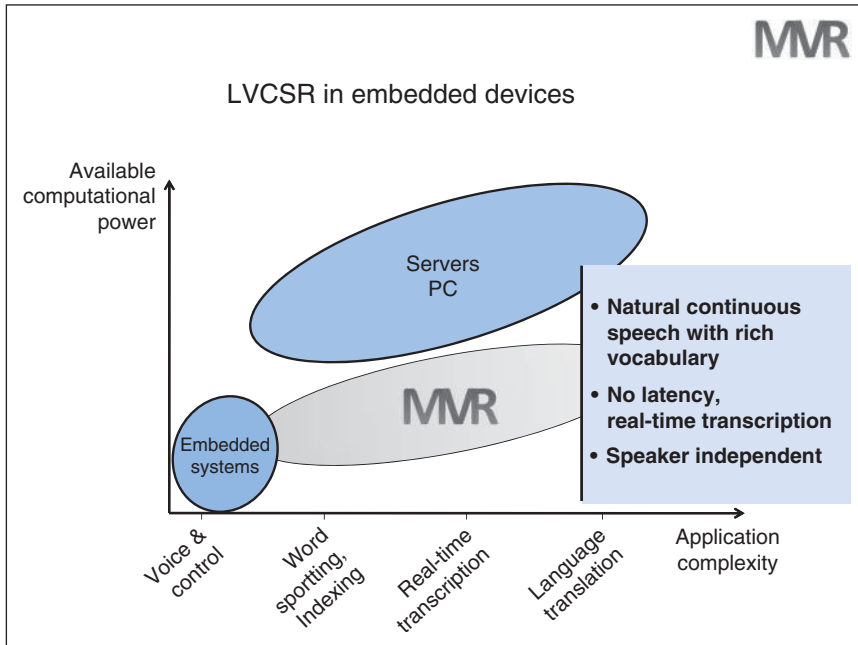


Figure 3.3 Solution slide

Table 3.3 Solution slide

Points	Comment
Simple, clear message	Highlight in as simplistic a way as possible the innovation; in Fig. 3.3, an unlabelled graph was used to compare computational power against flexibility as this is key in embedded systems.
Relate to pain slide	Having made the case for the pain, the presenter needs to ensure an innovative or clear solution that relates directly to the problem.
Product	Need to make a clear case for what will change as a result of the product being created. Will it create a new market? What bottleneck will it remove?

3.4 Pain and Solution

Coming after the introduction slide (Fig. 3.1) and associated guidance (Table 3.1), the pain slide is the most critical as it represents the core problem that the company is tackling and it is the first real content that the prospective investors will see; it needs to highlight clearly and in layman's terms the environment or key issue that the product is addressing. It should describe the pain in terms of the commercial proposition that is being solved. Is it a pain that everyone has and is easily understandable? Or is it a vitamin, that is something that you should have or is nice to have? If it is the latter, then it must be related to the potential market. If the proposed

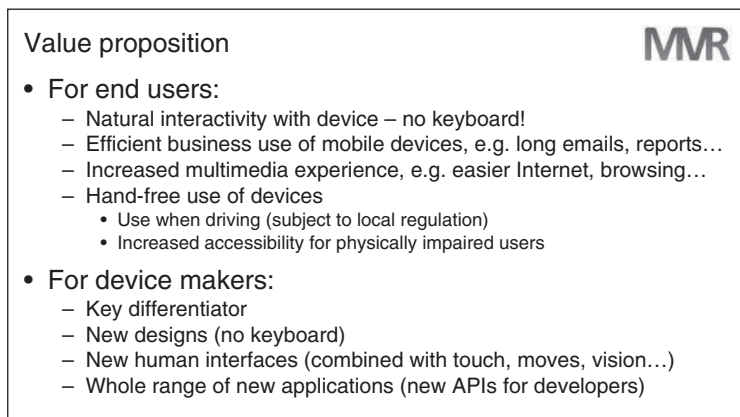


Figure 3.4 Proposition slide

Table 3.4 Proposition slide

Points	Comment
Articulate value	In Fig. 3.4, we highlight the value to both end users and device makers of emphasizing the point. We ensure that the potential value is highlighted.
Existence in value chain	We clearly show that this value chain potential comes at the user end but also indicate that it has cost-saving potential for the device manufacturer.
Avoid abbreviation of technical terms	It is assumed that the pitch is largely made to business people, so not a lot of abbreviation and technical terms are given!

customer for a solution has either available funds to buy the product (e.g., is retired) or could release funds (e.g., young executives), then this must be emphasized.

In the MVR pain slide given in Fig. 3.2, the key emphasis is to highlight the limitations of interacting with a smartphone. A number of different issues are highlighted, ranging from the perspective of a business (need for interaction) and health (with repetitive strain injury and safety); in all cases, the arguments are backed up with source material. This is really a case of highlighting to the audience a pain that they might not be aware of, and backing it up with relevant data; this approach may not work for other propositions. Guidance for completing this slide is given in Table 3.2.

In the Nutrifit example, the case for fitness in children does not need to be made but the size of the problem may need to be emphasized; this is the focus that the team took in their pitch, using all types of governmental and world health reports to highlight the growing problem of obesity. In contrast, Noctua highlighted the problem of nightclubs wanting to target customers to specific events and understand clearly whether their strategy was effective. This was particularly relevant in the current economic climate, where people tended to stay at home rather than go out.

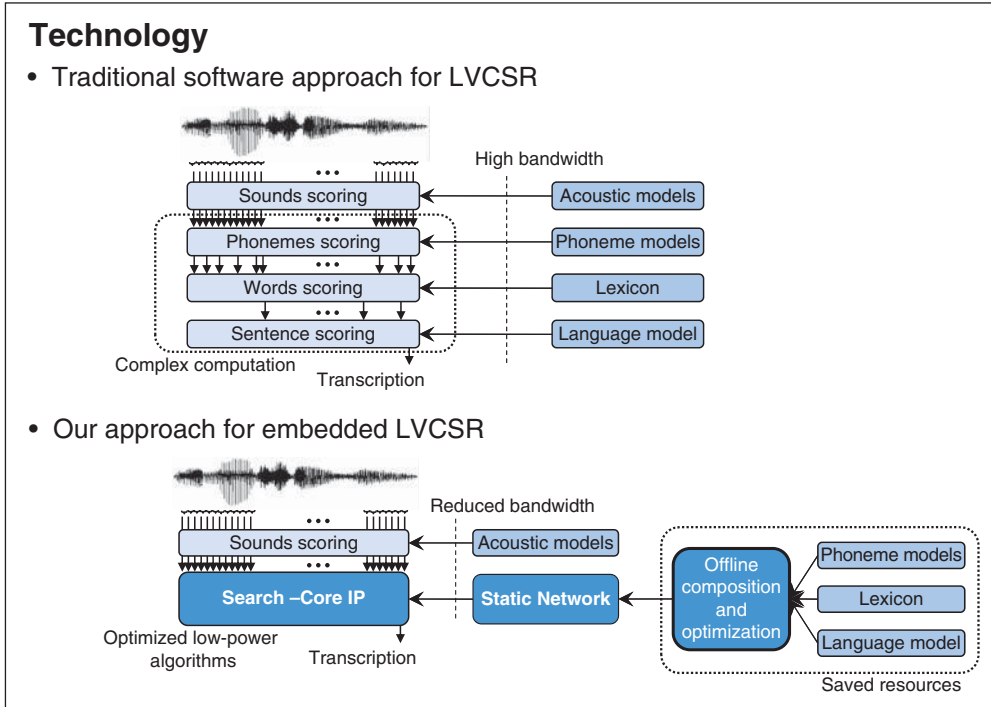


Figure 3.5 Technology slide

Table 3.5 Technology slide

Points	Comment
Layman’s terms	Essential to keep the message simple. In Fig. 3.5, we have reduced the detail and tried to highlight the reduced computation and bandwidth which are essential for embedded systems implementation.
Use pictures	Pictures in Fig. 3.5 are used to demonstrate functional differences between conventional and proposed solutions. By using pictures, we avoid any technical jargon and attract the audience’s attention to the key issues of computation and bandwidth.

The solution slide given in Fig. 3.3, with associated guidance in Table 3.3, attempts to highlight how the proposed product will address the pain. In the case of MVR, the goal is not to solve the speech recognition problem as this has been a major ongoing problem for many years; the key innovation is in implementing a speech recognition system on an embedded system. Thus, the drive is to show how an embedded platform compares with other products, specifically computing servers. It shows that the product can be used for a large range of

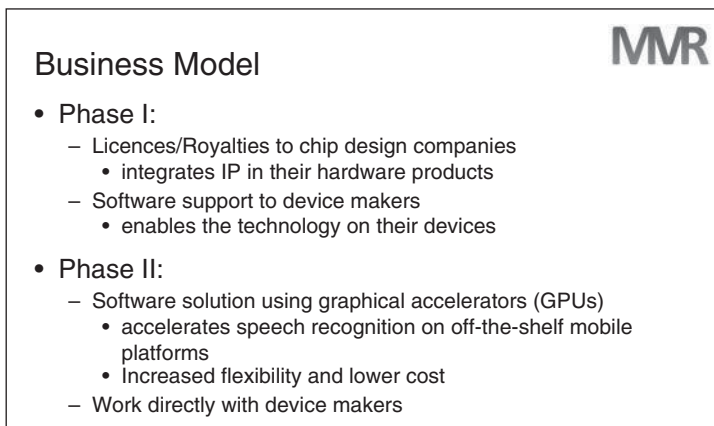


Figure 3.6 Business model slide

Table 3.6 Business model slide

Points	Comment
Ideal customers	Need to identify ideal customers as this clarifies the sales proposition and gives the investors a clear indication of market size. This can be done by identifying a class of customer such as the elderly or young, single executive types.
How do they buy?	Again, this is trying to ensure how the product will be bought. It may be directly dependent on the age of the customer. For example, you may want to target the elderly via commercial advertising on certain TV channels, the young by direct marketing (e.g., Facebook).
Pricing model	Connected to revenue and will give clear indication of the business potential. There may be several variants of the same product. Could be the same product with reduced features in order to reduce costs!
Revenue model	How will the business scale? This is a key aspect for investors as they want to identify products with considerable market potential.

applications that previously were the domain of servers. During the pitch, the presenters aim to highlight the considerable potential of this brings to new markets.

TRY THIS

Try to generate your own pain slide. Work out the angle that provides most potential for customer engagement. Try to use images wherever possible. Keep the message ‘easy to understand’ and ‘gripping’.
Then try to create a solutions slide that matches this challenge.

Table 3.7 Market slide

Points	Comment
Market opportunity	In the MVR case, as the market potential was directly linked to the market for smartphones, we used Frost and Sullivan and other data to show the growth in smartphones (Fig. 3.7). Size and maturity! Best to show size of market using graphs and use years on the x -axis in order to demonstrate maturity.
Market positioning	There needs to be some evidence to show how the product is positioned in the market. This can be done by showing the competition and the pricing market size figures, although this could be confused with the competition slide.
Product uniqueness	Important to show how uniquely the product fits into the market as this gives a clear indication of how it can be sold. This could be the key product advantage.
Market segment	You need to show how the product fits into a full market. For example, you could be selling a spice to be used in Eastern restaurants. Work out the total restaurant market, then the percentage that are Eastern and then the percentage that might buy from you. These figures need to be right and make sense.

3.5 Value Proposition and Technology

The key aspect of the pitch is the value proposition and the speakers must clearly highlight this potential; it forms the basis of the company proposition and has to be shown to lead to a viable business proposition. The team have to clearly highlight the potential user base and indicate the benefits and commercial potential. In the case of the VCR pitch (Fig. 3.4), the value proposition is increased interactivity for the user, allowing for more effective use of mobile phone technology. Also included is the possible value to device makers in that they can reduce their product cost if they can improve connectivity with the device in the forms of new modes of interaction, namely speech. The *carrot* of providing new APIs is in highlighting the possible business potential. Other suggestions are highlighted in Table 3.4.

One of the challenges for engineering students is to restrict the presentation of their technology to one slide and then present it as a single slide in layman's terms. At the same time, the team must ensure that the technology does not come across as simple, so a careful balance must be made to convince the audience of technical expertise but explained in a coherent fashion that will be clearly understood. An example technology slide is shown in Fig. 3.5, and guidance in Table 3.5, where the main focus is to show the differentiation between the conventional and MVR approach. We have highlighted the two key aspects, namely computational complexity and bandwidth. Again, it would be explained during the presentation that these are key aspects for embedded systems, so the direct emphasis indicates the company's potential to achieve the embedded system realization without getting into detail.

The business model is needed to show how the team will take the product to market and needs to cover a range of aspects. It should indicate an ambitious strategy and an understanding of

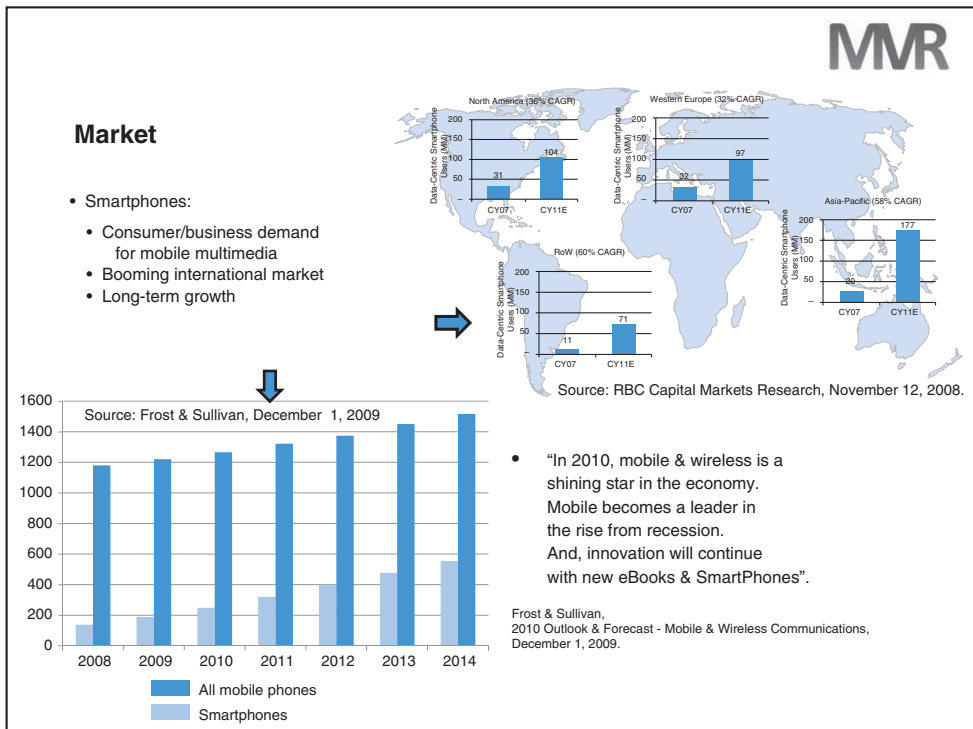


Figure 3.7 Market potential slide

how money will be made and how the product will be protected. As indicated in Section 3.3.1, the key commercial goal was to design IP for use by third parties in the creation of smartphones. As illustrated in Fig. 3.6, this is given in two stages to reflect the development in current mobile phone technology. Firstly, it is included in the form of an IP block that will be incorporated into the phone at manufacture, therefore requiring close interaction with the supplier and secondly, it is included as IP in the form of programming code for a graphical processing unit (GPU) which will be a component in next-generation smartphones. If nothing else, this approach demonstrates to potential vendors a good knowledge of mobile-phone developments. Key points to consider for the generation of this slide are given in Table 3.6.

TRY THIS

Create a number of versions of your value proposition slide. Try to generate your own pain slide. Work out the angle that provides most potential for customer engagement. Try to use images wherever possible. Keep the message 'easy to understand' and 'gripping'.

3.6 Market and Competition


Any business plan and company needs to have a marketing strategy as this demonstrates the potential of the venture. It also needs validation and the team must ensure that any market analysis is well reasoned and comes from reliable sources. It is important that the teams stress this without exposing the audience to unnecessary tedium in the process. The analysis can depend on reliable sources such as Gartner (Gartner 2013) and Frost and Sullivan (Frost and Sullivan 2013), and possibly published government studies. There is a danger in using Internet studies unless these are recognized, and they can have the opposite impact, but finding reliable information can be hard.

The market analysis must also be highly relevant for the proposition being pushed and also relevant to the market. In many cases where the plan is to export, market figures for international markets are vital and should be included to demonstrate the financial potential for future products. In the case of the MVR offering, this was a case of demonstrating the worldwide potential growth in smartphones and demonstrating a strategy which matches this market projection, as shown in Fig. 3.7. In the actual presentation, this was backed up by the data in an additional slide (not shown), which sets this in the context of the product offering and how it matches competing technology. As before, key points to consider for the generation of this slide are given in Table 3.7.

An important consideration is to highlight the competition and then differentiate your product. This is dangerous as you do not want to highlight another product as being important by choosing a comparison criterion in which your product fairs poorly and which may, under questioning, completely undermine the product pitch. On the contrary, some teams have used questionable comparison metrics which the audience recognizes as not valid; then the audience will question the validity of the comparison.

This can be done by creating the classic comparison table, as indicated in Fig. 3.8 which attempts to compare the proposed product or solution with other relevant, competing technologies. This must be done in a fair manner in order to demonstrate the potential. It is tempting to avoid including relevant competitors which present a strong competition, but this is unwise

Competition



- Large number of speech recognition service companies
 - Most of them are based on a few existing solutions


		Desktop solutions (e.g. Nuance/ Microsoft)	Embedded solutions (e.g. SVOX/ Loquendo)	Server-based solutions (e.g. Nuance/ Google)	Fully costumed hardware (e.g. Academic research)
Large vocabulary continuous speech	✓	✓	x	✓	–
Embedded	✓	x	✓	x	✓
Real time	✓	✓	–	✓	✓
No delay	✓	✓	✓	x	✓
Low power	✓	x	–	✓	✓
Flexibility / programmable (API)	✓	✓	✓	–	x
No additional hardware	–	✓	–	✓	x

Figure 3.8 Competition slide

Table 3.8 Competition slide

Points	Comment
Competitive landscape	List direct and indirect competitors, i.e. those who can move into your area. The main concern will be a multinational company who could effectively bully your company out of the market. Of course, this company could be a potential buyer.
How do you differ?	It is usual to do a comparison slide as in Fig. 3.8. Realistic comparisons need to be used with the relevant and obvious information. The objective is to show the advantage of the product.
Competitive advantage?	Aim to convince the audience that the listed items are key criteria. Be honest, it will quickly become obvious if you have listed irrelevant criteria. The key advantage could be the investor clincher.
Customer feedback	The team could do some initial market survey with a small group of prospective customers in order to establish market potential. It is a very persuasive argument that the product has major sales potential.

in the long term and undermines the business case. With this in mind, it is important to choose the appropriate comparison factors that seem realistic for comparable technology. Obviously, in the case of the MVR approach, we use low power and low delay as these are obvious advantages of an embedded technology whereas large vocabulary would be seen as a key advantage of speech recognition. The questions that you should address are listed in Table 3.8.

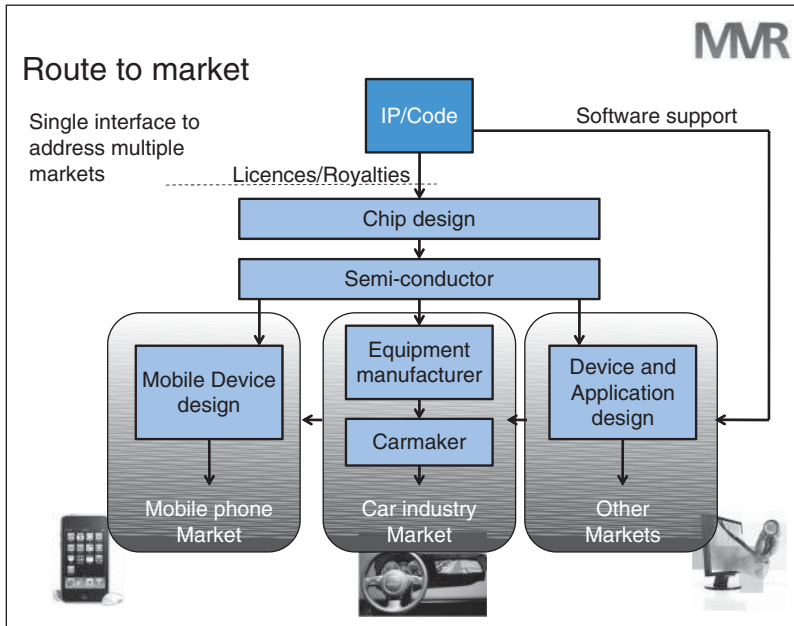


Figure 3.9 Go-to-market slide

Table 3.9 Go-to-market strategy slide

Points	Comment
Marketing plan	Need to give a clear indication of what the strategy is for marketing. Need to give a range of options, as illustrated in Fig. 3.9. The more detail, the better – without being boring!
Getting the customers	Marketing material needs to show clearly how they will target their customers. It is particularly convincing if the groups can use new forms of marketing, e.g. Google Adwords, which are relevant to the customer base targeted, of course.
Direct/indirect marketing	Product will dictate which form of marketing will be used (or possibly both). The MVR example will involve more than direct marketing, as it would be a case of building up relationships with key vendors. Also, are alliances proposed?
Third-party validation	If there has been some initial customer engagement this should be highlighted, as we have indicated in the go-to-market slide (Fig. 3.9).

In the other case studies, the comparison was not as technical. For example, in the Noctua case the comparable technology was fliers, street promotions and loyalty cards. Evaluating the success of the approaches was difficult as little data exists, but it was clear that there is a need for the product. Likewise, Nutrifit also had a diverse range of comparators.

TRY THIS

Generate a competition slide. Firstly, identify who your competitors are. Then, determine what the comparison factors are. Try to be 'fair' in terms of the factors considered.

3.7 Company Traction and Go-to-Market Strategy

At this stage, the proposition, market and sales potential will have been sold to the panel of investors but now they need to be convinced that the team is right. Usually, a company will

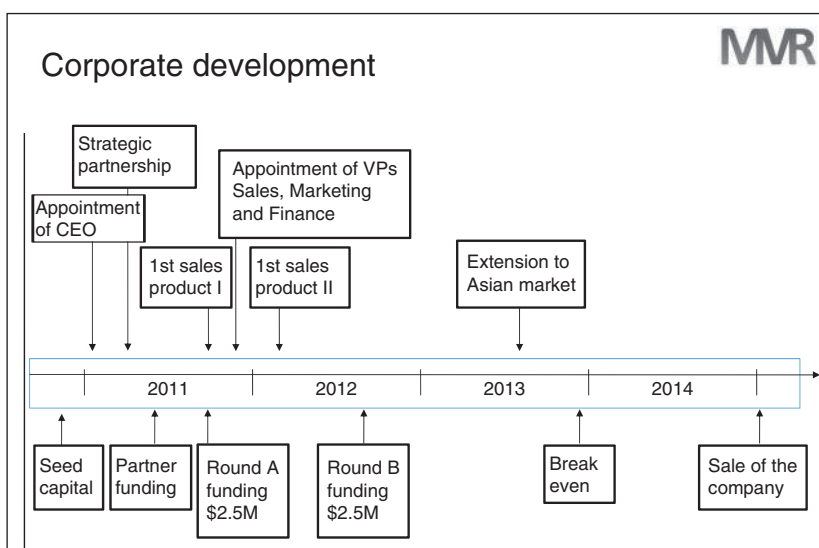


Figure 3.10 Company traction

Table 3.10 Traction slide

Points	Comment
Team	The team could be your greatest asset, particularly for engineering teams. It allows people to show their background, with an advisory team or company board to cover any skills deficit.
Barriers to entry	This could give the existing IP strategy to address any concerns of technology risk (Fig. 3.10). Need to show a clear route to market. This needs detailed discussion as weaknesses are sometimes not obvious
Milestones	It comes across strongly if the group can give clear outline goals for the next five years highlighting key events such as major investments, new products and proposed new alliances.

have engaged a business leader or sales/business development-type person with several years experience to allay these fears. However, in the case of the team of engineers, the core team is usually a team of young enthusiastic engineers who may have limited business experience. The group are encouraged to highlight their engineering background to indicate the technical expertise and to add either any startup expertise (and indeed some students may have this) or to address any perceived business weakness in the pitch. For example, it may be possible to create *ghost boards* involving some of the instructors that they met during the course, or some other connections.

In the MVR pitch, we dedicated two slides (not given for confidentiality reasons), one of which highlighted the experience of the team (which was considerable) and another which highlighted an outline board. The *team* slide indicated 20 years plus experience in either speech recognition or embedded systems, and one of the staff was a very well-known academic with considerable experience of working with industry. The board comprised a US professor and company founder, a major international software vice-president, a senior member of staff from a well-known processor company used in phones and a senior technologist. This provided strong credibility in the pitch, and the marriage of these slides gave a clear convincing message to the proposed investors that the company had the technical expertise and business clout to back up their proposition.

In the case of the other two case studies and indeed other team proposals, they tended to link in with the course experts and propose them as board members bringing expertise in marketing, sales and IPR. In some cases, they also brought in those academics with specific expertise in the area of interest to act as technical advisers.

Marketing strategy is a key aspect of showing intent in making a company successful. It would be an expected *weakness* for engineering students given that it is not usually taught as a core aspect of an engineering course; investors might expect that teams would concentrate on the product definition and creation of prototype, and that they would think less about the sales and marketing. Thus, it is important that they think of innovative approaches to marketing. Indeed, it is their familiarization with IT and web-based technology that sometimes comes to the fore, leading to innovative marketing approaches. This is reinforced by the marketing approaches highlighted in Chapter 5.

Examples of the go-to-market and traction slides are given in Figs 3.9 and 3.10. Tables 3.9 and 3.10 cover the points for discussion which are important for the generation of these slides. A selection of marketing strategies are listed in the slide of Fig. 3.11. Standard marketing could be covered, but it is important to target it towards the product requirements. Use of new marketing techniques such as Google Adwords, marketing through LinkedIn (www.linkedin.com) and possible sponsorship of specialist meetings in order to raise the company profile gives a much more focus. Highlighting the specific marketing approaches that tend to match the product appeals to investors and will depend on the customer. For example, targeting of teenagers will require different technology from that used for the elderly.

TRY THIS

Get the group member responsible for marketing and finance to develop the marketing strategy. Use this as a catalyst to get the group thinking about novel forms of marketing.

3.8 Finance

One of the issues that has been problematic for the engineering students over the years is the creation of the necessary financial statements – specifically income statements, balance sheets and cash flow – as this is not something that has been covered in the course material to date; for this reason, Chapter 8 has been dedicated to finance. Some additional points for consideration are highlighted in Table 3.11.

For the presentation, a graph that gives the cash flow but the projected income and balance is also important. This can be either three or five years in total. The finances aspect of the business plan contains a lot of information that is needed to convince investors of the company product.



Figure 3.11 Marketing strategy slide

Table 3.11 Finances slide

Points	Comment
Realism in figures	For the final report, it is sensible to have carried out detailed analysis which can be shown if needed. It is very likely that there will be questions on the finance as this is central to the investment.
Five-year estimates	The calculation needs to be done over five years and should not come across as estimates, i.e. straight lines! Some panels have indicated that five years is too long for a pitch given the business involved, but it demonstrates clear thought in planning.
Critical assumptions	Interesting to highlight these on the graph. Typically, assumptions will include investments and percentages of expected market share (see Fig. 3.12).
Avoid detail but know it	The graph in Fig. 3.12 is probably sufficient to give a detailed explanation as it links cash flow, income and balance but time would be needed during the presentation to allow the viewers to digest the detail.

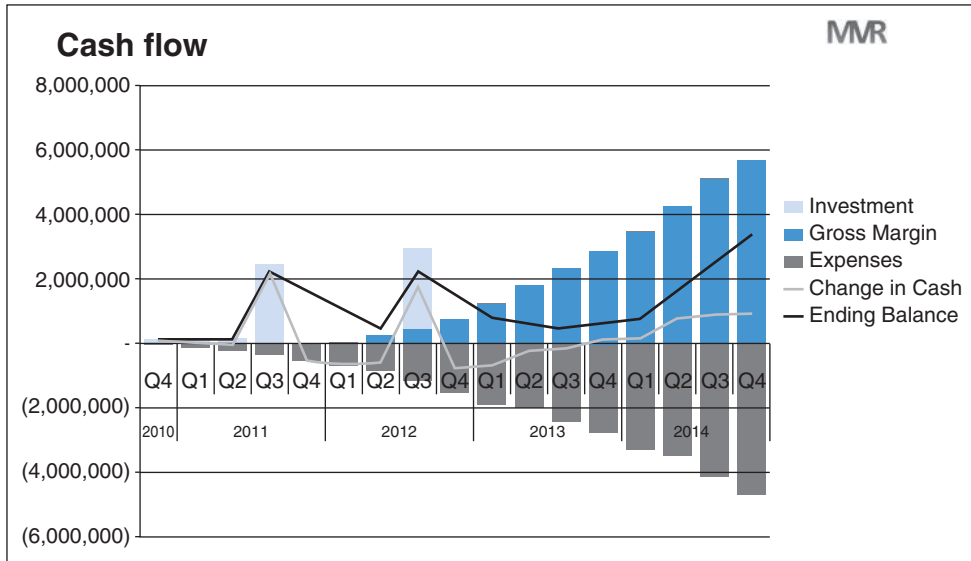


Figure 3.12 Cash flow slide

It is vital though, to represent the key aspects of this in a few slides, in this case one, even though it contains a lot of information.

The goal with the finance slide or slides is to put some meat on the proposition and indicate what value the company can develop over a five-year period. To be investable, it has to be shown that the company has the potential to become an entity that will make profits of several million pounds; this will indicate clearly to an investor that if he/she makes an investment of say £0.25M then they would see a tenfold return. Thus, it may be insisted upon that part of the pitch may highlight key funding events where the team may be looking for investment, so this expectation is made clear to the teams.

Some of the teams who have spent a great amount of time preparing the finance figures are keen to produce a series of graphs in order to convince the investors that they have gone into reasonable detail. They are encouraged to generate finance figures with a granularity of monthly values which clearly show how expenses and income will vary. For example, raised income immediately after a show due to increased sales would be a sensible adjustment; similarly, drops in cash flow when the team have had to buy in bulk when creating stock in order to be able to get the most cost-effective component prices. Also, consideration should be given to specific finance features such as payment of VAT.

Rather than go through these finances in detail, the teams are encouraged to present the basic figures as we have done in Fig. 3.12. Indeed, it is probably best to give the minimal headline figures as this entices the investors to see more detail; this is where the backup slides, which include such detailed finances, come into play. Key information in the slide of Fig. 3.12 is the cash flow and the profit after two to three or four to five years. The slide shows expenses and income, but the cash flow is very relevant as it represents the baseline for any company in terms of operation – possible large profits will mean nothing unless the company is in existence.

Also included are the investments, which show a clear intention for the initial investors that the company is ambitious and does not see the initial investment by those people in the room as the only investment. The team must be realistic enough to comprehend that this initial investment is something that is required as a series of investments, and must reassure investors of the intention to reach the five-year profit line.

TRY THIS

Think about what aspects you feel are important regarding the finances and which financial features you want to emphasize in the presentation. Try to work out what five-year profit you would intend to make.

3.9 Presentation Process

The previous sections outline the various portions of the presentation and how the discussion hopefully illustrates that (if the template is followed) a bright and convincing presentation can be brought together in a coherent fashion to obtain the interest of a group of possible investors. This is certainly the case with the Buteos pitch (see Chapter 11), where the team entered the Northern Ireland £25k award and made the heats with very little change in the presentation which had been put together for the course. This shows clearly the impact of the resulting pitches.

The process by which the presentation is created, though, is probably as important as the final pitch itself and this is where the team ethos and interaction with the mentors come strongly into play. We have attempted to illustrate this in the various stages given below, but the reader is encouraged to look in detail at the student perspectives in later chapters, namely Chapters 11 and 12.

- **Group formation.** The creation of the group is critical. Here, this is done through osmosis, by allowing the members to form their own groups. This usually means that the last team is comprised of the people who were less pro-active in getting together. This is highlighted to the teams involved, and they are encouraged to undertake some team-building activity.
- **Member roles.** It is indicated at an early stage that it is important for the team members to undertake the key roles and there can be some pressure brought to bear by the mentors to ensure firstly that members take these roles on at an early stage and understand the responsibilities, and secondly, that the members take on the correct roles. For example, it is usually clear that the member who got the team together should probably undertake the CEO role. Other members who may have a close relative who is an accountant would be encouraged to possibly consider the CFO role.
- **Weekly progress meetings.** The groups are encouraged to have several meetings at the start of the process, particularly in the idea-generation part of the process (see Chapter 2). With roles assigned, issues raised such as potential competition, market potential and cost of creating products are then assigned to the CMO, CEO and CTO, respectively or, if an issue is seen as critical, then it is assigned to the whole team. Poor commitment is addressed by them, and the mentors will usually apply *positive encouragement*. Ultimately, continual

poor interaction will be handled by the peer assessment forms and the assessment marks allocated to that person in fulfilling their role (see Chapter 3).

- **Presentation development.** The groups are encouraged to start working on their presentation as early in the process as possible, but certainly before the halfway point. In particular, attention is paid to the pain, solution and market aspects as these form the pillars of the pitch in that there has to be a recognizable pain, an innovative solution that can lead to finance creation and a market to suggest that the company will grow.

The teams give a number of dry runs of the presentation to the mentors who give direct feedback, so the groups can evolve their presentation material and their presentational skills. In some cases this has involved encouraging the students to be more dynamic in their presentation, changing when they provide the demo, getting the first engagement of their audience through direct involvement in the presentation and even, in one case, persuading the CEO to not be involved in the presentation. This is an essential part of the development of the presentation.

3.10 Conclusions

The purpose of this chapter was to outline the process by which the teams create the presentation material that becomes a key part of their pitch and more specifically describes using an example, the NISP CONNECT template presentation. This has been identified as an excellent outline that covers most scenarios. The need for the presentation is introduced at as early a stage as possible in the exercise to ensure that the teams concentrate their minds on the business opportunity. This is very important to do, as it has a major influence on the choice of their product.

The material was demonstrated using a template presentation for business pitches and reference was made to two other presentations that had been carried out by students in different years. Generally, the result has been the creation of material that stands up well to scrutiny on presentation in a *Dragon's Den* environment.

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Creating an Effective Business Plan

Roger Woods

PURPOSE

A core part of creating a business is the production of a convincing business plan that reflects the product, the market and the company potential. The importance of the plan is stressed early on. This chapter covers an outline of the ‘problem’, the ‘need’ for the company and associated products. It includes company personnel and proposed roles, location, mode of operation and also finances and strategies for protecting the product from exploitation and marketing.

TOPICS

- Preparation of a business plan outline
- Development of convincing financial plans
- Identification of the product market
- Competitive analysis and marketing strategy

The chapter is organized as follows:

- Section 4.2 describes a **business plan template**.
- Section 4.3 shows how to give a clear impression of the **team** and **company**.

- The **product** and its **uniqueness** are highlighted in Section 4.4.
- Aspects of **creating the company** are then emphasized in Section 4.5, along with **market and associated issues** in Section 4.6.
- The key issues of how the product compares with **competitors** are given in Section 4.7, with **marketing analysis** covered in Section 4.8.
- In Section 4.9, a brief treatise on the presentation on **finances** is outlined.

A core part of creating a business is the production of a convincing business plan that reflects the product, the market and the company potential.

4.1 Introduction

The creation of the business plan is a critical part of the student's activity and indeed their assessment depends heavily on it (see Chapter 13). It is critical to highlight to the students early on the importance of creating this plan, and how it depends on the decisions that they make. To perform well, the groups need to produce a terse business plan, which appears to be bursting with detail and which captures the reader's imagination for the product. At the same time, however, they should ensure that it does not bore the reader with unnecessary detail; thus, the selection of the relevant material is vital.

There are many other texts and online resources illustrating to readers the key features in producing a business plan. In addition to these, this chapter acts to provide a motivating backdrop for groups of engineering students in order to allow them to generate a convincing document that will act to interest possible investors. It is written from the engineering student's perspective and will tend to emphasize those aspects identified by the mentors. The students are encouraged to think about how to attract possible investment and thus concentrate on commercial potential rather than engineering innovation; the authors feel that this has not been the focus of any practical coursework to date. An outline is described which has been created through numerous interactions with previous Industrial Project student groups. Therefore, the reader is encouraged to treat this only as a starting point for their own work and to place their own emphasis on developing their outline in discussion with their mentors.

'A business plan is like a dry run to see if there is a major problem with your business before losing any money'

Mike McKeever, author of *How To Write A Business Plan*

Based on the review of the many plans to date, it is clear that the emphasis is centred on the proposition being promoted and on feedback from the reviewers of the commercial pitch, as outlined in the previous chapter. Concerns highlighted include a lack of need for the product, a limited understanding of the product potential and concerns about the market, to name but a few.

4.2 Business Plan

Engineers tend to get really excited by technology and its potential to make new products. This is not surprising, given the ‘application of science’ role that is central in many engineering courses. However, an interesting product does not make a business and the mistake of starting with a technology, a solution and then trying to realize a product was highlighted in Chapter 3 as being flawed, since it may not end with a successful business. As emphasized in the previous chapter, it is better to start with a customer pain and then derive a technological solution using the relevant technologies. When this process has been achieved and the groups have developed their presentation, then they will be prepared for producing the business report.

‘For these engineering teams, it is better to start with a customer pain and then to derive a technological solution using the relevant technologies’

Steve Orr, Northern Ireland Science Park

If you consider some innovative companies like Facebook, how could Zuckerberg and colleagues have convinced the investors of the need for people to interact as this concept was only emerging? The initial Facebook prototype that allowed ‘rating of how good looking people were’ made a more convincing argument than any business plan. The teams are actively encouraged to challenge their concept and product to identify the possible weaknesses and use this analysis to focus effort in the preparation of the material.

A good example from previous years’ assessments is the Nutrifit team, who developed a health product for children. They clearly wanted to take advantage of the current concerns about obesity, and dedicated much of the report to emphasizing the considerable EU and World Health Organization data which suggested that the product could have a massive impact. They also emphasized the concern of the main customer, i.e. parents, who are deeply involved with their children’s welfare.

The activity of putting the business plan together is an interactive process, usually between a number of the team members mainly associated with this activity, namely the CEO and CMO, with some feedback from the mentors. The result of an initial interactive process is a detailed business plan outline which gives details of the core section headings, subheadings and a general estimation of the length and quality of content. Typically, the final business plan document should be no more than 40 pages, expanding to possibly 80 pages with associated appendices.

4.2.1 Business Plan Outline

A suggested business report template is given in Table 4.1. Its creation will most always be led by the CEO, with the main aim of being able to convince the reader that the group have

Table 4.1 Suggested core sections for business report

Points	Comment
Executive summary	Critical part of the report. This text highlights the ‘whole shebang’ and acts to excite the reader. There is some debate on whether to have this as a short and snappy section or a two-page detailed treatise.
Company	The presentation of the company has to be classy and professional as this will create an impression. Typically, with many hi-tech businesses, the personnel is key although this is less convincing given the students’ status. However, the work experience of students can be brought to bear in strengthening the case for their product.
The business	This will usually include the product and services and sometimes can be titled as that. The teams need to outline the pain that is being addressed and show how innovative their solution is, by showing its uniqueness. Teams are encouraged to have a subsection on this specific topic. They are also encouraged to think of a range of products, and discuss their future ones in reasonable detail.
Business strategy	One of the ‘pennies to drop early’ in the exercise is that the students realize they are creating a company and not just a single product! They must therefore demonstrate the company strategy, that they will adopt for selling their product. Also, they want to show the five-year plan and what the company will be at that time. In addition, they need to consider how they intend to price their product.
Market	Identifying a market from which they will generate sales and therefore income is critical. The groups will spend a considerable amount of effort in firstly identifying the correct market and then generating realistic data from dependable sources. This will also involve key market segments and trends.
Competition	This will include direct and indirect competition and usually results in a comparison table with highlighted features against the nearest competitors.
Finances	Finally, the groups need to generate key financial figures. They are usually encouraged to include summary data in the form of profit and loss, breakeven analysis and balance sheet and to back this up with detailed figures in the appendices.

considered all aspects of the setup and establishment of the startup company. In particular, the report needs to address the following points:

- The outline of the ‘problem’ or the ‘need’ that the company and associated product(s) are attempting to address. What is the key differentiation of the solution? Why has it not been proposed before? What innovations come specifically from the engineering background of the groups?
- The proposed solution described in layman’s terms, aimed at a non-specialist reader. It should highlight particularly the novelty of the approach adopted and the innovations exploited.
- The creation of an actual company, outlining the personnel and proposed roles, the proposition for its location and mode of operation. Also an outline of the work undertaken to date to validate any aspects of this, including registration of a website and website development.

- A detailed outline of the finances, highlighting how the company will operate profitably, how income will be generated, and how, why, when and where the investment will be obtained from customers to ensure successful commercial operation. The plan should give a decent estimation using tables, wherever appropriate, of initial actual or projected costs.
- What is the strategy to protect your product from exploitation by others? How has IP been protected? Have costs been included to cope with this?
- How do the group propose to undertake the marketing? What are the key challenges and how do the group intend to address these practically? What level of primary/secondary marketing has been undertaken? Outline this initial evidence without being boring!

‘If, after reading those first few lines, I still don’t know what they’re doing, that’s not a good sign. You have to tell me in a few lines why you have a competitive advantage in whatever market you’re going after, because I need to know why you’re going to win. Most plans don’t do that.’

Jim Casparie, Chief Executive of The Venture Alliance

Based on our experiences of previous groups, the sections given in Table 4.1 have been proposed for the initial report plan but please note that the selection and order of the topics chosen by the various groups will differ from year to year. It really depends greatly on the specific product/services and/or the company being proposed. We have refrained from providing a fixed framework but obviously topics such as market, finances, company, etc. have to be addressed in some form or other.

TRY THIS

At a very early stage in your assignment, generate a business plan outline and pass it to your mentors. Identify what portions of this resulting outline will need more work because they are weak. Also, what are the aspects that will need more work?

4.2.2 Executive Summary

The executive summary is vital as it sets the scene for the reader about the product and general proposition. It could even be said that this section has the biggest impact in making up the reader’s mind as to whether he/she is excited by the product and/or company. Therefore, due attention should be paid by the team to ensure that the text is slick and succinct; at the basic level, it must highlight the pain, the novelty of the solution and give some impression of the financial potential of the proposition.

There are two mindsets with regard to the summary:

- **Make it short and snappy.** In this scenario, the author will need to highlight the pain, then the novel solution plus give some brief comments on the possible income generation and profit; it quickly gives the reader a clear goal of what can be achieved.

- **Detailed executive summary.** This gives a more extensive description of what has been achieved. It provides a more detailed description of the problem, the pain and a more defined argument for the market and possible profits to be made. It may highlight other aspects that may be relevant, such as particular market trends that will be addressed, future product roadmap, etc.

Think of the executive summary like an elevator pitch and quickly highlight all the important stuff, such as communicating your value proposition, how it will make money and why customers will want to pay for your product.

The authors are cautioned that this will be the first thing that the reader will examine and could possibly be the only aspect of the report covered. Thus, it is critical to make a very positive, first impression. However, some teams have left the executive summary to the end and not spent the necessary time on it. Whilst the mentors advise the groups to leave its preparation to the end, they emphasize that due care and attention be given to its preparation. It also helps to be dramatic, capturing the reader's attention in the first few lines.

In their abstract, the Noctua team who developed the application for nightclub entry suggested that they were about to reveal a product that would revolutionize the nightclub experience and give nightclub owners a competitive edge in attracting new customers.

Other aspects that teams have sometimes utilized include:

- **Keys to success.** A number of statements characteristic of the opportunity and directing the reader to see the positive aspects of the document.
- **Financial figures or even graphs.** Advertisement of the key aspects of the proposition, namely company turnover and the profits that may be earned from the proposition.
- **Mission statement.** A clear, succinct statement outlining to the reader the group's intense desire to create a viable company. This can help present an image of professionalism, which is important for the credibility of the student group.

The Nutrifit team highlighted the considerable body of evidence on childhood obesity. This is a strong driving force which can be exploited to make parents feel a little guilty and encourage purchase of their product (rightly or wrongly)!

In many cases, the mentors have encouraged the team to put their own 'personal stamp' on the report and thus there is no real standard approach to producing it as long as it includes the

correct and necessary information in terms of team, market, sales, finances, etc. Thus, many of the reports have varying executive summaries.

4.3 Company

A key aspect of the report is to give a clear indication to the reader/examiner that the company has been fully considered and has either been created or is on the verge of being so. This will come about from creating a clear company identity and should include the company naming, image and the initial marketing material. In some instances, this can even involve the creation of a company web page or, as in the case with one team recently, the creation of business cards and personalized information for investors. This created a powerful impression at the pitch session but there is probably a sensible limit to which the team can go with regard to first impressions.

The groups must understand at the earliest stage possible that their proposition must be very convincing. Therefore, details about how the company will be formed, how it will operate and its organization are vital.

It is often said that most investors will look at the quality of the team as a key investment criterion, particularly for larger funding rounds. Of course, this is something of which the student groups are particularly conscious, as apart from possibly a year's placement in an engineering company they may be largely inexperienced in business. To this end, previous teams have created advisory boards and populated these with experts with the necessary expertise and even, on occasions, persuaded the mentors to have some involvement.

On many occasions though, and certainly in two of note, the relevant experience of the teams has had a major bearing on the development of the product and in this sense, represented important background knowledge to encourage the reader's/investor's faith in the team. Certainly, the performance in the presentation has had a major impact in convincing investors of the team's enthusiasm and energy in pushing the product. In cases where the team have limited or no experience, this becomes a challenging section to write.

Many companies will depend on the relevant business and/or technical experience of the team forming the company.

Some groups have also highlighted aspects of *strategic alliances*. It is remarkable that in the short space of time that these student teams have to investigate their project ideas, that they are able to develop strategic alliances either through personal family contacts or through connections established by the course mentors or specialist experts, many of whom have contributed to this book. This greatly impresses the panel of potential investors, as it demonstrates a clear

understanding of the importance of getting your product to the correct customer and also the importance of sound guidance. It has had a major bearing for the student companies that have entered competitions for startup funding.

4.3.1 Team

Many hi-tech companies are valued on their teams. Indeed, in some instances in Silicon Valley companies are sold on the basis of the value per specialist engineer, which can be as high as \$1,000,000. It could be argued that this is less so for the companies being created here, but it is still important to list the team members in the report and emphasize their industrial expertise if applicable. To some extent though, the team are disadvantaged as they may have limited experience to date. In many cases the students have included short bios and even pictures to personalize the document.

4.3.2 Branding

Depending on the product, branding can ‘make or break’ and so the groups are encouraged to consider this aspect carefully. In the past, groups have paid different levels of attention to this aspect depending on the nature of their product. For example, the Nutrifit team who were developing the good health product spent a considerable amount of effort not only on the company branding but also on creating a computer-based animal as the plan is that the children would become attached to this product and would need to like it. For this reason, they expended considerable effort in creating these animals and employed artists to create the visuals for their first set of animals. As a matter of course, they also developed a full company logo and branding.

The Buteos team product was very much a practical product with little ‘emotional’ attachment as above. However, they planned a complete branding activity based around the Latin name for the common hawk, which could be deemed to have an ‘eagle eye’ and which highlighted the focus for the product. This would probably not be obvious to the ordinary customer, but it does present a level of detail to the investors.

The teams are encouraged to pay attention to the image for their product and encouraged to consult with designers as needed. Indeed, some funds are made available to allow the students to get experimental design work undertaken. The branding has a particular influence for the groups in their presentations.

TRY THIS

Outline a strategy and timeline for the company and its growth. Using Excel, determine the staffing levels at different years and highlight key events such as major rebranding activities.

4.4 The Business

In many cases, the groups present their products and/or services in the business section and they may also highlight operational aspects there. At the end of the day, it is an essential section as it outlines what the company is going to make money on. The mentors indicate to the teams that the choice of title (i.e., *business* or *product*) will depend on which they view as more important. In most cases, it is based around the potential of the product rather than the company, given the level of career development the students are at.

The section is usually organized as follows, with some variation:

- products and/or services
- unique features
- future products.

4.4.1 Products and Services

This describes the business or service that the company acts to provide. In many cases, companies can be set up to provide a service for prospective customers either as a specialist consultancy or something as simple as providing special equipment setup and maintenance. The groups are encouraged to develop a product as this represents a more natural outcome from an engineering-based team, and is seen as something that is immediately transferable from an investment point of view. In a service company, expertise usually exists within a small group of people and the investment is at risk if the core team leave. This can be overcome by the investor through tying the founders or specialist staff into the company for a number of years when making a major investment; however, staff can be resentful of this arrangement.

A product is seen as a more natural outcome from an engineering-based team and represents a less risky investment than investing in a 'service' company, as this will depend on the quality of the staff rather than the product.

This section of the report usually starts with a brief reminder of the product need and then the specification of the product or range of products. It is important to highlight to the reader the existence of any regulations that may need this product; a good example is the XPressLF team (<http://www.nisp.co.uk/top-10/>) who have developed an innovative tyre pressure monitoring system (TPMS) activation tool which directly addresses European legislative changes that will be introduced in 2014. This creates a very strong case for the future market. In other cases, it would usually be a case of quoting the total market potential with some idea of geographical targeting. This would be done in detail in later sections of the report, but would need to be alluded to here.

The groups are also encouraged to either have a range of products or, if they are a team with a clear idea of a single product such as Buteos, to have a clear idea of future products.

They should clearly outline the need and market for such future products, even though they will not have the same level of detail as that given for the first product. In many projects, the groups are encouraged to have a strategy for future products, in case the analysis by the panel of the initial product reveals any issues with the ‘single-trick’ solution. This will usually take the form of a documented section outlining the strategy for the development of the range of products.

The Noctua product comprised three parts, an RFID tag worn by the user allowing access to the club via a VIP entrance, an RFID reader to be used by the nightclub owner allowing them to scan the RFID tags and a website which collated nightclub attendance by users. They needed to clarify that the RFID tag is worn by the nightclub attendee (i.e., the customer’s customer) and the RFID reader is used by the nightclub owner (i.e., the company’s customer), who needs to seek the information from the company’s website regarding the success of their night. This information is where the money is made.

In some instances, the business case can be supplemented by the provision of a service to back up the sale of the product. In some cases, this is a powerful argument for continued revenue generation using this approach for the sold product, but the teams are cautioned with regard to the earlier arguments regarding viability of service versus product.

In other instances, the product can be more straightforward or obvious, such as in the case of Epsifon’s Texalate product which was essentially a smartphone application or in the case of Noctua’s Oculus product described in more detail in Chapter 11. In these cases, the initial product is clearly the main one with future versions being only a mass-produced version and therefore much cheaper but also better protected.

TRY THIS

Derive a description of the product and use graphics and design drawings to emphasize it.

4.4.2 Uniqueness

A core aspect of the product is the identification of its ‘uniqueness’. This comes from a detailed analysis at the start of the exercise to generate a list of ideas where uniqueness is seen as a

The *uniqueness* of the Buteos product was that their technology did not exist in Europe and whilst a product existed in the USA, tow-bar technology was so different and the technology’s features were so different that it had a level of uniqueness. This is not to say that either products or companies cannot push solutions that are not as unique, it just means that a much more creative case has to be made for the market potential and selling potential.

Usually, teams can come up with one really good product but it must be remembered that groups are creating a company not just a product, so evolution of the product or development of related future products is essential.

critical selling point. Indeed in many cases, the groups have dropped a more mature idea in favour of a possible product with improved uniqueness, as this not only provides innovation but also makes the case of selling and marketing the product much easier. Noctua's product was compelling as, although loyalty schemes and special events were quite common, the idea of relating this to individuals whom they could track but who remained anonymous was unique at the time.

4.4.3 Future Products

One of the concerns is that the student groups create some great widget and do not give enough thought to the bigger picture, that is the creation of the company and the range of products. Groups tend to develop a *one-trick-pony* product that will sell indefinitely without thinking about evolutions of the current products or diversion on the current range of products. Good businesses will usually build the evolution of their products into the future plan of the company and make sure the costs are demonstrated in the financial plans to ensure it is seen that development has been taken seriously.

The more engaged groups will have developed a detailed outline or even a graphical design of their future products. For example, the Buteos team developed an initial near product prototype and then did a detailed specification of the end second-generation product. In contrast, the Epsilon team did not see an evolution of their 'text to txt' speak conversion software, so the future products comprised more smartphone applications.

TRY THIS

Develop a full product design map for the next five years, highlighting the versions of the current product and also the creation of new products.

4.5 Business Strategy

It is important to outline a clear business strategy. It is one thing to have developed an innovative product and a clear market potential, but there have been many examples where this has not been enough. Even the existence of a sales strategy and marketing data is not enough to create a company with a sellable product.

TRY THIS

Thus, it is important for the groups to think about how the company will be organized, how the product will be sold and what the *exit* strategy is. In other words, do they sell within a small number of years or build and expand.

To demonstrate that the groups have considered this, some groups have undertaken a strengths, weaknesses, opportunities and threats (SWOT) exercise as part of their development and in some cases have included this as a section within their report. Of course,

this can be dangerous as they might inadvertently highlight a possible flaw in their approach or by accident identify a market threat. It would probably be unusual in a conventional business report, but is included in this exercise largely to demonstrate that the groups have thought about the proposition and the formation and life of the company. In most cases, inclusion of such material has been noted favourably by the examiners and panel.

The groups are encouraged to think creatively about how they will market and sell their product and then to outline these strategies in their business plan. This will largely come down to the specific project idea. Frankly, the choice of the strategy will depend on the nature of the product. If the product is a ‘first’, then the strategy will be ‘first to market’ and they need a suitable marketing strategy which allows them to capture the ‘lion’s share of the market’. If the group have come up with an alternative product to something that already exists, then more is maybe expected on different marketing strategies to attract their customers. Also, there may be some novel forms of distribution, for example web-based or agreements with shops to market with a suitable percentage cut for the shop.

TRY THIS

For example, the Cibo group who were marketing their dog feeder product felt that they had a competitive edge in terms of the technology involved and also that the product was diverse, allowing the owner to feed multiple dogs and different types of pets.

An example strategy is given next but the reader is warned that this is neither a required list nor indeed a complete one.

4.5.1 Corporate Strategy

This is not something that readily comes to the groups, as they are initially focused on identifying the need for the product, the actual innovative solution, the initial plans and calculation of the profit. However, it is a critical part of the work of the CEO that he/she quickly determines that this is not just a ‘one-trick’ pony and that the groups put together a company rather than just a single product. This involves the creation of a three or five-year strategy.

Many of the groups outline a five-year plan, indicating appointments of staff, development of various products and key financial events such as investments. An example is given in Fig. 4.1, where each line refers to the generation of the product. It gives a good indication of how the

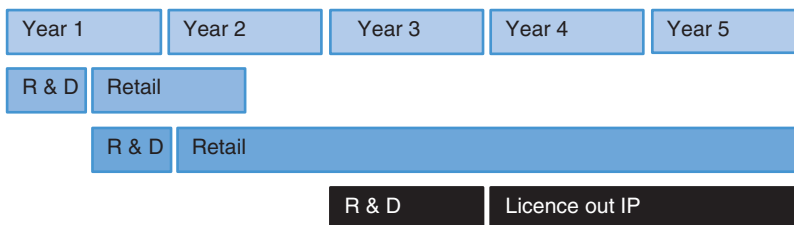


Figure 4.1 Five-year plan

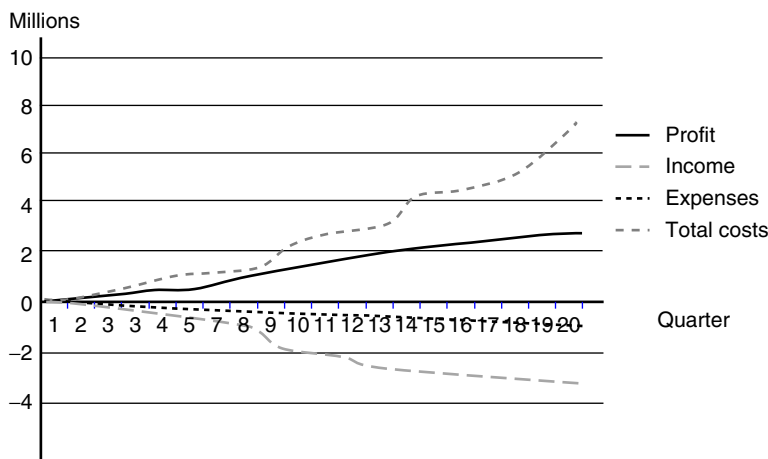


Figure 4.2 Example of five-year finances

product will be evolved and linked to finances. Some groups have populated such diagrams with key events.

Other groups have put together a basic finance graph such as that shown in Fig. 4.2. This gives key financial figures over a five-year period such as the *income*, *expenses*, *total costs* and *profits* and critically, shows the value at five years and any key events during the five-year period that might impact possible investment. Other teams have also used this as a mechanism to show the requirement for possible investments at key points, demonstrating good forward planning on behalf of the students.

TRY THIS

Derive your own business plan and financial chart for the next five years using Fig. 4.2 as a template. Produce a short report with a figure which describes the assumptions made and the key finance events.

4.5.2 *Competitive Edge*

It is probably a wise approach to allocate this as a separate section as it provides a clear indicator that the students know what the commercial rather than the technical difference is in their product offering. However, once they have identified the section, they need to back it up with a suitably developed strategy that holds up under scrutiny. The strategy could be that they have the ‘first developed’ product (which is probably unlikely), however, it could come down to how they have developed the product. For example, the group who developed the child alarm system used a bracelet for the child but then used a mobile phone as the alarm. This meant that parents could easily remember to take the ‘alarm system’ with them but required that they had a charged smartphone; this is justifiable, as it is unlikely given the modern-day need to stay in touch that parents would leave the phone uncharged. This was purported as an advantage over existing solutions.

4.5.3 Pricing Strategy

There may be some pricing aspects that are relevant. For example, the Baccus team who came up with a variation of the RF band for attending nightclubs proposed a loyalty scheme which provided pricing benefits to their members for attending certain venues. They also had a pricing strategy for information that their nightclub/bar customers could access.

This section can also contain information on how the price of the products will vary. For example, the Buteos team had an initial product with a higher cost than the second product, as this latter product was to be mass manufactured and would be much cheaper. Demonstration of a product which is going to have increased profit, even though the cost of the product may have to be reduced in future, is highly attractive to investors.

There could also be a standard volume/cost strategy in cases where multiple versions of the product are sold. In this case, consideration of how the group will provide a reduced cost based on volume demonstrates forward thinking. This will be coupled with some summary of the engineering detail on how to reduce manufacturing costs in order to strengthen the business case.

4.5.4 Sales Strategy

The groups clearly need to show the sales strategy for their product. This will be centred on the marketing strategy and possibly some novel ideas on how to sell the specific product. The key is to choose the right route for the product under development.

The groups are encouraged to be innovative in their approach, given their natural understanding of computing and Internet technologies and appreciation of their impact. This can include online advertising, agreements with major shopping retail outlets, trading magazines, TV shopping channels, mail order catalogues, product demonstrations, customer testimonials, Google Ad words, etc. A lot of this is covered in Chapter 6.

From a financial planning perspective, the groups need to relate the impact and timing of the marketing strategies to determine accurate and justifiable sales figures. This might be shown in the information presented in the finance part of the report (Chapter 8).

TRY THIS

Identify and classify your competition. Using suitably justifiable comparison parameters, derive a comparison table that you will be able to both use in your presentation slides and also justify in the business report in one page of text.

The potential market for your products or services can be defined as the pool of consumers or businesses who would consider purchasing them.

Shawn O'Connor, *The Launching Pad's Small Steps: Big Leaps*, Forbes

4.6 Market

It goes without saying that the market for the product is important. The marketing section should be clearly focused and authoritative, so that it backs up the business case. It should demonstrate a number of features:

- **Detail.** This will give the impression of thoroughness, but the report should not be more than 30 pages so the trick is to highlight key figures in the main report and either use multiple references or appendices to demonstrate the thoroughness of the material.
- **Properly sourced.** It is important to stress to the groups that using Wikipedia and weakly sourced reports can have an alarmingly negative impact on the reader. The authors are encouraged to use recognized sources such as Frost and Sullivan or Gartner if possible, although it is sometimes difficult to access these detailed reports without cost implications. However, you many find that some local investment agencies (in our case, InvestNI) will give access with limited, regulated reproduction rights to some of the more detailed reports. This can also include surveys conducted by the team with prospective customers that have substance as they have been carried out in a reliable manner. Trusted sources of information are vital to back up the analysis.
- **Correctly targeted.** It goes without saying that data and analysis is only useful if targeted at the right area. There is not much point in producing an animal feeding product for dogs and cats and then giving loads of information on the full range of pets including birds and goldfish! There is a major temptation for groups to fill up reports with irrelevant information, but this just acts to turn off the reader.

There are a number of key marketing aspects that should ideally be considered, but this is not prescriptive:

- market definition
- key market segments
- market trends
- target market.

Chapter 6 gives a detailed treatise on key market issues and how to gather the necessary information.

Seek out market information from either industry associations, Chamber of Commerce, government agencies, census data or even from other business owners.

4.6.1 Market Definition

One of the challenges for the groups is to identify the correct market and what segments are relevant. This may seem relatively straightforward but it really comes down to correctly

identifying your customer. The correct choice is vital in influencing the reader to believe that the group has correctly identified the market, as this helps to convince them that there is a market. This has a knock-on effect for the sales and marketing strategy.

Cibo, who were developing the animal feeding product, were particularly focused on their market. Is their market related to the number of pet owners? Well probably yes, as this will give a figure for the total market. However, who will need the product? The elderly/retired? The young executive? Probably, anybody without the time to feed their pet would need this. Also, where would the market be for this? They cleverly identified their product as an 'accessory' and then focused on the existent impressive growth, even during the recession, of pet accessories and their owners' continued interest in their animals.

4.6.2 Key Market Segments

The group's product can be targeted at one segment of customer. If the reader/reviewer suspects this, the team should have sufficient evidence to back it up. For example, the Cibo group targeted pet owners, in particular cat and dog owners, and would need to highlight that particular market to show they have a business. They gave details of pet owners and then gave detailed information on dog/cat owners.

What has real potential is the creation of a market due to changes in legislation. The XPressLF product was responding to European legislative changes on tyre pressure monitoring.

4.6.3 Market Trends

It is important to demonstrate the market potential. This can be done by indicating a market trend. The XPressLF team's business case was built around the notion of a market trend as the change in EU law meant that there was a definite need for their product, with the new EU regulation due to start in 2014.

4.6.4 Target Market

Whilst the previous analysis may help to indicate the potential for the product, the teams must indicate clearly their target market and relate it to the sales figures that they will generate later in the report. This is a feature that comes to the fore earlier in the exercise as a good product is one thing, but a potential market is what makes the company viable.

4.7 Competition

To demonstrate awareness, the groups will usually include a section highlighting the competition. This can include both direct competitors who have a product which can be judged to provide an alternative solution to your customers and products that might in some indirect way provide competition. For example, a tablet can be used as a camera and therefore provides indirect competition to a digital camera, although you might not initially view a tablet as a camera.

‘The identification of a key competitor particularly a major supplier can be a killer for a business proposition and the groups have to do their homework well to ensure that they don’t get caught out.’

Graeme Roberts, Icon Containment, Proform, Oakridge, GTRNI and GS Smoothies

4.7.1 Direct Competition

Even though many of the groups derive a *new* product, it is highly unusual if there is not some alternative product that cannot be judged to be competitive in some way. For example, the Cibo team highlight a number of feeder products as their *direct* competition and standard feeding bowls that dispense food as their *indirect* competition.

The most presentable means of doing this, both in the business report and in the pitch presentation, is to develop a table for comparison; a brief outline is given in Table 4.2. The competing products would usually be listed vertically and then the chosen features which are both deemed to be important for comparison purposes and show the product in favourable terms against the competition are given horizontally. Sometimes, this provides a dilemma for the groups as they seek to choose features which present their product in a good light rather than present the true comparison. In addition, they sometimes look to price their product as the cheapest, but this needs to be a well-judged call, as some features may be critical and not available or supported well in other competitors. Thus, it should be an ‘appropriate’ price that gives a reasonable profit but also sets itself well against other competitors.

An example slide was given earlier in Fig. 3.8; the slide presents a highly technical product so most of the comparison factors are technical, whereas groups have tended to choose operational

Table 4.2 Product comparison table

	Feature #1	Feature #2	Feature #3	Feature #4	Price
Competitor #1	Fully	Partially	Not covered	Partially	\$90
Competitor #2	Fully	Partially	Not covered	Fully	\$180
Competitor #3	Fully	Fully	Not covered	Fully	\$240
Company product	Fully	Fully	Partially	Fully	\$90

features of the products including *essential* and *would-like* aspects. The choice of key features tends to govern the level of comparison, so the groups are encouraged to make sensible choices.

4.7.2 Indirect Competition

It is a positive aspect that groups include direct competition, but it is also important that groups highlight the full range of possible competitors, as this gives readers confidence that the groups have been considering the widest possible range of competition. In the case of the Buteos team who were developing the towing camera, they listed parking sensors as a possible competitor. Although this technology had not been designed directly for this purpose, it could be envisaged that the user may use it as some crude form of guidance for trying to reverse their car near the trailer.

4.7.3 How We Compare

It is important that the groups indicate how their technology compares, and they may add a dedicated section to illustrate this. The section will usually comprise a table such as that outlined in Table 4.2.

4.8 Market Analysis

Identification of a potentially large but relevant market is a key activity of the business effort by the team. This should have taken place at the early stage of idea generation, as an exciting or potentially great product without a key market must be eliminated at the ideas stage. When this happens, it is disappointing for the teams. For example, many of the teams recently came up with a concept for an alarm system for slurry tanks, an issue which was highlighted by the death of a well-known Ulster rugby player and members of his family. Sadly, the groups were discouraged from developing this idea further as the market potential was limited and the requirements to ensure it was fail-safe were deemed too risky and time-consuming for the project teams, given the time that they had to complete the exercise.

4.8.1 Market Growth

The marketing analysis needs to be well sourced as it provides the cornerstone for any sales projection for the product. The analysis usually highlights the volume of possible customers, and can give market sizes in terms of country profile, etc. It should be clear that the market data is relevant to the product under consideration. For example, the Buteos team presented information on cars with tow bars and the geographical breakdown. Similarly, the Cibo team with the pet product looked at dog and cat owners based again on totals and then geographical breakdown, but also gave potential markets for animal products.

4.8.2 Position

The positioning of the product is important as it is central to setting the price for the product, it is not just a case of working out the product cost and then increasing it by a fixed margin to

provide a product; this is what some teams have used as a mechanism to determine price, but it shows a lack of business acumen. Determination of the product price can be connected to the possible cost of not using the product if, for example, it was a safety product. It will also give some insight into how the product should be marketed and sold.

4.8.3 Pricing

Possibly because of their own economic situation, the student teams tend to assume that the product will have to be as cheap as possible and certainly cheaper than their competitors' products. However, the groups are quickly made to realize that price needs to be based on capability, uniqueness as well as profit achieved beyond the cost to manufacture the product. Thus, the groups will usually undertake a competitive market survey, either on products that compete directly or on the pricing of a product for a similar market.

There may be a number of prices, the first calculated on the costs of assembling the prototype and an estimated judgment for how these costs would be adjusted to reflect manufacturing volumes. In addition, groups have then gone on to calculate the cost of a possibly mass-marketed project by even going as far as contacting manufacturing sites as far away as the Far East. Justification of this preliminary work is usually substantiated by including the formal quotations in the appendices.

4.8.4 Sales Strategy and Projection

A critical aspect of the business plan is to do a justifiable forecast on sales. This is done in various ways depending on the product. Typically the groups have identified a market and then acted to take a share, the size of which depends on the sensible expected share. This depends on a number of criteria including the mechanisms by which the product is sold, for example direct marketing via the web or indirectly by third parties (see Section 6.7), and also the geographical strategy.

The groups are also encouraged to develop a strategy for product sales that considers various forms of external influences, geography, trends, etc., many of which are covered in Section 6.4. Projections of sales must be included and justified. This will form a key aspect of the finance figures, and will also form the sales forecast (see Section 8.6).

4.8.5 Distribution

The distribution section should outline the strategy to distribute the product. For example, are the group using a packaging and delivery company? Do they have an online strategy, in which case this will have to be backed up by a distribution network. Of course, this can be made easier by having a key relationship with a major distributor or high-street company (if such a relationship can be developed).

4.8.6 Advertising and Promotion

Once again, this is a section which the student groups may be expected to have under-appreciated. However, given the technical background of the engineering students, the

groups are in a highly advantageous position to avail themselves modern communication technology. In many business reports, student teams have developed innovative strategies for advertising and promoting their products.

The teams will be expected to have checked whether there are specialist trade magazines in which they should be advertising and also whether there are dedicated shows at which they should have a presence. A strategy that uses both social media and more conventional mechanisms works well.

4.9 Finances

‘Money is like a sixth sense – and you can’t make use of the other five without it.’

William Somerset Maugham

The financial planning of the project is something that some teams struggle with, not because of lack of mathematical skills to undertake the generation of the tables but because of the lack of initial training on many engineering courses. There are a series of graphs that are essential in any business plan, as outlined in Chapter 8. The groups are encouraged to spend considerable effort in generating the necessary level of detail, in order to create figures which can be stress-tested by any panel of investors. However, rather than include them in the main report, the groups are encouraged (where appropriate) to use appendices with summaries in the main report.

The key sections in most reports should include:

- costs
- breakeven analysis
- profit and loss accounts
- balance sheet
- performance ratios.

Other aspects that may be relevant include:

- bill of materials
- overheads
- marketing budget
- staffing and wages
- fixed asset register
- business debtors and creditors
- bank accounts
- projected sales
- grants.

4.9.1 Costs

The students are encouraged to think of a series of financial aspects in addition to the expected financial figures outlined above. This can include:

- **Bill of materials.** The concept of generating a bill of materials is a well-known approach in engineering and gives details of how much it will cost initially to develop the prototype/first product and then in the longer term, the more mature product. This can be included in the appendices but gives the reader confidence that a detailed study of the practical costs has been considered.
- **Overheads.** This includes looking at startup costs, which can be the costs of registering the company, registering a website, headed stationary or travel expenses for the sales teams. Again the teams are encouraged to be as detailed as possible, to give an accurate forecast of the financial plan.
- **Marketing budget.** The groups are encouraged to work out detailed costs for directed marketing techniques, including features in specialist magazines, attendance at various trade shows, online marketing tactics and Google Adwords. They are encouraged to contact publications and trade shows to gauge costs and potential market sizes and reproduce these figures in the report.
- **Staffing.** The importance of staff costs in the overall figures is emphasized to students, and the groups need to consider these in detail. The initial confusion is that all of the teams assumed that five or six members needed to be actively contributing to the company, but that is not the case. As Table 4.3 shows, only two or three of the partners need to be involved and can draw a modest salary as they are investors and would survive on minimal money. Also, there needs to be a clear understanding that sales is key and there should be an increase in these resources as the business plan develops (see Table 4.3). There may also be specialist staff, such as technicians or warehouse managers, all with different salaries depending on expertise.

‘Everyone misunderstands cash flow. People think that if they plan for [accounting] profits, they’ll have cash flow. But many companies that go under are profitable when they die, because profits aren’t cash.’

Tim Berry, President, Palo Alto Software

4.9.2 Breakeven Analysis

The company must be able to show that it is able to break even as soon as possible and then be able to show where profit is being made. In some scenarios this may be based on income or in

Table 4.3 Example staffing table

	Year #1	Year #2	Year #3	Year #4	Year #5
Three partners	£45,000	£52,500	£60,000	£75,000	£30,000
Engineers	£25,000	£25,500	£52,000	£53,000	£54,000
Technician	£16,000	£16,500	£17,000	£17,500	£18,000
Sales	£30,000	£32,000	£68,000	£72,000	£114,000
Admin	£15,500	£16,500	£16,000	£16,500	£17,000
TOTAL	£131,500	£143,000	£213,000	£234,000	£233,000

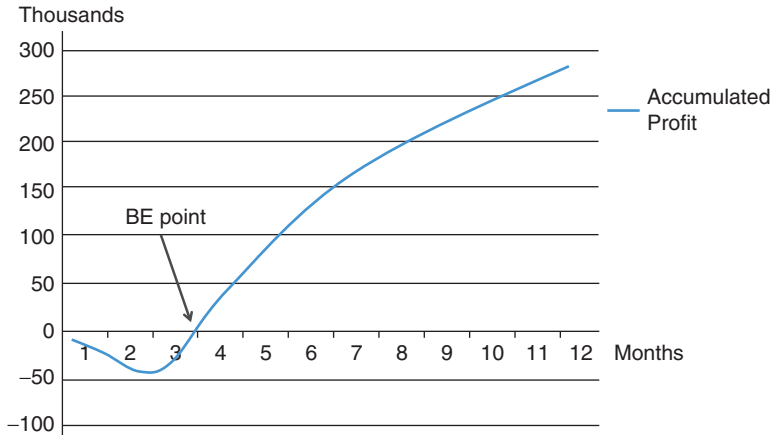


Figure 4.3 Breakeven analysis from profits example

the case of a product based on volume of sales such as in Fig. 4.3, will show how the company will break even based on a detailed cost analysis after 3.5 months. In many cases the groups will do ‘worse and best’ case analysis.

4.9.3 Profit and Loss Accounts

The graph in Fig. 4.4 outlines the basis of profit and loss. It will include core financial data that has been generated based on realistic predictions and detailed data as developed earlier. This graph is critical and should be backed up with data from the appendices, in order to demonstrate that it has been created based on sound data and in a professional manner.

‘No one ever achieved financial security by being weak and scared.’

Suze Orman

4.9.4 Balance Sheet

Balance sheets should be created for years #1 through to #5 (see Table 4.4). Current assets will include stock and cash, and debtors should be incorporated. Financial considerations such as balancing this with share capital reserves, etc. and profit and loss accounts will then complete the balance sheets. This is covered in Chapter 8.

There are many performance metrics that can be used and some are given here. Think of the one that best matches your business requirements.

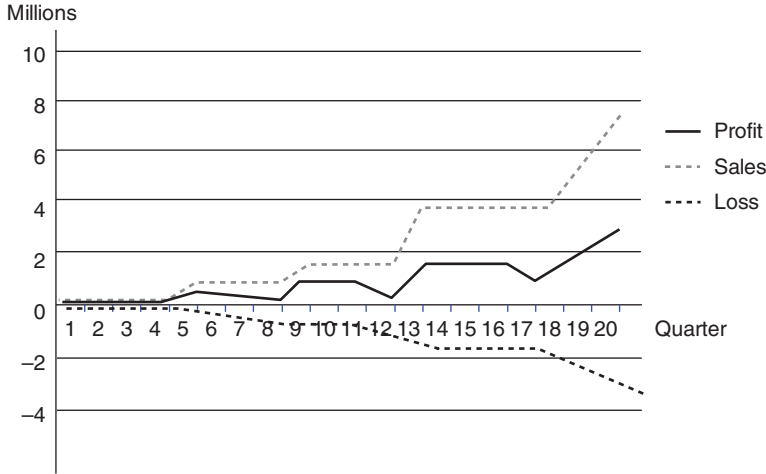


Figure 4.4 Profit and loss graph

Table 4.4 Example balance sheet table

Total Assets	
Year #1	£70,000
Year #2	£1,238,000
Year #3	£3,780,000
Year #4	£9,540,000
Year #5	£18,700,000

4.9.5 Performance Ratios

Chapter 8 outlines a number of performance ratios and the groups would ideally want to demonstrate some of these ratios in the report. A typical chart would look like that given in Table 4.5. Each of these groups will carry this analysis out to different levels.

Don't think of your business plan as a task for seeking funds but treat it as a live document which evolves as the company grows and changes. Planning is a continuous process; after all, 'plan' appears in the title!

4.10 Conclusions

The purpose of this chapter is to outline some of the key aspects that need to be included in a typical business plan. The elements covered are not prescriptive but give a range of topics that should be considered in the business case analysis undertaken by the students. With experience

Table 4.5 Profitability ratios for five years

	Year #1	Year #2	Year #3	Year #4	Year #5
Turnover growth	n/a	371.59	152.82	97.22	35.69
Gross profit margin	41.44	52.99	51.89	57.91	59.33
Net profit margin	4.08	31.97	36.62	46.96	49.27
Return on capital employed	33.35	1,231.43	3,565.71	9,017.61	12,838.31

of the submissions to date, groups have modified their plans and emphasized different aspects based both on their products and also on the group's opinion as to what they identified as important. This is a critical aspect of the work and, where possible, we attempt to ensure it stands up to scrutiny and can be compared with professionally prepared business plans.

It is clear that the generation of some of this material is not an inconsequential activity and also may require other skills sets. Over the past three years, it has become clear that the groups have required exposure to expert advice on a variety of topics, namely branding, marketing, IP and finance. For this reason, the next four chapters (Chapters 5–8) are dedicated to covering these topics and have been created by experts.

References

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Brands that Connect Create Differences that Matter

Gillian Colhoun

PURPOSE

Using examples throughout, this chapter tries to capture how to brand your product effectively and discusses usefulness, credibility and trust. The creation of taglines is also covered.

TOPICS

- Introduction to the concept of branding
- Aspects of trust derivation and discussion of customer pain
- Guidelines for product naming and visual aspects of branding

The chapter is organized as follows:

- After a brief introduction, the importance of **branding** is covered in Section 5.2.
- In Section 5.3 the process of branding, including **creation** and **validation**, is covered.
- The key points or **secret sauce** are then outlined in Section 5.4 using examples.
- Understanding why your product is **world beating** is covered in Section 5.5.
- Sections 5.6 and 5.7 cover the process of **naming** and taglines and branding, respectively.
- In Section 5.8, visual branding aspects are covered.

Before sitting down to write this chapter, I had lunch with a friend who also happens to be a very experienced branding professional. Whilst talking about different projects that we were working on, I mentioned I was writing an academic text on branding. My friend laughed and asked, ‘How many words?’ I responded that, ‘I’m tempted to go with three – tell the truth’. She laughed again and said, ‘Nope, much better to go with eight – tell the world what it wants to hear’. We were only half joking, but she made a good point. If you can inspire people to do things that inspire them, then the potential for achieving extraordinary things increases significantly.

Given that this chapter is aimed mainly at students developing new products, probably of a very technical nature, I believe this is a maxim that still holds true. Branding can be an overwhelming subject to jump straight into, particularly if an individual feels they have no experience, aptitude or inclination to do so. The truth is that everyone engages in branding. The exciting thing about brands is how they are capable of tapping into a person’s psyche and making a connection that motivates a change in behaviour.

The truth is that everyone engages in branding no matter what their product or service is – they must do so in order to make a successful product.

Motivating change isn’t easy. People resist it at every turn, sometimes consciously but mostly unconsciously. Which is why asking this corporation or that person to take an interest in what you’re up to is a big ask. Creating a strong brand can certainly ease that process. In a world where consumer confidence is low and budgetary vigilance is high, it takes a lot more than *bells and whistles* (i.e., features) to separate one product idea from another. What you need, right from the start, is a defining purpose.

A company that looks at its brand and asks not simply what promise does it make, but what purpose does it serve, to its customers and shareholders, and brings this purpose to life through every customer experience, will be the company most likely to beat its competition.

5.1 Introduction

The word ‘brand’, and its many meanings, has come a long way since the days when landowners burned an indelible mark of ownership on their livestock. Today, the word is used in many different contexts. For some it conjures up assets like intellectual property. For others it is the unmistakable curve on a bottle of Coca Cola. For many more, a brand is something that we buy into, emotionally and rationally. This could be a community, as in Twitter; an attitude, as in Nike; a belief, as in Christianity; a personality, as in James Bond; a sound, as in the roar of

a Harley Davidson motor cycle; a reputation, as in traffic wardens; or it could be a value like safety, as in Volvo cars.

In fact, experts have gone as far as characterizing a brand as a holy trinity – a promise, an experience and a memory. Others have called it a gut feeling. The truth is that the best brands are probably a combination of all these and more.

This multifaceted nature of brands makes it a tricky thing to put a neat fence around. Easier perhaps to say what it isn't. A logo is not a brand, although it is an extremely important expression of one. You cannot feel a logo, nor will it make you buy something. Some marketers believe that by creating a unique name and logo for a product they are creating a brand. These symbols are virtually meaningless if they do not reach out to users with some kind of connecting force.

A brand is not advertising, although it too can express many of its attributes; neither is it puffery, steam or compensation for a poor product. A brand rests firmly in the hearts and minds of its users, consumers and audiences.

'It's not what YOU say it is – it's what THEY say it is. The best you can do is influence it.'

Marty Neumeier, *The Number One Strategy of High-Performance Brands*

Here is an example. Close your eyes and conjure up the stars and stripes of the US national flag. Consider your attitude to the flag if you were an Afghan freedom fighter versus an American soldier about to embark on his first tour of Helmand Province. It's not that these people feel passionately about the colours and particular arrangement of shapes on the flag, it's what the flag stands for that compels them to take a stance.

In other words, your brand is everything that your customers and prospective customers think, feel, say, hear, read, watch, imagine, suspect and even hope about your product or service.

5.2 Why Branding Matters

There is a well-known saying that 'the opposite of love isn't hate but indifference'. The opposite of strong brands are those that are meaningless and undifferentiated, the ones that have no discernible idea behind them.

In the technological revolution, products have become increasingly homogenized. There are something like 1500 types of digital camera on the market today – each one with very similar features and benefits. Whether you are buying online or on Tottenham Court Road, making a decision is more akin to an endurance test than anything else.

A combination of overwhelming choice and very little time has meant that most buying decisions are based on *trust*. Among the noise, the clutter and the downright bewildering branding is a company's best effort to build lasting value by building loyalty among audiences. They do it so that more people buy more things over long periods of time at a profitable price.

This process, of course, has a beautiful symmetry – for if a company delivers less than it promises, its brand will suffer, people will buy fewer products over a shorter time and the result is commercial failure.

5.2.1 The Branding Evolution

It may be hard to believe now, but there was a time when life and business happened at a much slower pace. It was enough to make something, tell a bunch of people and hope to goodness that some of them would buy it. The premise of being noticed was deemed to be the best way to reach your audience. Big-budget advertising had one-way sales pitches, some entertaining, some not. Making a big bang, however, is transient and has very little to do with creating a strong brand. It just does not work any more because technology has moved the balance of power into the buyer's corner. People prefer to buy rather than be sold to and, essentially, buying is really about making choices. As human beings, we tend to make choices based on two important criteria – what we trust and what we believe.

This chapter aims to defog the branding process of finding and expressing your new, big idea so that you can get out there and create something that has a real motivating difference to the audiences you want to reach. One that no competitor can claim.

Data supports the claim that strong brands contribute anywhere between 50% and 80% of a company's total market value when compared with asset value. Or to use co-founder of BrandTeamSix, Bill Schley's comparisons, he asserts the value of a brand is similar to (Schley and Nichols, 2013):

- The value of a referral from an old friend versus a cold call.
- The value of a doctor's reputation.
- The value of having every employee on the same mission.

'What's the value of a dominant selling idea that can set you apart instantly from every other product in the industry – yet is so simple every manager, every sales person, every journalist, every customer and every champion can repeat it?'

The answer, of course, is that it is priceless.

Bill Schley, co-founder of BrandTeamSix

A very wise ex-CEO of Cadburys once told me that the only outcome that mattered from any business performance was profit. Sounded easy when he said it quickly, but making profit also means building market share, a solid sales base, growth and competitive strength. Building a strong brand will help do all three and create asset value for the company in the process. In short, it has the potential to deliver stability, growth potential, loyalty and longevity.

5.2.2 *The Dynamics of Trust*

If customers make choices based on who they trust, then that immediately puts an onus on us as brand owners to be trustworthy. And what is trustworthiness but an intriguing mixture of openness, passion and honesty. We want our customers to be right behind us in our ideas and be open to new ones.

The problem is that trust is a fragile concept. It is something that can take years to develop and seconds to destroy. From the outset, give your brand permission to behave in the same way that you would like your customers to behave. If you want them to be loyal, demonstrate your loyalty to them. If you want them to be passionate advocates for your brand, show your passion. They may not immediately reflect your enthusiasm, but they will sense it, and over time you will be rewarded for it.

Honesty, enthusiasm and passion form only one part of the equation. There comes a point where you want customers to think objectively about their own areas of pain or desire, hopefully with your brand as the superhero delivering the answers.

When we believe that our values align, we are happy to leave decisions to the brand that's earned our trust. By showing that you're aligned and communicating in a familiar and engaging way, you establish a rapport that allows customers to relax. 'Go for it', you say, 'we've got your back'. If they can believe you, they will.

While not necessarily relevant to students for this project, considering how the relationship between brand and audience might develop right from the outset will make it easier for early stakeholders, such as examiners or investors, to see its commercial potential.

TRY THIS

Which are the companies that you trust, which are the ones that you don't? Why? What is that rich alchemy that makes you inherently trust someone or something?

5.3 **The Doing Part of Branding**

That's all very well, but what happens next? Well, what's really exciting is that you can brand pretty much anything – towns, water, people, nature. You can even brand electronic gadgets

and gizmos that 99% of the population will never see or even touch. But you do need some vital ingredients right from the start:

- **A brilliant idea.** A dominant selling proposition and a discernible philosophy.
- **A world-beating attitude.** A genuine passion and belief in what you are creating.
- **The right name.** One that supports your proposition.
- **Brand strategy.** A plan with tactics.
- **A coherent identity.** One that connects with your audience.

Like building a house, it is vital to build these dimensions in the right order. You could start with the roof or the walls, but think of the chaos, the time wasting and the regret. To build something with longevity and inherent strength, always focus on the foundations first.

5.3.1 A Brilliant Idea

This usually comes with a dominant proposition and a discernible philosophy. If the point of branding is to bring an interested group together, it is almost impossible to draw them in unless they are connected by, or to, a single idea – or at the very least a belief system that means something important to them. The best experiences are rooted in a big idea – strong values, a point of view where extraordinary cultures are expressed through extraordinary customer experiences – where the strategy defines the intended experience.

Increasingly, the driver for making connections is in the idea behind the product and the philosophy of the brand that created it. If two competitors spend equal amounts on production, the one whose ideals resonate with the target market is the more valuable.

TRY THIS

The idea is to find space for a completely new product or to improve on an already existing device. In fact, the brilliant idea might have been born out of happening upon a way to enhance the lives of a person or a community. A good place to start is to ask yourself, how can we make things better, easier? Can we deliver our concept in a more intuitive way than potential competitors? Can we build an ecosystem around our idea that supports different aspects of where and how we implement it? Apple, of course, is the archetypal example of this type of thinking.

5.3.2 Be Useful

It sounds obvious, but your dominant selling idea simply must have a positive and direct impact on your audience. In other words, customers need to want (or desire) it. History is littered with cautionary tales of brilliant concepts that no one wanted or needed (google ‘dot.com era’ for some examples).

The *dot.com* days happened in the BG era – Before Google. People used AOL and CompuServe to conduct web searches with a dial-up 56k modem. Laughable as that might seem in today’s hyperspeed broadband culture, it was then the most exciting show in town.

The period saw the founding and, in many cases, the failure of new internet-based companies, often referred to as *dot.cos*, who inflated their stock prices by simply adding an e-prefix to their name or a .com at the end. These rapidly rising stock prices created a market confidence that the companies would make huge profits, leading investors to ignore tried and tested metrics in favour of infectious enthusiasm for a technological revolution.

One of the most famous failures of the dot.com era was Boo.com, a would-be pioneer in the e-commerce space. Founded in 1998, it began selling branded clothing online. In just two years, it managed to burn \$135 million before it stopped trading in 2000. A poor user experience, launch delays and unlucky timing all contributed to its inevitable failure. Since then, of course, online retail has gone from strength to strength as traditional retailers have expanded speculatively into the digital high street. You can see what Boo.com looked like at launch on the Internet archive www.web.archive.org and contrast it with today's dot.com user experiences in places like gilt.com, etsy.com and asos.com.

The moral of the cautionary tale then might be to focus on the most obvious need. Your difference has to matter. Remember that products fulfil needs but it's experiences that fulfil desires.

5.3.3 *Be Credible*

Selling an idea also relies on having credibility in your field. People are smart. They know veneer when they tap it. It's important that you give your prospects a reason to believe. It's a bit like a job interview – always give the interviewer permission to hire you. Take Nutella as a brand. It's a chocolate spread with a high sugar content BUT they manage to sell it as a slow-releasing energy-packed snack full of high-protein nuts. Sugary, high-fat chocolate spread or nutritious snack? It all depends on what and who you believe.

TRY THIS

When was the last time you had a brilliant experience with a product or service? Was it a visit to the Apple store perhaps? Or getting really good advice about which running shoes to buy? Why was it so good? What made it a pleasant experience? What were the small things that mattered?

5.3.4 *Have a Dominant Proposition*

Positioning is a 'relative' concept. In other words, it is about the space your brand occupies in the hearts and minds of your audience versus your competitors. In everyday terms, positioning is your speciality – the ability, action or attribute you offer that others cannot claim. It's the thing that makes you distinguishable and recognizable. It is the positioning that separates Lexus from Toyota, Caffé Nero from Starbucks, Samsung from Nokia and Cannondale from De Rosa. In other words, positioning is the thing you can 'own' that no one else can. It might be heritage,

national identity, attitude, delivery, technology, luxury, commodity, exclusivity, accessibility or simplicity. The list goes on. Only you can know. Articulating what you stand for and conveying it to the world is no longer an intellectual exercise for the soft and fluffy fringes. It's a necessity.

Here's another way of looking at it. Imagine a world where everyone is in sales. Well, the fact is, we all are. Maybe you're trying to sell your partner an idea for the next holiday in northern France. Maybe you're pitching a new project to an investor. Maybe you're painting your entire house magnolia, because it's about to go on the market. We are all selling, and whatever the offering (holiday, product, idea or house), it is vital that you have a really strong value proposition.

Look at Alex Ferguson. As an Arsenal fan, this is difficult to write. But here's a man who definitely knew his value. Manchester United knew his worth. The players knew his worth and so did the fans. Why? Yes, he got amazing results. But why did he get them? A combination of winning momentum, gritty determination, an eye for talent, a steely personality or an unshakable resistance to ever back down? Probably all of these things. The man leveraged his value to get decisions made the way he wanted them. And that's why Fergie can do whatever he wants now. Literally anything.

Value propositions are useful because they communicate why someone might employ you or buy your product. They distill all the complexity of your idea into something that your customer can easily understand. If all you do is describe the features or capabilities of your product, it won't be enough. As people, we understand features and benefits but they don't change our behaviour.

TRY THIS

As a rule, customers don't buy what you do. They buy why you do it. Feelings like trust and loyalty, behaviour and decision making have very little to do with the rational side of the brain, which is why it's important for you to be able to explain the following.

- What you do (the business you are in).
- How you do it (a dominant selling proposition).
- Why you do it (your purpose, cause, belief).

5.3.5 Brand Check Your Idea

Your proposition is not your tagline or slogan, but the foundation for everything you do from here on in. For the most part, it's used internally and is a combination of the business you are in and the reason why.

You might begin to articulate your big idea by attempting to write an only statement. In his well-loved book *Zag*, Neumeier (2006) talks about the importance of writing 'the only statement' (see Fig. 5.1).

He asserts that every company, in building a successful brand, should develop such an 'onliness' statement. If a company cannot say briefly what makes its brand different from the competition, he advises you to head back to the drawing board.

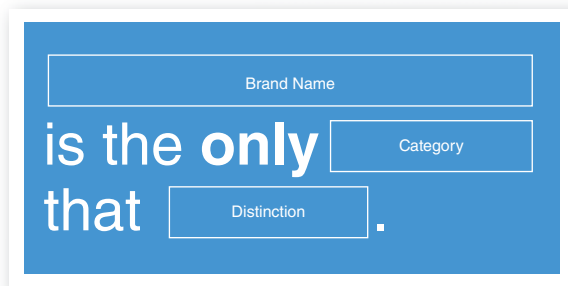


Figure 5.1 Neumeier's onliness statement

Writing this (and feeling confident about it) is a good start because it focuses your mind on what you do best for people – you know best. And you'll have no other choice but to innovate. You'll be able to do things that no one else does, or can do. You won't be 'all things to all people' – you'll be the only thing for some people. How much better for your business and your message to have that level of loyalty and engagement.

For example, take Cirque du Soleil. A spectacular visual feast that creates an experience through costume, make up, acrobatics and show. Its proposition is probably something very simple, like 'Cirque du Soleil is the only circus that combines acrobatics with theatre'. And that's a great piece of information for anyone involved in creating a new show, whether they're designing sets, costumes, make up or marketing it. Cirque du Soleil was a game changer and it understood why.

Fulcrum is Ireland's number one craft beer. It's the only one that combines all the flavour of a wheat beer with all the refreshment of a lager.

As I stated before, these aren't taglines. So don't worry if they don't sound catchy. The important thing is to nail down the business you are in (craft beer) and then what it is that makes you the best in your field (combining flavour with refreshment). 'We're best at *this*, because we do *that*.'

Most brand professionals will try to go a step further in narrowing down the core essence to one or two words. For example, Fulcrum's might be 'perfectly balanced'. Again, not necessarily a tagline, but you can see how it might be getting closer.

TRY THIS

Write an onliness statement for your idea, what you do and why it matters. The next thing to work on is how you do it.

5.3.6 *Belief Systems Influence Behaviour*

The role of modern branding is to create an experience which is entirely different from the old notion of consistently repeating the same messages over and over. In today's digital age, brands are largely patterns comprised of interfaces, interactions and experiences that require brand owners to design for coherence over consistency.

The traditional brand guidelines that seemed to occupy design agencies and brand owners alike just seem like a waste of time and money. No one reads or uses them anyhow. Technology and its immediacy mean you can reach the right kind of people quickly – people who are culturally aligned with what the brand stands for, including its values and belief systems. This will never come from a book. It can only come from leadership. It comes from a story that people relate to. It comes from you.

The world wants you to solve its problems and make existing solutions better. Knowing why you are important to the people who could potentially love you is necessary because it's where the design process for your business and its products begins. One informs the other. By developing a brand without this knowledge, you are essentially crossing your fingers and praying it will all work out fine in the end. Because products are like people, they have their own stories to tell.

RAPHA.CC

Rapha is a cycling company that does 90% of its business online. According to James Fairbank, Head of Brand, the company promotes a lifestyle and passion, rather than marketing products. They use a battle cry of 'Glory through suffering' as a motto to keep them close to what's true and authentic about cycling. Rapha was born eight years ago from a desire to combine everyday wear with a passion for cycling. The founder, Simon Mottram, wanted to do more than create yet another luxury lifestyle brand. He wanted to convince the world that cycling is the only sport. Through beautifully designed products, *Rouleur* magazine, group events, evocative films and sponsorship of young cyclists, Rapha continues to generate passion for the sport and create a more personalized shopping experience for their customers.

For what is essentially an e-commerce site, Rapha manages to do something quite extraordinary. It has been credited with exuding authenticity, exquisite taste and the spirit of the world's toughest road races. All of this from a company just eight years old.

The Rapha name comes from deep in the heritage of cycle sport. Rapha was a junior cycle-racing team in the 1960s, designed to prepare young cyclists for a career in the professional team sponsored by the St. Raphael drink brand.

'Our participation in cycle sport events is a key part of our marketing. Our marketing expenditure is actually very high, around 20 percent of turnover, but little of that is conventional advertising, we do a lot of events and essentially, we are an online retailer, so electronic marketing is very important.'

Simon Mottram, Founder, Rapha.cc

‘We broke all the rules when we chose the name. When I was in branding, I would advise my clients never to use a name that somebody else owns and never to use a name where you can’t get the dot.com web address. In the end, we did both. We had to buy the brand name, but it works so well visually and with the brand values that nothing else would do.’

Simon Mottram, Founder, Rapha.cc

TRY THIS

Discuss the values, principles and belief systems that are important to you. List them, then prioritize them. If you’re unsure about whether you are focusing on the right values or for that matter if they are in truth authentic and sincere, apply the following brilliant test from Simon Middleton’s book, *Build a Brand in 30 Days* (Middleton, 2010).

Simon Middleton’s Values Test

1. Is this value genuine? Do you actually, honestly, believe that this is important to you and your brand? If the answer is YES, keep it in.
2. Is this value liveable? Do you really, truly think that your brand and business (and therefore by definition your team) can actually live by this value? If the answer is NO, dump it.
3. Is this value compelling internally? Does it have emotional as well as intellectual power: the power to engage and motivate your team? Has it got the potential to affect positively the way they work, behave and think?
4. Will this value mean anything to your customers? Will anybody care? Honestly? If your customers or prospects learn about this value, will it make them more likely to buy into your product?
5. Is this value ‘relevant’ to the brand? Does it connect with the actual content of your business?
6. Does this value contribute to you being distinctive in your lane? It doesn’t have to be unique, just unusual.
7. Does this value have longevity/sustainability? Values, like puppies, should be for life, not just for Christmas.
8. Can you communicate this value to people? Can you explain it, justify it, enthuse about it? Does it make sense? Is it clear enough to grasp? Can you instantly recall and explain it to your mum, a journalist or a customer?
9. Can this value be brought to life in behaviour? A value that doesn’t result in behaviour change isn’t really worth its salt. Can this value be made real by what you and your people do in terms of product design, service or customer experience?
10. Would you fight to preserve this value? To put it bluntly, is this a value in which you believe so strongly that you simply will not compromise?

If any of your values survive this rigorous line of questioning, then it is likely they are going to form the foundations of your brand. There may be five or just one. Either way, they inform every decision from here on in.

Whether your ‘customers’ are external customers, employees, co-workers or even your family, the idea is to help them see the specific value that your offer brings to them. And by doing so, you will grab their attention in such a way that they know: ‘Yes, that’s the right one for me’. It means you’ll have a story no one else can tell.

5.4 The Secret Sauce: Tell a Great Story

‘Scratch the surface in a typical boardroom, and we’re all just cavemen with briefcases hungry for a wise man to tell us stories.’

Alan Kay, VP Walt Disney

A worthwhile exercise is to define the purpose of your organization and frame it as a story. Look for ways to bring your purpose to life in a way that’s authentic, meaningful and useful for your customers.

Great brands tell great stories.

And believing what you hear is central to those stories making a connection. Who gives a damn about perfect people in perfect lives going about their perfect business? It’s boring. I always felt the most boring person in English literature was from Jane Austen’s *Pride and Prejudice*. Elizabeth Bennet’s sister, Jane, was beautiful and impossibly nice to everyone. Even to those who destroyed her one chance at happiness. As a character she has one note. She’s nice. Great for her but not much fun on a night out. We all know life is not like that. People are not like that. It feels false.

The millions that Nike or Gillette have spent on ambassadors for their respective brands is another interesting example of this. Who among us can relate ourselves or our lifestyles to Tiger Woods, Roger Federer or Thierry Henry? For all sorts of reasons, their personae just feel at odds with what these big brands are trying to say.

In our million-channel world, it’s the brands whose customers tell the best stories that excel. Yet how often do companies tell a real story – without the veneer? How many of the things we communicate make our conversations more interesting? Great brand stories stem from the reason a brand exists. Apple wanted to free creative spirits and slay the Microsoft dragon. Coco Chanel set out to reinvent fashion and liberate women from tradition. With Honda, when you dream, anything is possible. In simple terms, if there’s nothing to overcome and nothing’s at stake, it isn’t a story.

Founding stories are particularly good reservoirs. If your's is unwritten, write it. It will be interesting because it will contain conflict and struggle and drama. They needn't be 150 years old to be authentic. What is a story but imagination, twist, embellishment, imagery and language that carry along information or data.

Author, Christopher Brooker, asserts that from the entire canon of literature, there are really only seven plots. In his book, *The Seven Basic Plots: Why We Tell Stories*, he suggests that storytelling is human beings' most effective method of communication. His symbolic 'plots' of storytelling are:

- **Overcoming the monster.** Where a hero must defeat a monster and restore order to a world that has been threatened by the monster's presence.
- **Rags to riches.** Where modest, generally virtuous but downtrodden characters achieve a happy ending when their special talent or true beauty is revealed to the world.
- **The quest.** A hero, often accompanied by sidekicks, travels in search of a priceless treasure and fights against evil and overpowering odds; the story ends when he gets both the treasure and the girl.
- **Voyage and return.** Normal protagonists who are suddenly thrust into strange and alien worlds and must make their way back to normal life once more.
- **Comedy.** Not always synonymous with humour. Instead, the plot of a comedy involves some kind of confusion that must be resolved before the hero and heroine can be united in love.
- **Tragedy.** As a rule, the terrible consequences of human over-reaching and egotism.
- **Rebirth.** Focuses on a threatening shadow that seems nearly victorious until a sequence of fortuitous (or even miraculous) events leads to redemption and rebirth, and the restoration of a happier world.

Think of your favourite novel, movie or play. Which plot category do you recognize in the storytelling?

In the digital age, we are all of us now in the content business. We must all generate content, whether that's the first 30 seconds of an introduction at a dinner party, or a question to ask the keynote speaker at a conference. This comes with a caveat. To generate content you must have something interesting to say.

Brands tend to fair better when they are distinctive and easily understood by their audiences. But there are other principles that have important roles to play. Is your story compelling? Is it credible? Do people connect with it? In other words, is it relevant to them? These questions are just as valid when applied to industrial brands. After all, there must be a good reason

why truckers prefer Michelin tyres. Ask them and they'll tell you they simply feel better riding on Michelins.

TRY THIS

Take the humble 'case study' for example. Lots of companies use them. The trouble is they tend to be dull and often smug. They tell us what to think and feel. They start by describing what the customer needed, moving swiftly to the part where the company answered the client need brilliantly, with very little detail in between. What human beings relate to is how people faced adversity – how they overcame challenges and what they learned from it. Our emotional and rational brains like relief to follow worry, but you can't have one without the other. Try writing a case study of how you developed your first prototype, but do it honestly.

*Example: It's worth knowing s**t from Shinola!* The way you design your product, the way you build your spaces, the way your staff dresses and behaves, the way you deal with your customers. Your brand's actual behaviour is the loudest storyteller of them all and any dissonance will be noticed. Look at every touchpoint and benchmark it against the story you aim to tell.

Shinola is a startup company with a 100-year-old name. Bedrock Manufacturing decided that Shinola, the popular mid-century US shoe polish brand, was just the right mark to reintroduce for their new line of American-made watches, bikes and other leather goods. As they've started putting their manufacturing operation in place, however, Shinola has proven not only to be a familiar name but also a reminder of how products can benefit from the stories behind them.

Their central idea is one of collaboration and they have already inspired lots of mini stories that together create the framework of the Shinola brand. Nowadays people call this content. Their landing page greets you with the following line:

'THE LONG TRADITION OF DETROIT WATCHMAKING HAS JUST BEGUN'

Shinola has placed collaboration at the core of its business and design strategy. Housed on the fifth floor of what was formerly home to General Motor's engineering, research and design department, the culture is one of passion for making products that are as beautiful as they are useful, and making them in America. Starting with watches first, a product that hasn't been mass produced in the USA for decades, they have built a state-of-the-art watch movement and assembly factory in Detroit; workers have begun assembling the Argonite 1069, the movement at the core of their watches. They're also producing American-made bicycles using handwelded frames from Wisconsin, high-quality notebooks through a partnership with Michigan-based bookmakers Edwards Brothers Malloy and a wide variety of leather goods – including iPad cases, MacBook envelopes, rucksacks and handbags.

A word of caution though. Content for content sake is pointless unless it triggers some kind of behaviour. Ideally, it should motivate or inspire an emotion strong enough to persuade. It also has to come from a credible source. Think about Sebastian Coe's bid for the London Olympics. He inspired the committee by describing how London 2012 would inspire the next generation of champions. His speech, though, was essentially an eloquent description of his personal struggle to become an elite athlete. And it proved to be incredibly persuasive because it was a tale of hard work, commitment, doubt, conflict, disappointment and triumph. Would this have been so utterly compelling if it had come from a politician?

Content and commerce are increasingly intersecting. There is an emerging breed of retail website that features magazine-like editorials, photospreads and inspiring video, all designed to inspire and, ultimately, sell products. This is much more than a side blog but an attempt to integrate content into an engaging and meaningful retail experience.

5.5 World-Beating Attitude

I love my job, but it comes with its own unique frustrations.

The worst frustration is when a client is, on the one hand, asking me to develop engaging content for their brand and, on the other hand, cannot for the life of them tell me why it's brilliant, or indeed why any customer would choose it over competitors, or indeed whether they would choose it over competitors. I made a deal with myself a long time ago; if I'm the only person in the room passionate about the idea, then it is time to walk away. Brands are about emotion. If you do not love it, who will? They are reflections of humanity. Sorting out your attitude and approach as a brand creator upfront will save all kinds of problems later on, and will dramatically improve your chances of taking people along with you.

To build a brand that makes sense, it helps if you have a world-beating attitude. Otherwise, what's the point.

On a first pass, the above statement might sound big or arrogant even, but it really isn't. World beaters are defined as masters of certain skills, whether their chosen field is science, music or sport. It's important for you to determine exactly what you are best at. That way you can work out how your brand is the best, the number one in any particular area. The benefit of working this out right at the beginning is that you get to decide what that special field might be. As Bill Schely points out, 'this sounds like a paradox but the truth is the narrower your focus, the wider your message will travel'.

In the world of engineering it's tempting to go to town on features and benefits. But the more information you throw at someone, the more meaningless you become. Take Volvo again. Owning a value like 'safety' means the brand can talk credibly about important things like intelligent engineering, durability, caring and trust. Committing to one central idea requires

guts and commitment. Resisting the desire to tell everyone everything about what you're up to is difficult, but it will pay off in the long run.

5.5.1 *Who Else is Out There?*

It's vital you know exactly who else is operating in your brand space. Competition can come in two forms – businesses who sell similar products and businesses who sell to similar audiences. Analysing the competition can be intimidating, but it is always better to know who else is out there AND have the measure of them.

TRY THIS

Write a list of all the businesses who either make similar products to you or sell different products to your target audiences. Decide how they are better than you in terms of design, pricing, communication, range of choice, etc. Now think about how your business can create a competitive edge. Can you improve on the customer experience, the product performance, accessibility, etc.? Now think about what each brand stands for. What are their dominant values? Do you stand for something totally different? Do this for each competitor and you have the beginnings of solid thinking for your own brand's development.

5.5.2 *Do Your Homework*

Like all design disciplines, research underpins direction. This doesn't have to be expensive either. Some carefully considered questions pitched to the right people can be remarkably enlightening. Remember, we are trying to develop a brand that is aligned to people's beliefs and attitude. It therefore makes sense to ask what is important to them; which of your competitors are doing a great or a poor job; what makes them happy; what makes them miserable. Listening to their answers and seeing their body language can deliver great insights. They might also give you some gems in terms of key visuals, taglines and product ideas – for free.

TRY THIS

- **Decide what you want to know.** Pain points, needs, desires, important influences, delivery, competitor data, if they had a magic wand, etc.
- **Decide who can tell you.** Sales people, decision makers, CEOs, engineers, logistics, journalists – 10 to 12 is plenty.
- **Write your killer questions.** Why does the world need your product? What do they want most? How important is it? What keeps you up at night? What makes you proud? What are your guiding principles for doing business? What are your strengths and weaknesses? What fact about your business would you hate the press to get hold of?
- **Ask them one at a time and face to face ideally.** Listen to non-verbal communication as well as the words. Don't interrupt. Build rapport and trust.

- **Record everything.** Someone usually says something golden.
- **Analyse your findings into patterns and themes.** Do this as a collective. You will identify more together.

5.6 Name it. Name it Good

Brand names are pivots. They are immeasurably important and valuable. They are also a nightmare to create. All the descriptive words relating to your product or service are probably already in use. In fact, a whole chapter alone could be dedicated to the subject (and pitfalls) of naming and name generation. Let's just say that you might as well give your brand a good name as saddle it with a pig that you will be forever spelling, explaining or apologizing for.

Great brand names have the potential to reshape categories. Just as Procter and Gamble created the disposable nappy category with Pampers, DuPont created manmade fibres in the 1930s when it invented nylon. Apple reshaped the personal computer category, 3M reshaped the engineered materials category and Cummins reshaped the OEM engine market. Supported by a powerful idea that creates the momentum, a name can change the world.

In the beginning though, they started out as one humble and lonely word. Generally, they fall into five categories.

1. Descriptive: General Motors, Toys R Us, Engineered Garments, Airbus.
2. Emotional: Dove, Yahoo, Apple, Wonderland, Cougar.
3. Founders and family names: Adidas, Guinness, Johnsons, Dean & DeLuca.
4. Made-up words: Kodak, Verizon, Hagen-Dazs, Twitter.
5. Statements: For All Mankind, I Can't Believe It's Not Butter, TechOnTheNet.

There are good and bad names, and everything in between. It's up to you to see the potential for greatness. You and your team will no doubt create lists upon lists to the point where you develop name blindness or where it's impossible to differentiate between the charmingly quirky and the downright insane.

When it comes to naming, anything goes, but there are a few hardline rules that are worth observing.

Avoid big generic names like 'WidgetWorld'. As a CEO, just imagine your disappointment when not long after launching a flagship store, you find yourself driving past WidgetCity, WidgetMart, WidgetSmart and WidgetLand, with not a single person able to distinguish one from the other. One particular crime within industrial branding is to use a series of either meaningless acronyms or forgettable numbers that no one will ever recall. Another rule is to make sure that when you have the right name in English, it doesn't mean something dreadful like 'cat droppings' in Arabic, particularly if you plan to do serious business in the Middle East.

The trouble is that everyone, from the accountant to your mum, will have (and voice) their opinion. That opinion may be based on experience and knowledge. It may also be based on gut reaction. Both are valid.

We all have our personal favourites when it comes to brand names. I'm a big fan of the dog food brand, Eukanuba. Definitely fun to say, but fairly risky in an English-speaking market. I also love Caterpillar, Lush, Blackberry, Volkswagen, Nespresso, Ping, DuPont and Weetabix.

Made-up names are the patent attorney's favourite for obvious reasons. They're easier to register and protect. So, even if you start out with a mix-and-match Frankenstein of a name like Viagra (from virile and aggression), make sure it's still supporting your dominant idea.

Sounds and rhythm can be just as poignant in supporting your brand's personality and positioning – think Kodak, Google, Hubba Bubba and Kit Kat. It's the delightful repetition of the sound that makes them memorable.

TRY THIS

Here's the testometer I use. If you can apply the following statements to a shortlist of possible runners and riders, then to my mind you are home free.

- Does it support your dominant selling idea, either in terms of meaning or sound?
- Is it evocative or colourful in the eyes and ears of the audiences you are targeting?
- Can you protect/own it or are you infringing anyone else's intellectual property?
- Do you enjoy saying it?
- Do you love it? At the very least, could you learn to love it?
- Some people feel they cannot live without a .com url. While it is so much neater to have it, they are incredibly and increasingly difficult to secure. In my mind this is less of a problem than people make out (see commentary on Rapha).

5.6.1 Taglines Can Make Things Simple, Not Dumb

I think that in 20 years' time, social historians will look back at the proliferation of taglines and think, what the heck was all that about? The rest of me thinks that when they are developed well, a carefully crafted slogan that supports your brand can deliver instantaneous clarity. Here are a few that tick all the boxes for me. The challenge for you is to match them to their brand owners.

The ultimate driving machine
Every Little Helps
Good things come to those who wait
The future's bright
It is. Are you?
Never knowingly undersold
The Real Thing
The Only Easy Day Was Yesterday
Imagination at work

*The mission is a man
Uncap what's inside*

(The answers are at the end of the chapter.
How many did you recognize?)

Many inspirational organizations, regardless of size, act and communicate from the inside out. As brand expert Simon Sinek says, ‘We live in times of high stress. Messages that are simple, messages that are inspiring, messages that are life-affirming, are a welcome break from our real lives’.

TRY THIS

Use your dominant proposition as a starting point. Look over your research and put yourself in the shoes of your target audience. Craft a slogan that brings instant clarity to your brand’s purpose and attitude. When you have a shortlist, test them against these criteria:

- Does your tagline support your difference that matters?
- Can you own it?
- Is it short and sweet? Or at the very least, easy to remember?

5.7 Brand Strategy (is Not a Dirty Word)

Reaching customers and winning them over means more than creating things for them to buy. Customers have to identify with what you are offering. Businesses must understand how to communicate and present their strengths to their optimum advantage.

Knowing who your customers are is central to finding a way to express who you are and what is unique about what you are offering. We are all hard-wired to make judgments about what we like, who we trust and who we don’t.

That’s really the essence of developing a good brand strategy – the foundation of your communication that builds authentic relationships between you and your audience. It describes where you want to go with the brand. Defining your brand strategy allows you to use marketing, advertising, public relations and social media to consistently and accurately reinforce your character. Without defining the core strategy and your big idea, then all channels of communication often become a ‘hit and miss’ expense. In reality, brand strategy is really about good leadership and understanding. It’s an articulation of destination and desirability.

Sometimes articulating what you are not can be an extremely helpful way to pinpoint what you are. The same can be applied to your target customers. No brand can appeal to everyone. It’s illogical and absurd, so there’s really no point in trying.

I was recently trying to find a holiday destination in northern France for the family. I was trawling endlessly through websites that promised this and that. And then I happened upon a site that invited me to click on ‘Do Not Come Here If ...’. Not being able to resist, I clicked on the link to find a list of things like, ‘You don’t drink red wine’ or ‘You believe children should be seen and not heard’. Scanning the list, I could instantly get an idea of (a) the owner’s attitude and approach to hospitality and (b) if we were the sort of family who would enjoy staying there.

Identifying the type of people you want to avoid will save you time and money on your efforts. For example, the guy who owns the chateau in Normandy might well have an enemy list that reads something like this:

- People who don’t like children.
- People who like modern, bland and minimalist interiors.
- People who are regimented about when and what they eat.
- People who don’t like to experiment with new flavours.
- People who think hospitality staff exist to serve them and them alone.

TRY THIS

Think of a brand or business you admire and take a guess who might be on their enemy list. Now do the same for your own brand. Start with the line, ‘Our brand should not attract people who ...’. Now flip this on its head and write your list of ideal customers.

5.7.1 *Make Sense to Your Advocates and Your Customers*

This discipline of locking down a brand strategy is critical because it provides the blueprint for the experience you design, manage and deliver. Without it, employees and partners find it difficult to deliver an experience that makes sense to the customer. What’s worse is mixing the two.

Ikea would never put the brilliant Apple-esque genius bar in their stores. Why would they? It would mean hiking up the prices to pay for it and undermining the entire customer experience and relationship they have cultivated. Ikea designs its entire customer journey, so they shouldn’t need a genius bar. One isn’t necessarily better than the other – they’re just different examples of brand strategies that make total sense for the type of markets in which they operate.

ASOS BRAND STRATEGY (A PLAN WITH TACTICS)

Aimed at fashion forward 20-somethings globally, ASOS attracts 18.8 million unique visitors a month. comScore rankings for 15 to 34-year-olds (31 August 2012) showed ASOS as the most visited fashion website on the planet (daily). In 2011, they more than doubled the growth of their biggest rival TopShop without a significant media budget or change in strategy.

Here are just some of the marketing tactics they use to keep their brand on track.

- A team checks to see what is trending at 9am each morning with the aim of having their homepage changed by 11am to reflect what is most being talked about online.
- Every touchpoint of the brand directs people towards their Facebook page to gain a 'like' and capture an opportunity to engage with that fan.
- Their social media 'community management' team is seen as part of the e-commerce team, not the marketing department.
- Customers are encouraged to sign up to their Facebook page from the main homepage, by offering 'secret sale extras' such as previews and exclusive offers.
- The company increased their IT budget by 72% and their marketing budget by 54% in order to grow their Facebook page and build a mobile site – preparing for expansion into Italy, Spain and Australia.
- ASOS Lifestyle magazine is given away free and builds the brand, whilst also generating £3m in revenue from advertising as it has a distribution of 456,000 copies.
- The ASOS marketplace has a series of online 'boutiques' rather than one big Top Shop-style web shop.
- Delivery costs have been reclassified as 'operating costs', so that all deliveries and returns are free.
- Recommendation tools share more potential purchases with their customers – even if the items that most match their tastes are on someone else's website.
- To stay 'aspirational', sale offers are showcased with catwalk clips and customer video diaries such as 'Confessions of a queue jumper'.
- ASOS care about the customer journey by obsessively asking customers, 'What do you like about the site and what don't you like?'
- A 'Fashion Finder' will soon allow you to enter your measurements and virtually 'try on' clothes to see if they suit you.
- Customers' clothes can be 'recycled' through the ASOS marketplace to provide a more emotional way to engage with consumers.
- To grow, they refuse to expand into other markets such as children's wear. Since only 3% of the world's online traffic comes from inside the UK, they see 97% of their growth coming from the same customers in international markets rather than a wider demographic in the UK.

'In a business school, it probably doesn't make sense to [do these things]. But in a customer school, why wouldn't we?'

Nick Robertson, ASOS founder and CEO

A clear strategy allows companies like ASOS to design products, interfaces and spaces that customers experience on the phone, in print, in digital media and mobile applications. It is one of the important ways to weed out bad ideas, to keep employees focused on the game plan and most importantly keep customers happy and loyal.

TRY THIS

Develop a strategy for your brand that will allow you to connect with your customers on a regular and meaningful basis. Think about the deep need that you satisfy. What are you really brilliant at? What is the reason for this brand to exist? Now, thinking from the perspective of your customer, here are some questions to get you thinking. You may have already considered these questions as part of your marketing strategy, but it is vital you reorganize and craft them as part of your brand message.

- Who is he or she? What does s/he do and need?
- What problems does s/he need to solve?
- What improvements does s/he look for?
- What does s/he value?
- Can you deliver a difference that matters?
- Is it easy to grasp or does it require you to educate an audience?
- Does it address something important for someone?
- How does the product solve their problems or offer improvement?
- What tools do you need to reach them?
- What value and hard results does it offer the customer?
- Will the market believe you. If so, why?
- Can we inspire people to believe in it?
- How and where will you convince them?

TRY THIS

Again, put yourself in your customer's shoes and answer these few questions.

- 'Why should I buy this specific product or idea?'
- 'I want to buy this product or idea because it will ...'
- 'The things I value most about the offer are ...'
- 'It is better than competing products or ideas because ...'

5.7.2 *A Word on Industrial/Tech Branding*

There have been many times when I've sat in the boardroom of a manufacturer who makes either technical, engineering or industrial products. More often than not, the senior management tend to be product focused. That's a good thing, in fact it's essential. In the technology sector, where today is yesterday's news (think HP, Blackberry and Nokia), the most important thing is not to advertise a story, but to live it.

Most industrial buying decisions are made based on the holy trinity – *quality, delivery and price*. It is interesting, however, that the most successful technology and industrial giants tend to think differently. Their approach extends to *trust, reliability and friendship*.

It's true that there are differences when it comes to B2B and industrial brands, but not many. The same core principles still apply. Yes, for industrial products the word 'value' may have a different meaning. Pricing is a major factor, particularly in replacement and aftermarkets. But in most business markets, if your pricing is not competitive, you will have trouble compensating with branding. This is not to say you must have the lowest prices, but your prices should be perceived as competitive.

'We don't try to manage the IBM brand. We try to manage our character as a business. And we've never defined IBM by what we're selling.'

Jon Iwata, Senior Vice President (Marketing and Communications)

Whatever you're selling, the decision to purchase it (or not) is going to be made by a real, live person with emotions, wants and needs. It will be someone just like you who has successes and failures, good days and bad.

Instead of embodying a product, IBM and the brand giants embody a culture. As Sandy Carter, an IBM VP, says, 'Culture eats strategy for lunch'. 'Culture', as Shawn Parr of Fast Company puts it, 'is a balanced blend of human psychology, attitudes, actions, and beliefs that combined create either pleasure or pain, serious momentum or miserable stagnation'. In other words, it is human.

Instead of asking, how do we exert our influence – our brand – on others, IBM is asking, how do we allow our brand to be defined by what the culture demands?

It's in this way that IBM has become increasingly more human and less 'techy'. You can see this happening, in a way, with other tech companies, like Cisco. They too are developing blog networks, focusing on people and attitudes more and more.

Here are some more tactics that solid industrial/tech brands use to their advantage.

5.7.2.1 Connect with People

In 2011, electronics company RS Components established a new 'Connectivity Hub' portal on its website to provide electronics design engineers, technical managers and students with

an easy way to locate, design and buy a wide range of connectivity components, devices and equipment.

RS Components stocks thousands of products that are designed to connect devices together, from board-level design to interface cards, dongles and cables. The Connectivity Hub provides a single site that links the major connectivity technologies used today in electronics design to the extensive range of products available from RS, along with further information and other useful links.

The hub links to a wide range of products from multiple manufacturers that are designed for use in various connectivity technologies, including: USB, Ethernet, I2C, Power-over-Ethernet and low-power RF. It's updated on a regular basis, with new product ranges, individual components and devices added daily. It also promotes product offers and the latest industry news.

'Our world is becoming increasingly connected – almost every electronic product in our home, or school, or workplace has been designed to communicate with another device', said Fred Knowles, Head of Product Management, Electronics, at RS Components. 'Whether at the board-design or end-equipment-interface level, connectivity is clearly an elemental constituent in modern product development, and we believe that this new RS hub will further ease the task for designers to quickly find and buy the right components for their innovative designs.'

5.7.2.2 Tell a Great Story

More and more brands are seeing the benefit of creating their own content. Facebook wants to be the brand that's synonymous with everything that's interesting about life. To promote that idea, the social network launched a monthly online magazine called Facebook Stories to showcase the interesting ways in which people use technology to change their lives.

Each month has a different theme – from 'Remembering' to 'Degrees of Separation' to 'Election Day'. As people increasingly live their lives on social networks, Facebook is contracting journalists and well-known authors like Joshua Foer (and partnering with *The New Yorker*) to collect and tell extraordinary tales.

The result? A fascinating collection of original journalism, video and interactive graphics that lives off Facebook's main network, but has been shared across the web.

5.7.2.3 Position Yourself Differently

Unlike many players in the mining industry, Vale's leadership recognized that as part of their global growth strategy, they needed to clarify the brand's positioning and communications. To help people understand the role of the company's activities in people's lives, management created a differentiated brand to help explain Vale's contributions and commitments to society – one that would reach out as much to the public at large as to investors and direct customers.

Key to the new positioning was a different visual identity. Competitors' messages and logos were all very similar; it was clear that there was plenty of room for Vale to stand out with a unique, ownable mark. They developed a mark that is modern, confident and energetic, while retaining a link to the company's Brazilian heritage.

The result was a simple V that suggested many positive attributes – a heart, the blending of elements of the earth and the valley where the company originated. The redesigned logo

then became the basis of a company-wide visual identity roll-out that was expanded to sales collateral, business cards, stationery, vehicle and building signage. The company's new brand strategy and identity quickly won plaudits and buy-in from employees worldwide, and have since garnered widespread, acceptance with external stakeholders.

5.7.2.4 Align Product Innovation with Communication Strategy

Performance running shoe brand Brooks used to be a hot ticket in the 1970s and 1980s, but it also tried to be a full-on athletic company selling cleats, high-tops and a wide range of apparel. The firm's endorsement roster included football's Dan Marino, James Worthy of the NBA and tennis legend Jimmy Connors. 'We used to play the game that Nike has perfected and we were not successful', says Brooks Sports CEO Jim Weber.

Weber joined Brooks in 2001 as CEO and spearheaded a new initiative that focused on performance running shoes and gear. No more basketball or football. Tennis was out. Distribution was narrowed to mostly just top running retailers and specialty retailers. The results have been outstanding in recent years.

Sales have more than doubled, from \$180 million in 2009 to \$409 million in 2012. Weber expects sales to hit \$500 million in 2013. Elite runners are increasingly turning to Brooks. Weber says that more people were outfitted in Brooks' shoes than Nike at this year's Boston Marathon. The reason, he says, is because 'We're building a brand with runners and that is where we pay the most attention to. We are creating a brand that doesn't have to be cool with high school football players'.

'Nike will spend more by noon today on marketing than we spend in a whole year'

Jim Weber, Brooks Sports CEO

So, how do they compete? Where Nike's attitude is all about winning ('Second place is the first loser' and 'You don't win silver, you lose gold'), Brooks takes a different approach with the simple slogan: 'Run Happy'. Brooks rejects expensive media ad campaigns and instead invests money in grassroots marketing. It invests in events and specialty run retailers. It relies heavily on social media and word of mouth.

Since bathrooms are always a challenge at long-distance running events, Brooks offers a VIP Porta Potty at its sponsored races. It rents super-deluxe heated or AC-equipped toilets that have mahogany wood. The Brooks marketing team is in T-shirt tuxedos and the area is equipped with red carpet, linens and mints. Buy enough product at the company's booth the day before the race and you get access to the high-end bathrooms. 'We have some fun with it and everybody smiles', says Weber. He compares Brooks to Volkswagen. Both companies have superior engineering in their products, but also convey a fun image for the brands.

5.8 A Coherent Visual Identity

If you have reached this stage by building each foundation step by step, then this, in theory, should be the most straightforward part of your brand to cultivate.

Now is the time to begin thinking about a key visual image that provides the anchor to the rest of your identity (logo, stationery, website, packaging, animations, video, sales presentations and so on).

5.8.1 A Central Visual Image

Imagine you are launching a traditional soup company. Your key visual image might be that of a country kitchen. Right in the centre is a big wooden table with a large pot of ‘homemade’ soup on top. Steam is rising and a family are eager to tuck in with a doorstep of chunky, freshly baked bread. Picture this image and it requires no further explanation. It’s a Polaroid snapshot that demonstrates your positioning and selling idea in one swift move.

It takes a lot of collective brains, creative thinking and a good headwind to hit on the right image. Soup is relatively emotive. Admittedly, it’s harder to do this for industrial brands, like electronic components or intangible professional services, like a software developer, but the process is essentially the same. Think of the ‘good hands’ of the Allstate logo. Or read Jason Fried’s excellent and controversial book, *Rework*, where he tells his own startup story of how he and his partner Carlos Segura began his app and software company, 37Signals. He writes:

‘Back in 1999, Carlos was watching an episode of Nova on PBS about the SETI project, which involves the network of radio telescopes in New Mexico that is listening for signs of life in the universe. There are apparently billions of signals and sources of noise out there, but, according to the show, there are 37 signals that remain unexplained. When Carlos told us about that, we all thought it was a really cool idea, so we named the company after that. And, as it turns out, the domain name was also available.’

Jason Fried, 37Signals

A great key visual image about connectivity (and a name) that came from one central idea. When it comes to visual elements, you are swimming in the territory of the brand expert and graphic design professional. It’s difficult and complex and requires expertise and skill to navigate your way around, but that should not stop you from having a go.

5.8.2 But What About My Logo?

I’m aware that in a chapter about branding, logos thus far remain conspicuous by their absence. That’s because when it comes to developing valuable creative collateral, I firmly believe it’s best left to the professionals. People devote lives of study to the very precise arts of typography, illustration, photography, digital animation, UX, video and public relations. Their talent can be your most valuable asset if you brief and manage them appropriately.

If you have moved through the steps outlined in this chapter, then you are certainly on your way to developing a first-class brand presentation for any potential investor (or graphic designer for that matter) to interpret. Here’s why.

TRY THIS

Look around you for inspiration. Magazines, literature, songs, movies, the Internet. Keep your dominant proposition in mind. Think of your tagline and try to conjure up a visual image that speaks volumes about your brand, its purpose and its attitude. It might be one central image that has offshoots into other areas. Either way, try to find a visual image or metaphor for your brand. And at all costs, steer clear of stock photography websites. Cliches kill brands dead.

Great branding does not start with design, it starts with meaning. After the strategic elements have been kicked, tossed, challenged, teased and reassembled, the only real chance it has of winning is if the logo, stationery, digital assets, photography and packaging are professionally and thoughtfully designed.

By all means study the brands you love and cherish. Analyse how they use different media to support the dominant selling proposition. The more you look, the more instinctively you will recognize and appreciate the skills in action. Your visual identity is the visible expression of your brand. It's important, so my advice is to pay, bribe or barter your way to a professionally crafted identity.

When and if you do go on to develop creative work with a graphic design partner, you might want to test your thinking with an appropriate audience. A recent client of mine put early creative ideas on Facebook and invited people to pick one. A bold move. Even though most of his followers were loyal customers, most people favour familiarity and reject change. After all, the reason why they became loyal followers in the first place was because the brand was already speaking to them. In the end, my client could read the audience comments with objectivity and knew in his heart that the only way forward was to commit to an idea that was much closer to where his brand needed to be. About 55% of his customers agreed. And that was enough for him.

Don't fall into the mind trap that identities are expensive luxuries. They are the necessity no SME or startup can afford to do without. Every day small businesses make this mistake and it costs them untold fortunes in terms of time, money and customer perception.

TRY THIS

Instead, gather examples of what you like and what you don't. Why is it working, why is it not? Benchmark the identities within your own brand landscape and identify the opportunities for doing it better.

5.8.3 *Brand Touchpoints*

All of the aforementioned activities require a leader. In the same way that an orchestra needs a conductor, or a movie needs a director, you need to be the Hannibal Smith of your own A-team. For it is you who is responsible for ensuring every point at which a customer interacts with your brand is up to standard.

TRY THIS

Let's go back to those brands you love. Think about how they connect with their audiences (you) in different ways – advertising, social websites, sponsorship, direct mail, answering the phone, responding to your questions, recyclable packaging, easy-to-open packaging, clean toilets, no queues, smiling faces, quick delivery, tidy shop floor, interior design, nice coffee and so on. Make a list and add a +1 or –1 for each criterion. Now do the same for the brands you hate. You'll learn a lot about the brand you want to create and what to prioritize.

There's no rule that you have to be a brand expert to develop strong brands if you have the desire, belief and commitment. In my experience, the more a client company is involved in the process, the better the outcome. Neither is there one process set in stone. This chapter is an interpretation of what I've learned, read and what works for me and the team of design professionals that I regularly work alongside.

What are the core elements of your idea that need to be communicated consistently? If you had infinite resources, what would you do to become a world beater? Unless you have a genuine aptitude for graphic design, show examples rather than attempt to design them yourself.

5.9 Conclusions

I opened this chapter with the suggestion that when it comes to branding, and life for that matter, telling the truth is usually a good place to start. It seems fitting to end on a quotation from one of the old advertising guard of the 1960s and the inspiration behind the TV series, *Mad Men*. This observation from Bert Bernbach has almost become a mantra to my working life. It's one I try, though not always successfully, to adhere to every day.

'The truth isn't the truth until people believe you. And they can't believe you if they don't know what you're saying, and they won't know what you're saying if they don't listen to you, and they won't listen to you if you're not interesting, and you won't be interesting unless you say things imaginatively, originally, freshly.'

Bill Bernbach

Answers to Taglines and their Brand Owners Exercise

The ultimate driving machine (BMW)
 Every Little Helps (Tesco)
 Good things come to those who wait (Guinness)
 The future's bright (Orange)
 It is. Are you? (*The Independent*)
 Never knowingly undersold (The John Lewis Partnership)
 The Real Thing (Coca Cola)

The Only Easy Day Was Yesterday (US Navy Seals)

Imagination at work (GE)

The mission is a man (*Saving Private Ryan*)

Uncap what's inside (Sharpie)

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The Marketing of Your Business is Your Business

Graeme Roberts

PURPOSE

Marketing is essential in communicating your product's value proposition to potential customers and creating new businesses and brands. Simply put, marketing communication is the art or science of communicating the benefits of your goods and/or services to the right people, at the right time, in the right place, in the right way and for the right price.

TOPICS

- Identify your target market
- How to undertake market research, determine market size and trends
- Understand demand indicators
- Promotional techniques, including social media and how to use it

The chapter is organized as follows:

- After a brief introduction, **marketing** and **communication** are defined in Section 6.2.
- Ways to deduce **target market** size are covered in Section 6.3 using examples.
- The **demand indicators** are outlined in Section 6.4.
- In Sections 6.5 and 6.6, **market research** and **strategy** are discussed.
- **Promotional techniques**, including social media, are highlighted in Sections 6.7 and 6.8.
- The concept of **case studies** and **referrals** is highlighted in Section 6.9.

From the earnest product focused engineer's point of view, the whole reason that a company exists is because of the awesome initial idea and the beautifully designed product that resulted. From the slightly product distrustful sales and marketing department, the product can be secondary and the whole future of the company relies on their department's ability to communicate the benefits effectively and drive serious interest; oh and of course, close sales which is where the ideas and products magically turn into cash!

6.1 Introduction

There is a well-worn perception in business, that a ribald banter exists between the designers and engineers of great products and services and the companies' sales and marketing departments. However, the different disciplines within a business are like the cylinders in a car, they all need to be firing well and together to deliver the optimum performance.

For example, if you scientifically evaluated every single chef in the UK and scored them on just how good a chef and 'dish creator' that are, I'm not sure if the household names Jamie Oliver, Delia Smith or Gordon Ramsay would be in the top 10 or 20! However, if you evaluated all the chefs on their cooking skills AND their marketing ability, these three household names would be high in the rankings. If they were great at marketing and awful at cooking they would get found out almost immediately. The true recipe for their success is blending their obvious passion, talent and drive as chefs with an excellent marketing system. In almost all businesses, you cannot be successful by having a great product without great marketing and vice versa.

In my own 20-year career primarily focused on sales and marketing, I have found it useful to approach new products and services with a sceptical and frugal potential customer's point of view. That is, from a resistant standpoint. 'Why should I buy or pay good money for this?' is a question that all marketing communications really need to tackle and answer well. 'Build it and they will come' is as useless a standpoint for a marketing strategy as it is for a website.

So as an overarching principle, you and your company need to answer the only question that really matters from the customers' point of view. 'What's in it for me?' If you can get this into your DNA, then you have a very good chance of creating a successful marketing plan. If you do not, you may be forever incredulous as to why your wonderful idea and the resulting products/services did not take off.

There are many different ways of communicating with potential customers. It is a continuous ongoing process but before we look at that subject, it is important to identify the target market.

6.2 Definition of Marketing and Marketing Communication

A good working definition of ‘marketing’, especially with regard to communications and creating new businesses and brands, should be: marketing communication is the art/science of communicating the benefits of your goods and/or services

- To the right people
- At the right time
- In the right place
- In the right way
- For the right price

Products and services don’t sell themselves. Even if you are lucky enough that they are so popular and useful that viral word of mouth drives everything and becomes the only marketing you’ll ever require, you will still need to start somewhere and will need to inform and explain to businesses and individuals why they need what you have, and more importantly, why they should pay for it.

6.2.1 Identifying Your Target Market

Whilst we would like every individual and business on the planet to be a potential customer, it is very unlikely that your new product or service will work or be relevant for everyone. The good news is that this means it is possible to have the target market categorized in a way that will give your marketing plan good focus, enabling prioritization. Most likely, you will not start your business with unlimited marketing resources and will have to target the ‘low-hanging fruit’ (i.e., potential customers to focus on) to create initial revenue, product feedback and business development ideas.

TRY THIS

Is your potential customer:

- (a) A consumer – end user or individual?
- (b) A retail organization (on - or offline) with consumer customers?
- (c) A commercial business, e.g. business to business (B2B)?
- (d) A public-sector entity, e.g. a government or public body?
- (e) A non-profit organization, e.g. a charity or professional body?
- (f) A regulated business, e.g. power company, water supply, health?

Once you have categorized your target markets, you can begin market research.

6.2.2 Market Research for New Companies, Products or Services

Market research is not an exact science and with regard to products especially it is true that sometimes people don't know that they want something until they can see and use it. New ideas and products by their very 'newness' are generally going to receive a cocked eyebrow, rather than a gushing flow of excitement when first described.

The modern example of this would be the iPad, which was widely appreciated by those that saw it for the first time as a 'gorgeously designed piece of technology', but they were not quite sure what they would use it for. Of course, here we are a few years later with over 1,000,000 apps and it's becoming more and more valuable and useful every day; its launch spawned a whole new tablet and mobile app industry.

If I'd listened to market research we would have created a faster horse.

Henry Ford

That said, focused and relevant market research is, of course, vital to your ability in creating a business plan, and making informed cost-conscious decisions on your initial marketing and sales plans. In the context of the associated university course and most startups, you will not have the resources to hire a 'Mintel', 'Mori' or 'TNS Global' to do all the market research for you, but the resources available through public libraries, local government trade and industry organizations and of course online are extensive.

Sometimes people just don't know what they want until you give it to them.

Steve Jobs, Apple

Once you have identified the most likely target markets, which may be a single category or a combination of a few categories, you can then delve deeper and research the following:

- target market size and trends (next 5, 10 and 20 years)
- segments
- competition
- market cycles.

6.3 Target Market Size and Trends

What you are looking for here is an indicative total potential revenue or user number (individual customers or end users) of the target market, including all potential competitive solutions providers, in the geography that you are targeting first (if not globally). You can then use this as a basis to estimate the percentage of the total market that would potentially buy your specific products and/or that your services could touch.

Oakridge Ltd's KwikDock product is a dock for the MacBook Pro range of 13", 15" and 17" laptops manufactured by Apple. It is compatible with this specific range of laptops only, so the current potential market size for this dock would mirror the total number of compatible models sold by Apple. The ongoing future market trend would mirror Apple's sales projections for this compatible model. With Apple being a public company, these figures are relatively easy to find online and through their public filings.

You can further analyse these topline numbers by applying filters on your product's value proposition, available sales and marketing resources, initial target geographies, manufacturing capacity and route to market. This will allow you to come up with projected sales figures for your business plan.

6.3.1 Segments

It can be useful, especially with very large market categories, to segment them further. This may help in creating a more targeted marketing plan, focused on each specific segment or indeed a combination of several segments. Three common market segmentation categories would be *demography*, *geography*, and *spendability*, but many others exist, mainly as a sub-set of *demography*.

6.3.1.1 Demography

This is best described as the concentration and spread of age groups and genders for which your products and services are targeting in a particular area. Knowing this can inform your communication style and media choice for advertising or PR, as well as specific product messages and benefit focus. Note that demography can also include income levels, household size, etc, but this is mainly useful for consumer products and covered generally by the spendability segment.

A golf cart manufacturer has seen recent increased sales to retirement community villages in Florida without having specifically targeted them. After product feedback, they adapted their range of carts for use by retirees for transport within the retirement village complexes, and quickly adjusted their marketing messages to specifically communicate the benefits of their electric carts for this 'new' use/application and age group. Now, they chart concentrations of retirement villages in the USA and focus their marketing efforts on the 'electric transport' carts in these areas.

6.3.1.2 Geography

The physical location of your target markets may be driven primarily by the nature of your products and services. The geographical location of your target markets will inform

the marketing (and sales) plan in relation to languages, cultural idiosyncrasies, shipping/import/export considerations, distribution models, commercial regulations and lead times.

If you have created a new type of environmentally friendly gritting salt to remove snow and ice for road treatment, your target markets are going to be geographically located in certain latitudes and/or altitudes, and this knowledge will drive the marketing and sales plan.

6.3.1.3 Spendability

Segmenting target markets by their *spendability* or disposable/available income is especially useful to inform marketing plans with regard to pricing strategies and media/online advertising; this is especially true for consumer products and services. Social class, lifestyle, interests, attitudes, personality traits all form elements of the spending behaviours and your marketing plan must consider these behaviours with regard to those prospective customers that will most likely buy your products and services.

For example, your company has designed an upmarket luxury range of luggage with a relatively high price point. Your research on disposable income and spendability will inform you, especially with regard to what publications, online sites and social network groups serve your target audience, and will give you the exposure that you need within these groups. You will likely target luxury travel publications, websites and social network groups to engage with your target audience.

6.3.2 Competition

Having solid competitors is a great thing as long as you have valuable *unique selling points* (USPs) that will allow you to compete well with them. You can learn a lot from your competitors but whilst researching, always think about learning from their mistakes and ways of delivering a better customer experience. In many respects after all, they will have ‘been there’ and ‘done that’. Visit competitor websites and see what you can discover on their pricing and if they sell directly through agents or resellers. Competitors sometimes publish lists of their resellers who, of course, can become your resellers.

Other sources of competitor information include: sales literature, advertisements, press releases, websites, exhibitions, trade fairs, their customers, suppliers, newspapers, patent office, industry reports, company accounts, surveys, questionnaires.

Your pricing strategy and value proposition need to make sure that your product is competitive in that its USP has a defensible additional value per pound or dollar spent than that

Table 6.1 What competitive info to look for

Products or services	Product or service range, product or service quality, future product development, USPs, competitive advantage, features and benefits
Marketing	Logo/branding power, reputation, promotional methods, marketing materials, customer care, e-commerce
Operations	Premises/location, staff, equipment/vehicles, production process, quality systems, suppliers/materials, research development, IT/computer systems, tenders/contracts, ISO accreditation
Finance	Prices, financial performance, credit terms, VAT registration

of your competitor. You may have an almost identical product or service but can you deliver it at a better price or have faster lead times or any other significant benefit to customers? In your deeper competitor investigations, you may even come across a company that may one day acquire you or that strategically you may want to acquire yourself.

Be respectful to competitors. If you are tempted to pretend to be a bogus prospective customer and request a lot of information and quotations for your competitive intelligence purposes, then beware! You will likely be found out and flagged as an aggressive competitor and they will be more likely to strategize specifically against you. The best way to get information is to find and call some of their customers and get third-party opinions and information, by telling them exactly the purpose of your call. The competitive information that you should look for falls into four broad categories (see Table 6.1), however, with a view to long-term plans associated with each category.

TRY THIS

Call someone you know or a business that has bought a comparable product from your competitor and say, 'I'm calling from ABC company. We are launching a new product that does X, Y and Z and I just wanted to ask you a little about any comparable products that you might buy at the moment and what you think of them and their suppliers.' Most people love being asked for their opinion on something, others will be suspicious; you just have to glean what you can. They may have such a good reputation with your competitor that they may tell them about your call. With a nod to the adage that 'there is no such thing as bad Public Relations (PR)' do not worry about that, if your competitor does not know about you yet they certainly will soon if you have a good marketing strategy. With the rapid spread of feedback groups and forums online, you will also find lots of independent reviews and comments especially for consumer products.

For example, check out www.reddit.com for product reviews. Check out competitors' company structure and finances at www.duedil.com.

6.3.3 Market Cycles

Evaluate your products and services in relation to possible seasonal trends and cycles. This research will be well appreciated by your finance and production planners, as highly seasonal

businesses need to be very careful that they cover non-cyclical fixed costs, like office space, utilities and full time staff, and that they have enough product in the high-demand seasons. These trends and cycles can include:

- Seasonal businesses – for example ice cream, Christmas or Halloween decorations, home heating oil, garden furniture, back-to-school products.
- Fashions or fads – for example short-lived, massively popular products or services such as cabbage patch dolls, yo-yos, skateboards, Rubik’s cube, flared trousers, stylophones, etc.
- Fixed one-time events – for example Ireland grand slam winners 2009 shirts, London 2012 Olympics merchandise, royal baby souvenirs.

6.4 Demand Indicators – Keyword Tools

Google’s dominance in the search engine sector means that they have an enormous and continually growing database and history of search queries, that is specific data on the volume of searches for particular ‘keywords’ and ‘keyword strings’. Use Google Analytics and Adwords to obtain very accurate data on the number of monthly searches for keywords that would be relevant to your own products and services. You can choose your countries and widen your data, although you may need to use other language phrases to match the country that you are targeting.

In 2013, Google integrated its keyword tool in to its Adwords service and you can access it at <http://adwords.google.co.uk/o/KeywordTool>, as illustrated in Fig. 6.1.

Modify search

- Search for new keyword and ad group ideas
- Get search volume for a list of keywords or group them into ad groups
- Get traffic estimates for a list of keywords
- Multiply keyword lists to get new keyword ideas

Enter one or more of the following:

Your product or service

For example, flowers or used cars

Your landing page

www.example.com/page

Your product category

Enter or select a product category ▼

Get ideas

Cancel

Figure 6.1 Google’s keyword tool

Table 6.2 Monthly keyword search analysis

Keyword term	Google.com	Google.co.uk
report templates	135,000	14,800
report builder	110,000	9,900
report software	90,500	5,400
inspection reports	60,500	14,800
insurance reports	49,500	2,400
building reports	27,100	2,900
surveying software	27,100	2,900
report apps	14,800	880
professional reports	12,100	1,300
health and safety reports	4,400	1,300
mobile data app	4,400	390
surveyors report	4,400	1,600
property valuation reports	1,900	390
ipad survey app	1,600	260
apps for surveyors	880	140
mobile data capture	720	170
mobile surveying	720	91
transcribe notes	720	46
survey report templates	590	140
quantity surveyor reports	480	36
mobile inspection software	260	12
professional report software	140	7
mobile data collection apps	73	5
automatic report writing	36	3
	547,919	59,870

Bing, Yahoo and other search engines also have keyword tools but obviously have less volume of data than the market dominant player, Google. Once you have filtered a list of approximately 20 keywords and keyword strings (short keyword phrases), you can export the data to a CSV file and use MSEXcel to analyse the results.

Table 6.2 gives an example of the monthly search traffic for keywords for a company called GoReport®, specifically in the market offering iPad and web applications to reduce data capture and administrative time wasted in the compiling of onsite surveys and reports. The list clearly illustrates some general demand for the service, and greatly informs the companies about keyword placement on their website.

6.4.1 *The Value Proposition – Features TELL, Benefits SELL*

With the aid of good market research, building out your product's value proposition and USPs should be relatively straightforward. However, a common mistake is to concentrate on features and not the 'what's in it for me' benefits that really engage and compel customers to buy.

Features describe your product or service and what it does. Benefits describe how the product or service will add value by, for example, saving time and money, increasing your sales, decreasing your liabilities, adding comfort, enjoyment and efficiency to your life and your business as well as positioning you ahead of the game. Customers buy because of the perceived benefits to them and not general features.

For every noteworthy feature of your product you must come up with an associated benefit that this feature can give the potential customer. This is where the customer will connect with the idea that it can help them improve something that has been somewhat cumbersome, problematic or downright disruptive in their life. As the benefits build, customers start to add up the value of the benefits that they see as applicable to them or their situation. If the value of the total applicable identified benefits is worth the price that you are charging and they have funds available, then they will likely buy the product or service.

Presenting value propositions to customers can be an art and science in its own right and you may spend many hours and sometimes weeks and months with some customers building a unique value proposition that fits with their specific needs. Also, the same products or services can be purchased by many different customers for many different reasons.

In its broadest terms, marketing communications can highlight a range of possible benefits and the sales and marketing strategy has to match those benefits to customers needs, in order for a sale to happen. If your product is something that can easily be sold online, the journey that a customer must take needs to be clearly thought through and understood. It must ensure that when a customer journeys through the website it builds interest, ticks off benefits and ensures the customer is 'happily convinced' when they arrive at the 'BUY NOW' button.

6.5 Evaluating Your Market Research

There are a number of activities that must be undertaken after your market research has been carried out. These include:

- Revisiting your product or service ideas and brainstorming to work out how you can improve its value proposition in light of your market research.
- If you find you cannot compete or provide a really good USP, you should drop or radically adapt the idea or develop a new one and start again.
- Analysing the cost to produce or deliver your product or service and comparing it with what the research tells you about the maximum price you can charge. This must be profitable.

TRY THIS: Composite Covers

Are the following words and phrases features or benefits? Recently, advances in technology have enabled ubiquitous cast-iron covers to be replaced with hi-tech glass fibre/resin composites. There are a host of potential features and benefits to communicate to prospective customers. Identify which is a feature and which a benefit.

	Description	Feature (F) or benefit (B)
1	Lightweight	
2	Anti-slip surface	
3	Saves installation time and expense	
4	No significant corrosion	
5	Meets DOE regulations	
6	Low total cost of ownership, saves Capex and maintenance budgets	
7	One person can lift it	
8	Reduces public slips, installers' back injuries and hence reduces insurance/compensation costs	
9	Can be locked	
10	Reduces theft of underground cable or fuel from underground tanks, saving money and insurance liability	
11	Ergonomic design	
12	Ventable	
13	Watertight seal	
14	Reduced maintenance costs	
15	Transparent to radio waves; allows remote monitoring and wireless, reducing the need for lifting which saves injuries, time and expense	

Answers: 1-F, 2-F, 3-B, 4-F, 5-F, 6-B, 7-F, 8-B, 9-F, 10-B, 11-F, 12-F, 13-F, 14-B, 15-B

'Revenue is vanity, profit is sanity'

6.6 Your Marketing Strategy

Part of the business plan will relate specifically to the marketing plan, and data captured in your market research will largely inform a good marketing strategy. It is impossible to offer a universal marketing strategy as the one that works best varies so much from product to sector to industry to geography and demography.

We can look at several principles and break options down into the relevant categories that specific marketing actions will generally fall under. We will focus on several categories in this section, defined as follows:

Direct marketing. This is the activity of getting direct marketing communications straight from your company directly into the hands, ‘in’ boxes, eyes and ears of relevant decision-making individuals. Examples include phone calls, email, physical mail shots, Tweets to followers, LinkedIn inmails, etc. These contacts need to be ‘opted in’ to receive your direct marketing communications, in line with Privacy and Electronic Communications Regulations (http://www.ico.org.uk/for_organisations/privacy_and_electronic_communications).

Indirect marketing. This covers almost all advertising and PR, both online and offline, where no specific individual is targeted and it is more a ‘blanket’ type of marketing. Examples are newspapers, magazines and TV ads, or online banner ads.

These headline categories can be further divided into online marketing or offline marketing.

Online marketing is any digital campaign, post or communication that you generally create and distribute online via the Internet.

Offline marketing is often still referred to as ‘traditional marketing’ and examples include TV, newspaper and billboard advertising, that is marketing activities that do not rely on the Internet for distribution.

PR is about reputation – the result of what you do, what you say and what others say about you. Although PR is often decoupled from the umbrella ‘marketing’ function because its practice is more closely related to ‘brand’ and ‘image’ enhancement and management, with a goal of developing perceived value and authority, it can deliver impressive customer buy-in and sales in its own right.

PR is the discipline which looks after reputation, with the aim of earning understanding and support and influencing opinion and behaviour. It is the planned and sustained effort to establish and maintain goodwill and mutual understanding between an organization and its public.

Chartered Institute of Public Relations

6.6.1 Monitoring Reputation

Google offers a change detection and notification service called Google Alerts. It automatically notifies users when new news, web, blogs, video and/or discussion group content matches a

set of search terms selected. A little similar to Google Analytics, the results are delivered as an email report to a Gmail account. The service is available to the general public as an open beta research but only provides content from Google's own search engine.

There are six different alerts that can be set up:

- Everything (default setting) – aggregates news, web and blogs.
- News – sent when matching content makes it into the top 10 results of a Google news search.
- Web – sent when new web pages appear in the top 20 results of a web search.
- Blog – sent when matching content appears in the top 10 results of a blog search.
- Video – sent when matching content appears in the top 10 results of a Google video search.
- Groups – sent when matching content appears in the top 50 results of a Google groups search.

Users can select the frequency of checks for new results. Three options are currently available: 'once a day', 'once a week', or 'as it happens'. The alerts are sent only if new content matches the user-selected search terms and if you select as it happens, you can end up with a lot of emails – especially during marketing campaigns. The alerts can give companies a head start when it comes to handling unfavourable web feedback on product, company or service issues and can be incredibly useful in reacting to and heading off negative situations before they become reputationally damaging.

6.7 Promotional Techniques

Taking your market research into account, the marketing strategy should focus on delivering compelling information about your products to your target customers in your target areas. The list of possible marketing activities or promotional techniques that can be undertaken runs to several hundred, but here are some of the most popular.

6.7.1 Offline Marketing

As a general rule, the more that you can measure the results of all marketing activity, the more that you can determine what works and less of what does not. This is tougher with offline marketing as it is more difficult to measure the results. However, having strong calls to action 'offer codes' and persuading recipients to visit online sites where traffic is recorded can give good measurable data.

Using any of the potential ideas given in Table 6.3, a marketing message needs to be formulated first in the offline marketing column. Here are some general rules of thumb to create compelling ads or communications:

- Headlines – use at least 20–25% of the space, use the word 'you' not 'we'. Also, ask a question too if possible.
- One message only – don't include lists or bullets and try to focus upon one USP per advert. Edit text (copy) to the minimum, with absolutely no unnecessary words – add depth to your headline.

- One image – powerful images sell. You don't have to be blatantly literal, but use an image that works with your headline.
- Include an offer (if appropriate) – make it simple, and give it urgency by adding an availability limit or a time constraint.
- Simple call to action – phone, email and web address. Always include a response code.
- Don't be afraid of white space – make sure your brand has room to breathe.
- 'QR codes' direct people from offline media to online pages which are measurable and potentially offer video and richer sales copy and images. They are slowly becoming more popular and take you to a web page when scanned which will further expand the information on the advertisement or communication. The URL attributed to the QR code should be unique, so that you can get web traffic figures for clicks that can only come from scanned QR codes (see Fig. 6.2). You can generate QR codes for free at <http://qrcode.kaywa.com>.

Table 6.3 Examples of offline and online promotional techniques

Offline	Online
Exhibitions, trade shows, corporate sponsorship, seminars, networking events	Creating a website
Business cards	Submission to search engines
Corporate gifts, calendars, diaries	Search engine optimization
Promotions and sales (e.g., 2 for 1)	LinkedIn
Fax-shots	Facebook
Brochures, flyers	Twitter
Business stationery	Affiliate marketing
Mailshots, flyers, brochures	Email marketing
Television ads, radio ads, cinema ads	Banner advertising
Printed newsletters	Blogging
Signs, billboards, bulletin boards, posters, leaflet drops	Content creation
Sandwich boards	Article submission
Telephone directories	Webinars
Transport ads (e.g., bus)	You Tube
Point-of-sale materials	Vimeo
Newspaper ads, magazine ads, newsletters	Online directories
PR	RSS feeds
Flash Mob	Pay per click (PPC)



Figure 6.2 Example QR code

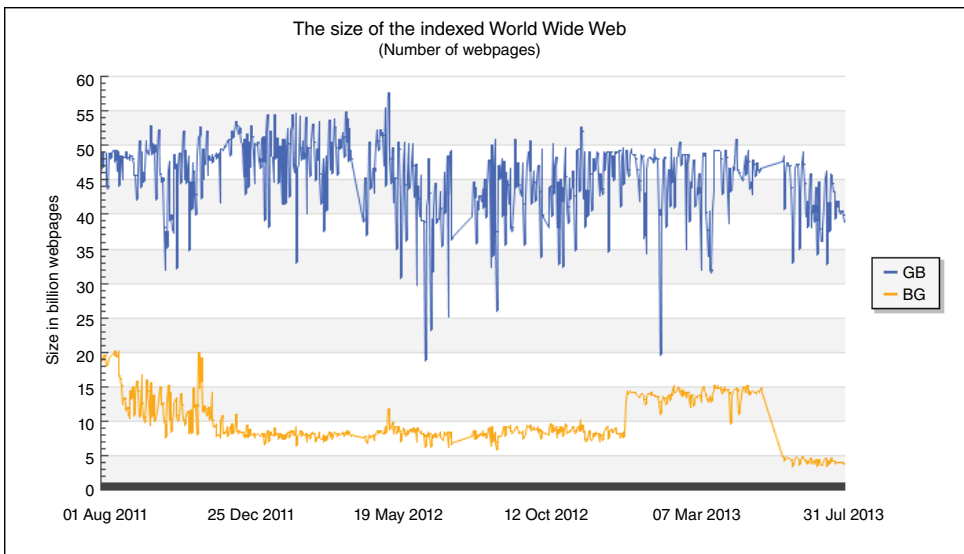
For print media advertising, the best size is 1/2-page vertical – around 60% of the cost of a full-page ad. If you place it on the right-hand edge of a double-page spread and stick to the above formula, it will have just as much impact as a full page.

6.7.2 Online Marketing

Online marketing is a huge subject to cover in part of a single chapter, however, it can be broken down into categories. Generally, every product and service should be marketed with a mix of off- and online marketing, and every product or service should be searchable online either in a dedicated company website products and services section, through online retail stores or via specific ‘landing pages’ (single pages dedicated to promoting one or two products or services).

6.7.3 Websites

If your product or service can easily be deployed through e-commerce, your website will be radically different from a typical corporate or ‘brochure’ website. Just look at the size of the web, as detailed in Fig. 6.3. Brochure sites are just that, websites that tell you all about a company and its products and services; they do not let you place orders, change sporadically and have limited interactive features. They should still be optimized for ‘findability’ with search engine optimization (SEO), strong calls to action and well-constructed keyword-rich content.



GB = Sorted on Google and Bing

BG = Sorted on Bing and Google

Source: <http://www.worldwidewebsize.com>.

Figure 6.3 Size of the web

These should include call outs to get in touch with a sales person or contact general inquiries, or requesting a call back for more information and pricing, etc.

‘Build it and they will come’ is no longer true of websites, as ‘surfing’ the web has become more of a ‘searching’ the web behaviour at the time of writing. There are over 37 billion indexed pages on the world wide web. The question is, how can you and your products and services ever get found amongst this huge amount of ‘noise’.

Chartered Institute of Public Relations

When websites were first coming online in the late 1990s, and early 2000s, their creation was generally the domain of true graphic designers so the emphasis was on design rather than message, marketing or ‘visitor engagement’. Aesthetics are important for sure, but a more focused marketing approach with clear concise messages and an intuitive flow to your website will promote good ‘dwell time’ or ‘stickiness’ (the art of attracting visitors to stay and read on), which will result in a higher rate of conversion. Conversion rates are the percentage of visitors who go on and either buy or fulfil some other set goal, for example, to fill in an inquiry form or sign up for more information (opt in).

6.7.4 Search Engine Optimization

Search engines such as Google and Bing use algorithms which they like to update quite frequently, so beware. They create page rankings based on their definition of relevance to the terms or keywords entered into their search boxes. There is a definite art to designing a site that will rank highly, so it is worthwhile employing or outsourcing expertise in this area to keep up with the latest focus and trends; the difference in number of site visits between a site ranking third in unpaid searches and a site ranking 75th on page 8 of the returned searches can be tens of thousands of visitors.

A general rule of thumb on an ‘unpaid for’ position is that 60% of people click on the first result, 30% on the second, 25% on the third, etc so that by the time you flip to page 2 of the search results, less than 1% of searchers could be clicking on this result. The best way to approach good page ranking is with well-written, clearly relevant and frequently updated websites, with good content and good use of targeted keywords or phrases.

A common myth that exists is that you can massively influence page ranking as a direct correlation to the amount of ‘back links’ (links from other sites to yours) that you have. ‘Black Hat’ or ‘guerrilla marketers’ used to set up hundreds of 1-page websites with back links directed to a certain site promoting a product and were, in the past, able to see good traffic increases. This practice has almost been squashed by upgrades and changes, especially at Google that recognizes these links as bogus and then effectively invalidates the linked-to page or URL with the product promotion.

There is a thriving group of individuals constantly inventing new ways to drive traffic artificially to sites by hijacking search behaviour, and this will most likely never end. Suffice to say, the best advice is to stick to the basics: write interesting, compelling and relevant copy and regularly update your news feeds and blogs.

6.7.5 Website Analytics

It is absolutely imperative to add tracking codes to your website that can be recognized as it will give you real data on visitor numbers, click-through rates, location of visitor referral sites and much more. This can be done easily by visiting www.google.com/analytics.

Use the data to inform your online content and strategies as a whole. Set up conversion goals and automatic weekly analytics reports into your in box to make sure you are on top of how your site is performing.

6.7.6 Affiliate Marketing

Affiliate marketing is frequently overlooked by advertisers. While search engines, email and website syndication capture much of the attention of online retailers, affiliate marketing carries a much lower profile. Affiliate marketing is a type of performance-based marketing in which a business reward or commission is paid to one or more affiliates for each visitor or customer brought by the affiliate's own marketing efforts.

The industry has four core players: the merchant (also known as the 'retailer' or 'brand'), the network (that contains offers for the affiliate to choose from and also takes care of the payments), the publisher (also known as the 'affiliate') and the customer. The market has grown in complexity, resulting in the emergence of a secondary tier of players, including affiliate management agencies, super-affiliates and specialized third-party vendors.

Affiliate marketing overlaps with other Internet marketing methods to some degree, because affiliates often use regular advertising methods. Those methods include organic SEO, paid search engine marketing (PPC), email marketing, content marketing and in some sense display advertising. In contrast, affiliates sometimes use less orthodox techniques, such as publishing reviews of products or services offered by a partner.

Affiliate marketing is commonly confused with referral marketing, as both forms of marketing use third parties to drive sales to the retailer. However, both are distinct forms of marketing and the main difference between them is that affiliate marketing relies purely on financial motivations to drive sales while referral marketing relies on trust and personal relationships to drive sales. Affiliates still continue to play a significant role in e-retailers' marketing strategies.

6.7.7 Email Marketing

Email marketing is a direct and cost-effective way to communicate a message to your prospects and customers and should be a vital component in any digital strategy and a complement to your social media campaigns. Permission-based email marketing platforms such as Eweber, Constant Contact, Mailchimp and many more will help you devise a data-capture method allowing you to build your email lists organically and communicate effectively with prospects and customers on an ongoing basis.

Using e-marketing you can optimize every possible data-capture opportunity, embedding links and calls to action, and of course you can get instant and total access to statistics such as amount of emails delivered, open rates, click-through rates and much more.

6.7.8 Social Media

Social media uses Internet and web-based technologies to transform broadcast media monologues (one to many) into social media dialogues (many to many).

Wikipedia

Types of social media include forums, message boards, blogs, video sharing, photo sharing, social bookmarking, social networking, rating, reviews, user-generated content and Wikis. At the time of writing, 91% of marketers are using social media and the top used by marketers are:

- Facebook (74%)
- YouTube (65%)
- Twitter (63%)
- LinkedIn (60%).

6.7.8.1 Facebook

Great for customer communication, interaction with your brand, promotions/competitions and delivering good customer service. In a more general sense, Facebook works to promote brand exposure through their branded, customizable business ‘pages’ and more recently, through targeted advertising pages.

6.7.8.2 Twitter

Twitter is great for customer communication through trending topics, # tags and save search. It can give you brand exposure, viral capability and integration with your website.

6.7.8.3 LinkedIn

LinkedIn is more of a professional work-based network. It can be used to promote thought leadership within groups, establish yourself (and by extension your business) as an expert in your field of business and can be integrated into your website.

6.7.8.4 YouTube and Vimeo

YouTube and Vimeo video publishing sites allow your business to have its own video ‘channel’ that can entertain, inform and engage with customers. This dynamic content adds depth to website content and promotes brand exposure and higher page ranking, linking back to your website. Video is becoming more and more an essential part of any company’s marketing mix. It must not be ignored and should be a significant part of your online content-creation strategy.

6.7.8.5 Pay per Click

PPC is one of the most important revolutions in marketing this century. If you're serious about business success, you must test it out.

The following points can be made about PPC:

- PPC is one of the most powerful breakthroughs in marketing this century – yet very few entrepreneurs truly understand its power.
- PPC allows you to reach people who have an interest in what you have and who are looking for it right now. As you read this, someone, somewhere is almost certainly on Google looking for what you have to offer.
- PPC advertising allows a link to your website to appear at or near the top of the search engine results that they see when they do their search.
- Best of all, you only pay when someone actually clicks on your ad.
- If you run a local business, you can even specify that the ads only appear for Internet users in your area.
- Make sure your conversion rate is high enough for your PPC advertising to be self-funding. For example, if you win 10 new customers a day giving you an extra £100 profit and your PPC campaign cost you £180 to find these new customers then you need to stop and think, as the costs outweigh the reward.

6.8 What is Social Media All About and Why is it Important for Business?

Traditional forms of advertising can expend a large percentage of any marketing budget with often immeasurable success, and may not end up even reaching your target audience. Having more people see you and know that your business exists has always been expensive.

Social media is about conversations and relationships and is essentially word-of-mouth marketing online. Facebook and other social networking sites have created engaging platforms to make this aspect easier. Businesses can create a 'Group page' or a 'Fan page' for their business and engage with members of their community, increasing their visibility, building their brand and staying top of mind for many.

As the major search engines like Google, Yahoo and Bing index social media content and display it in search requests, communication can become content and make the business known to people who previously had no contact with the business. The more people get to know you, the more your brand will spread on social media and on the wider Internet space. Becoming a visible brand is important to gain attention and to get the chance to start a conversation with potential customers. When publishing valuable and share-worthy content via social media, the

chances are reasonable that your network will share it with their friends. With this share-ability of content, more people become aware of your business and maybe connect with you and visit your website to see what you have to offer.

A key component of a business's presence within social media is maintaining an engaging and up-to-date space. Crucially, engaging with the audience and continuing that engagement builds strong relationships. The feeling of talking to a friend is more comfortable than talking to a sales person.

Acquiring new customers is the cornerstone of business growth. Social media is a real-time mechanism for attracting potential customers and can be used to initiate engagement with laying the foundations of client/supplier relationships. It is this relationship that can be leveraged to attract further customers through word of mouth. Also, using social media is a powerful way to maximize customer retention by continuing to build relationships and, in turn, build customer loyalty and advocacy.

6.8.1 *Facebook Facts*

A couple of facts are useful to consider, which were compiled at the time of writing.

- Facebook has 1.15 billion active users, compared with 150 in 2009.
- Around 600 million people use Facebook on a daily basis.
- Facebook claims that more than 30 billion pieces of content are shared each month.
- The average user spends 55 minutes per day on Facebook.
- The average user is connected to 80 pages, groups and events.
- 100 million active users are currently accessing Facebook through their mobile devices.

Traffic generated on these pages can be measured using a number of tools, including Facebook Insights reporting. Marketers should set up a company page which is very different from a personal profile. It can be used to create likes or fans which proliferate the page content to friends of friends as the like action shows up in personal profile news feeds (depending on user privacy settings). Facebook pages are customizable and are almost mini websites or blogs in their use and usefulness.

6.8.2 *YouTube, Vimeo and the Use of Video for Business*

Video provides an excellent opportunity for your brand to show off its products and connect with existing and potential customers in a quick and dynamic way. With our impatient, busy lives, many people would prefer to watch a video instead of trying to digest written information. And since more and more consumers are spending time online instead of watching TV, the popularity of watching videos online is growing exponentially.

With so many businesses catching on to the importance of social media marketing, YouTube, Vimeo (and other similar video-sharing sites), it can sometimes be forgotten or at least misunderstood in terms of its importance to a company's marketing plan.

Video is a very popular content format that's regularly shared via social media and email. So Google, Yahoo, Bing and other search engines tend to favour site that offer it. Hosting video and images on your web pages, as well as having your own YouTube or Vimeo channel, will improve the overall quality of your site's content, as well as entice visitors to stay longer and check out what your business has to offer. In turn, this gives you a better chance of ranking higher than your competitors in search engine results.

Offering video is a great way to help attract visitors to your website and keep them engaged. Creating original and compelling video content will increase your page ranking.

Online video is also an 'easy-to-share' format; if you watch something that's compelling or entertaining, then you are likely to share it with friends, colleagues and family who will also pass it on. This can usually be done by just a few clicks of your mouse or taps on your smartphone or tablet. In this way, your video content has the potential to go viral and connect with a wide range of potential customers.

With content marketing (in particular, blog articles), your written content is rarely published in more than one place. Videos are much easier to syndicate via social media, industry websites and brand partnerships.

Many videos that have gone viral on the Internet have been produced using a webcam or camera phone with inbuilt recording facilities. Depending on how you want your brand to be perceived, it can be easy to produce original, engaging and useful video content on a relatively small budget.

Keep your main promotional videos short, focused and to the point just like you would any marketing communication. A general rule of thumb for product or service promotional videos is that the initial 'teaser' video you promote should be approximately 60–90 seconds in length. Obviously, longer videos can be used for detailed product service or information, but the 90-second promotional video will be the most likely to engage with new customers.

Most smartphones and tablets are optimized for playing video content. Not only will this increase the ability for your video content to be seen, but it can also differentiate your business from competitors. In terms of branding, your videos can convey brand messages that would be lost if you were providing purely written information. Video allows for your brand to capture emotions and visual attributes of your product that leave a lasting impression on your audience.

6.8.3 Twitter

Here's what Twitter itself says in relation to business benefits.

A lot of the benefits for using Twitter for business are similar to other social media platforms in terms of building brands, communication etc ... but its short format and sometimes obsessive usage does differentiate it from other social media. Of course, connecting with customers is still the main reason why you should use Twitter for your business. You will be able to connect with your customers because they themselves are most likely already using Twitter. If you have an unsatisfied customer, you may hear them on Twitter. This will help your company to assist them and you can keep an ear out for this kind of thing with tools such as Twitter search where you can get alerts (e.g., Google alerts), if you are mentioned on Twitter, which can enable you to handle a potentially negative situation more proactively.

6.8.4 Branding and Twitter

You don't have to be a big brand like Apple, Dell or Virgin to brand yourself on Twitter. You can be an average Joe and brand yourself on Twitter. If your company is not yet recognizable then you need to get a **personal** account. Why? Firstly, nobody wants to talk to a **logo** unless it's a famous brand. Once you have connected with your customers you will for sure be getting feedback on how you can improve your product, your services and maybe even improve your customer service. Listening to this will help you in the future.

You can also give the latest updates on Twitter about your company by tweeting. Figure 6.4 is a Tweet by digital marketing company, Ambition Digital.

You can also Tweet about new offers and coupon codes to help give your company an extra sales or new product launch boost (see Fig. 6.5).



Figure 6.4 Ambition Tweet

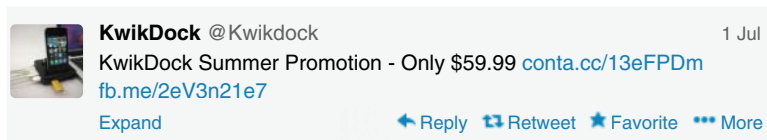


Figure 6.5 Kwikdock Tweet

Twitter can be viral. If you have succeeded in gaining some popularity with your Twitter account you will know how viral Twitter can be. Using Twitter search you can also keep an eye on your competition.

There are many online services that monitor and analyse social media chatter, allowing you to quickly understand and respond to the most important conversations about your brand. Two of the most popular are www.gorkana.com and www.brandwatch.com.

6.9 Case Studies and Referrals

As we all know, the power of word of mouth is enormous and there is a real comfort factor in knowing that you are spending money on products and services that others – whose opinion you respect – have done likewise.

It is absolutely imperative that you get a good system in place to follow up and get positive quotes and feedback from satisfied customers. Many people are very happy to give feedback and let you use what they say, but if you are offering someone products or services that give them an edge in their own business growth, they may want to keep that very quiet.

A quote from a well-known, respected or admired individual or organization can be huge for a company's fortunes. You only need to consider the 'ambassador' deal done between sportswear companies and famous sports people to understand the value of good referrals. With more technical products or services, it can be invaluable to get a case study or white paper written up that takes an individual's or organization's previous situations and tells the story of how things were improved by using your products or services. These can add mutual value by illustrating real-world tangible benefit examples, as well as promoting customer businesses. A great win – win situation.

6.10 Conclusions

It is extremely easy to look carefully at the failure rate of startups and become daunted by the statistics. In my personal experience though the most crucial factor in a viable business's early success or failure (after funding and cash flow) is the strength, focus and resourcing of the marketing plan.

Once you have completed your marketing plan, cost it out and plan it out for the year and agree a budget. Get your colleagues to buy in to why it is important, what the proposed outcomes will be with the actions and expenditure, and make sure everyone knows that they can all influence success by constantly looking for customers and business opportunities through their own networks of colleagues and friends. In times of economic downturn, marketing budgets can be the first to get cut. This is counter-intuitive in many ways, as it is the perfect time to get noticed more by increasing awareness of your products and services while your competitors reduce their budgets. Stop marketing at your peril! These days, human attention spans have been squeezed dramatically with the massively increased abundance of media. You can easily be forgotten.

Products and services do NOT sell themselves. Marketing is not the art of exaggeration or embellishment of a product's value or usefulness, but sometimes just the act of a little bit of self-promotion can drive new business owners into a crippling shyness. There is no real reward for being overly modest when trying to grow a business, so don't shy away from promotion. You don't need to ram it down people's throats but you do need to be heard.

The massive noise of media that we all absorb day in and day out is only occasionally broken by something truly valuable, interesting and specific to you. If you can create interesting, compelling and real-life story-based content and a proper marketing system, then you are already leaving 85% of the competition in your wake.

Intellectual Property

Rosi Armstrong

PURPOSE

Intellectual property (IP) provides protection for ideas and an understanding of IP issues relevant to your company is considered an important part of the course. This chapter provides an overview of IP, describing its importance, the different types of IP rights and what they protect, suggestions on how to decide on the relevance of IP to your company, how to develop an IP strategy and how to include IP in your company business plan.

TOPICS

- Understand the different forms of protection of IP
- Why IP is important
- Ownership of IP
- When and how to protect your IP

The chapter is organized as follows:

- The **importance of IP** forms the initial part of the chapter (Section 7.1).
- The different types of **IP rights** are discussed in Section 7.2.
- **Ownership** and information obtained from IP are then described in Sections 7.3 and 7.4, respectively.
- In Section 7.5, the **IP** you need to protect in your company is highlighted.

- What you need to do in order to protect your **company IP** is then outlined in Section 7.6.
- Finally, the approach to include IP in your **business plan** provides conclusions (Section 7.7).

7.1 Why Intellectual Property is Important

The creation of ideas is not only a fundamental part of this course, but is central to the formation of any potentially successful company. The ideas not only include those behind the basis of each student group company – namely the engineering product – but also, for example, ideas created around the company branding and route to market.

In any company, but particularly in innovation-led organizations, ideas generated within the business (often referred to as intellectual assets), indicate the company's commercial strengths and are considered to be key company assets. Such assets can form a significant part of the company value, often surpassing the value of its more tangible assets.

Given the importance of intellectual assets, an essential part of any business, and therefore of this course, is the consideration of the protection of these assets. Some intellectual assets, such as technical know-how and business information, are protected by restricting access to them within the company. Other intellectual assets, particularly those that need to be disclosed outside the business, can be protected using IP rights such as copyright and patents.

Once the relevance of intellectual assets to a company and the measures necessary for their protection have been understood, these can be used to develop an IP strategy and budget which can then be folded into the wider business strategy of the company.

Protecting intellectual assets through IP rights affords a number of commercial advantages to a business, including, for example:

- the right to own its ideas;
- creating barriers to the competition, allowing development time and giving a springboard into the market;
- enabling disclosure to collaborators without creating avenues for competition;
- protecting company reputation;
- helping to raise finances, e.g., by attracting investment;
- generating income streams by trading on its IP rights.

When most people think of IP, they tend to think of patents. This then conjures up in their mind the cost of filing and obtaining patents to protect the work, which they judge to be expensive. Thus, they assume that the company needs extensive funds to protect its IP rights. This notion, however, is ill advised as there are various forms of IP and different methods of protecting it.

7.2 Types of Intellectual Property Protection

This section covers the various forms of intellectual property protection.

7.2.1 Copyright

Copyright protects works which are original, that is not copied from another source; it provides protection for a range of types of work, such as literary (including product documents, web page material, business plans and software) and artistic (including drawings, flow charts and photographs). Copyright may not seem that relevant initially, but it will provide a means of protecting the intellectual assets of the company.

Copyright protects only the expression of an idea, that is what has been written or drawn. For example, copyright for an idea embodied in software protects against copying of the actual coding used for the software; it will not give protection for the idea which the software carries out and, in this case, if the original idea is seen as essential, then patent protection should be considered for this.

The protection afforded by copyright is automatically granted on creation of an original work, there is no registration required in the UK. Copyright in literary and artistic works expires at the end of a period of 70 years from the end of the year in which the creator of the copyright dies.

Copyright protection in a work is only infringed by copying all, or usually at least a substantial part, of the work. In the case where a piece of software is very extensive, this provides a level of protection as it could be possible to prove it was copied if a large proportion of the software remains the same in the alternative version. Independent creation of the same or a similar work does not infringe copyright.

7.2.2 Trademarks

The purpose of a trademark is to distinguish the goods/services of one party from those of other parties. A party's trademark designates the origin of the goods/services for which the mark is used; it expresses the company's image and brand and is a measure of the company's reputation. A trademark is therefore a significant intellectual asset of a company and, indeed, can be the principal such asset.

Trademarks to be avoided include those which are devoid of any distinctive character, those which consist exclusively of signs that may serve, in trade, to designate the kind, quality, quantity, intended purpose, value, geographical origin, time of production of goods or of rendering of services; also, other characteristics of the goods/services for which a mark is to be used, and those which consist exclusively of signs that have become customary in the current language

or in the practices of the trade to which a mark relates. Care should therefore be taken when choosing a trademark.

A trademark can be any sign capable of being represented graphically and may, in particular, consist of words (including personal names), designs, letters, numerals or the shape of goods or their packaging. However, not every sign will make an effective trademark. As the purpose of a company's mark is to separate its goods/services from those of others, the mark should not be the same as or similar to other marks used for the same or similar goods/services.

Once chosen, a trademark can be used, at least in the UK, without registration or before registration. However, registration of a trademark can make it easier to prevent other businesses from using the same or a similar mark for the same or similar goods/services. A UK-registered trademark lasts initially for 10 years and can be renewed indefinitely for further periods of 10 years.

TRY THIS: Trademark Search

POLO

- (I) Use the UK Intellectual Property trademark database, search by Word or Image.
- (II) Choose Type of Search = 'WORD'.
- (III) Choose Trademark Word Search Type = 'Exact'.
- (IV) Type POLO into Trademark Word Search Word field.
- (V) Select Status = 'Live'.
- (VI) Results – approximately 45 hits: EU001439181, in Class 30 (confectionery), owned by Nestlé, EU000751933, in Classes 4, 7, 12, 122, 28, 37 (cars, etc.), owned by Volkswagen; EU004049334, in Classes 18, 25 (clothing), owned by Polo/Lauren. This demonstrates that identical trademarks can be registered to different companies if the goods and services are different.

The owner of a UK-registered trademark has exclusive rights in the trademark. Broadly, these rights are infringed by use of the same or a similar trademark for the same or similar goods/services in the UK without the owner's consent.

In Europe, a single trademark registration can be obtained which is valid throughout the countries in the European Union. The criteria for registration and the protection offered by such a community trademark are largely similar to those for the UK. Trademark registration also generally exists in other jurisdictions.

7.2.3 Patents

Patents can be used to protect ideas or inventions, which are new, have an inventive step and are capable of industrial application.

The main criterion for an invention to be new is that it has not been made available to the public, in the UK or elsewhere, by written or oral description, by use or in any other way, before the date of application for a first patent for the invention. The main criterion for an invention to involve an inventive step is that it is not obvious to a person skilled in the art. An invention shall be taken to be capable of industrial application if it can be made or used in any kind of industry, including agriculture, except industry comprising surgery or therapy of, or diagnosis practised on, humans or animals.

In the UK, various types of ideas are not considered to be inventions and are not therefore patentable even if they meet the above criteria. In the context of this course, where each student group company is asked to create an engineering product, the exclusions from patentability will generally not be relevant.

One exception to this is the exclusion from patentability of ‘computer programs as such’. In practice, computer programs which have a technical effect are patentable in the UK if they meet the other criteria for grant of a patent. Software included in or operating on an engineering product would normally be found to have a technical effect. Computer programs for business methods are not considered to have a technical effect and are not patentable in the UK.

Patent protection must be applied for. The patent application must include a description of the invention described, for example, as a product, a system, a computer program or a process.

To satisfy the patentability criterion that an invention must be new, there must be no non-confidential disclosure of the invention before a patent application has been filed. Patents last for 20 years from the date of application.

A granted patent for an invention gives its owner the right to prevent others from, for example, using, making, selling and importing the invention. A granted patent does not, however, necessarily give its owner the right to use, etc. his own invention. That is, it does not guarantee that such use will not infringe a patent previously granted to another person or organization.

This issue of infringement of patents of other companies is one which should be considered in the scope of the course and an understanding of the process for assessing infringement should be demonstrated, even if this process is not carried out.

Infringement of third-party patents can be addressed by carrying out searches for previously granted patents for inventions relevant to the proposed engineering product.

The search results are then analysed to determine which of the patents are ‘in force’, that is alive, determine which of the alive patents cover countries where you propose to market your product, and for these patents, carry out at least a first-pass assessment as to whether the proposed engineering product comprises all of the features set out in the first product/system claim of each patent.

For the purposes of this course, the criteria for the granting of a patent for an invention and the protection afforded by a granted patent in other jurisdictions can be thought of as broadly similar to those described above for the UK. The main difference is the more or less strict application of patentability criteria to the granting of a patent in different countries, with, for example, granting of a European patent being one of the most difficult to achieve.

TRY THIS: Patent Novelty Search

Idea – hand dryer combined with a tap

Advantage – subject does not have to move away from sink to dry hands and avoids dripping water on the floor

Prior known technology – Dyson air blade hand dryers

Search:

- (I) Use the espacenet database, advanced search.
- (II) Type ‘Dyson’ into the Applicant search field.
- (III) Results – approximately 4500 hits, too many to review.
- (IV) Click on ‘refine search’ tab.
- (V) Type ‘tap’ into Title or Abstract search field.
- (VI) Results – approximately 7 hits, review to find International Patent Application WO 2012156736.
- (VII) Compare the Dyson invention with your invention to locate any differences.

7.2.4 Know-How

Know-how (or a trade secret) would be used to protect an invention of a company if putting a product incorporating the invention into the market does not disclose the invention or the product cannot realistically be reverse engineered to reveal the invention.

This type of protection can be strong, and can last longer than patent protection. However, the protection is only effective as long as the invention is not disclosed outside the company

and, if another party creates the same invention and files for patent protection, prior creation of the invention by the company will only give limited rights to continue using the invention.

7.2.5 *Design Protection*

There are two types of protection available for designs in the UK, design right and registered designs. The design can be for an aesthetic article or an industrial article.

Design right protects the design of features of the shape or configuration (whether internal or external) of the whole or part of an article, except those features of an article which enable the article to fit with or match another article. UK design right does not protect the surface decoration of an article.

In the UK, a design qualifies for design right protection if it is original, that is not commonplace in the field of the design at the time of creation of the design. Design right protection is granted automatically in the UK on either recording of the design in a document or making an article to the design.

UK design right expires either 15 years from the end of the calendar year in which the design was first recorded or applied to an article or, if articles made to the design are made available for sale or hire within 5 years from the end of that calendar year, then the design right expires 10 years from the end of the calendar year in which the articles were made available.

Design right protection in the design of an article is only infringed by copying the design to produce articles exactly or substantially the same as the design. Independent creation of the same or a similar design does not infringe design right.

In the UK, the design of a product can also be protected by a registered design. The design of a registered design can be the appearance of the whole or part of a product resulting from the features of, in particular, the lines, contours, colours, shape, texture or materials of the product or its ornamentation.

A registrable design should be new and have individual character. If a design is identical, or is different only in immaterial details to any previously available design, then it is not new.

A design has individual character if the overall impression it produces is different from that of any previously available design. The features of a product which enable it to fit with other products are not protectable by a registered design.

To acquire protection, a registered design must be applied for. Application can be made up to 12 months after any disclosure of the design by its owner, that is a design does not have to

be kept confidential before application. The right lasts for 5 years from the date of registration and can be renewed for four further periods of 5 years.

Registration of a design gives its owner the right to use the design and any design which does not produce a different overall effect. Using a design includes making or putting it in the market and importing any product which incorporates the design or any product to which the design is applied. The right in a registered design is infringed by a person doing anything with a design which is the design owner's right, whether as a result of copying the design or independent creation of the design.

Protection similar to UK design right and registered designs is available in the European Community (EC), with some important differences. A design is protectable by an unregistered and a registered community design if it is new and has individual character. Unregistered community design right lasts for 3 years from the date on which the design was first made available to the public in the EC. In the USA, designs are protected by design patents.

7.3 Ownership of Intellectual Property

In the first instance, IP is owned by its creator but this ownership may automatically pass to another party. For copyright, design right and registered designs, if the copyright work or the design is made by an employee in the course of his employment, the employer is the owner of the copyright, design right and registered design. Generally speaking, if an employee is employed to create inventions, then his employer will be the owner of the inventions and the employer will have the right to apply for patents for the inventions.

When a design is created as a result of a commission, the commissioner will own any design right and registered designs. Similarly, when creation of an invention is commissioned, the commissioner will own the rights to the invention and the right to file a patent for the invention. However, this is not the case for copyright; ownership of copyright in a commissioned work will not pass to the commissioner but rather remains with either the copyright work creator or his employer.

This is an important fact to keep in mind for this course, particularly if any student group company envisage having copyright works, such as website content, product brochures or software designed by another party.

7.4 Information from Intellectual Property

When starting the process of devising an engineering product for this course, each student group company will immediately be faced with several questions to address, such as how we

know if the product we are thinking of is already in the marketplace, how we find out which companies are working in this field, and how do we know if our proposed company name is already in use. A vast amount of information relevant to these questions is, of course, available on the world wide web but, supplementary to this and often overlooked, is the market and product information available from IP.

The IP information of greatest use in this course, and which is readily available, is the information that can be obtained from trademarks and patents (see Fig. 7.1).

Trademark applications and registrations are listed in various national databases, for example UK, EC and US trademark databases, which are freely accessible. These databases can be searched using a variety of query parameters, as shown in Fig. 7.1.

When an application for registration of a trademark is filed, the applicant must specify the goods and/or services that the mark is to be used for. The goods and services are chosen from an international trademark goods and services classification system, called the Nice classification (see Fig. 7.2). This classification can be searched to locate the classification(s) appropriate for goods and services of a particular type.

Information from Trade Marks

European Community Trade Mark Database:
http://oami.europa.eu/CTMOnline/RequestManager/en_SearhBasic

UK Trade Mark Database:
<http://www.ipo.gov.uk/tm/t-find/t-find-text/>

US Trade Mark Database:
<http://tess2.uspto.gov/bin/gate.exe?f=tess&state=4009:5ugaas.1.1>

Search by trade mark, goods and services classification,
 trade mark owner.

Figure 7.1 Information from trademarks

Information from Trade Marks



List of competitors' goods and/or services.

Defined in Nice classification system:

<http://www.wipo.int/classifications/nice/en/>

Figure 7.2 Information from trademarks (continued)

Using a combination of the trademark databases and the Nice classification, a student group company can discover quite a lot of information about their proposed engineering product. For example, the Nice classification can be used to locate a classification which covers the field of the product and the trademark databases can then be used as a starting place for uncovering companies which are working in the product field.

It will be expected that each student group company will devise a name for their company. The trademark databases and Nice classification can be used to check if the proposed name is free for use as a trademark.

Similar information can be obtained from patents, with even more detail being provided by this information source. As with trademarks, patent applications and granted patents are listed in various national databases, which are freely accessible. The European Patent Office database, espacenet, comprises information about not only European patents and patent applications, but also patents and applications of a variety of other countries including the UK, USA, China, etc. English translations of abstracts are also provided. This database can, as before, be searched using a variety of query parameters (see Fig. 7.3).

When an application for a patent is filed, the invention description is examined and at least one classification is assigned to the application according to the technology field of the invention. The invention classification is chosen from an international patent classification system, the IPC. The classification is displayed on the front page of the published patent application as in Fig. 7.4, and can be used as a search parameter to locate the classification appropriate for inventions of a particular type.

Using a combination of available patent databases and the IPC, a student group company can obtain information relevant to the novelty and marketplace of their proposed engineering product. For example, if a patent document has been located that is relevant to the proposed engineering product, the IPC published on the document can be used to search the database for other patent documents in this field. Similarly, the IPC can be used to locate a classification which covers the technology field of a proposed product and the espacenet database can then be used to search for previous products in this field and the companies which are working in the field.

Information from Patents

Numerous free patent databases, for example:

<http://ep.espacenet.com/>

Search by keyword, patent number, subject classification, patent owner name, inventor name.

Figure 7.3 Information from patents

Information from Patents

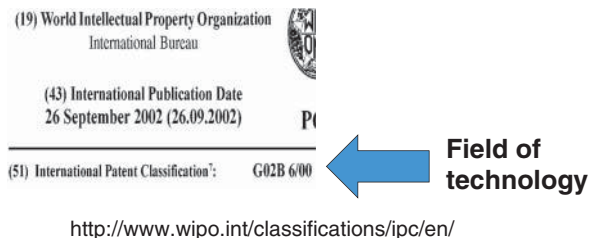


Figure 7.4 Information from patents (continued)

Information from patents

FIG. 2 is a flow diagram of an illustrative embodiment of a process to generate a display for a remote terminal session in accordance with the invention.

DETAILED DESCRIPTION

In broad overview, FIG. 1 illustrates a system 100 to generate a display for a remote terminal session that includes a first computing system (“client node”) 105 in communication with a second computing system (“server node”) 110 over a network 115. For example, the network 115 can be a



Figure 7.5 Information from patents (continued)

In addition to the above, individual patents and patent applications provide detailed information about inventions. The language of patent documents can be somewhat obscure, but to gain invention information it is sufficient to look at the portion of the document after the listing of the figures, which is sometimes entitled ‘Detailed Description’ or similar (see Fig. 7.5). Reading this portion of the document in combination with reference to the drawings will provide a good level of intelligence about an invention, and this can be used to inform the choice and development of the proposed engineering product. Whilst a full novelty and infringement assessment of a proposed engineering product would be beyond the requirements of this course, it would be expected that student groups will address these matters, possibly using the patent information described above.

7.5 Deciding How Intellectual Property Applies to Your Company

Each group will create ideas during this course, some of which will be associated with the technical product, others with the development of the business. Each student company will

need to decide what actions, with respect to IP in the ideas, are appropriate and necessary for their business. To do this, it is suggested that the IP situation of the company is considered in two parts: IP which is automatically granted and IP which must be applied for.

Copyright and design right are the two IP rights which are automatically granted, on creation of an original copyright work and design, respectively. For any idea created by a student company, when this is expressed in, for example, original documents, drawings, photographs, models, prototypes, etc. copyright or design right will automatically protect the document, etc. Consequently, a strategy for acquiring these rights is not necessary, but it is important to realize when these types of IP rights protect the company's ideas and include this in the company plan.

IP rights which must be applied, and therefore paid for, will require a strategy to decide on the importance of their protection to the company. It is suggested that for each idea, two basic questions are considered: is IP protection available for the idea and does my business need this IP protection? The answers to these questions will be different for different kinds of ideas, and will provide the data from which a strategy for these IP rights can be established.

It is expected that each student group company will devise a name for their company. Names can be protected by registered trademarks, if the chosen mark is distinctive.

With regard to the need for trademark protection, given the often favourable balance between resource spend (cost and time) to get a registration (at least in the UK) and the value to the company in protection of its reputation, acquiring this type of IP protection is usually considered appropriate.

If the engineering product is or comprises an article which is to be mass produced and marketed, these articles could be protected by registered designs. The resource spend to get a design registration (at least in the UK) is relatively low. If the design of the article is distinctive and it has been created to appeal to the market, the protection afforded by a registered design could be strong, and this type of IP protection would be an important asset to the company. When this is the case, it is appropriate to include registered design IP protection in the company business plan.

When creating a new engineering product, it is not unusual that this could comprise one or more technical inventions. This raises the issue of patent protection for the inventions. Owing to the large relative resource spend that can be involved in this type of IP protection, greater consideration needs to be given to the questions discussed above, that is, is IP protection available for the invention (referred to as the IP case) and does my business need this IP protection (referred to as the business case)?

Essentially, the IP case for patent protection assesses how likely it is that meaningful patent protection will be gained and the IP case assessment process should include at least the following considerations.

Using the information gained from the above considerations, a decision can be made as to whether patent protection for the invention is feasible. This information can also be used in the process for assessing infringement of any granted patents which are in force in countries where it is intended to market your invention. If infringement is suspected, either a different engineering product or a licence from the patent owner should be considered.

IP Case for Invention Protection

- Check if the invention comprises patentable subject matter, for example inventions comprising business methods are often not patentable in Europe.
- Check the novelty of the invention. The invention only has to be different in some way from similar inventions which are already available – this will often be the case.
- Make an initial assessment of the non-obviousness (inventive step) of the invention. This criterion for granting of a patent is often the most difficult to meet. The decision as to whether an invention is considered to be obvious to a person skilled in the field of the invention is, in practice, made by a patent examiner and is subjective and difficult to fully anticipate. However, it is important to arrive at some, even if limited, judgment on this matter. For example, if the novel feature of the invention is merely a replacement for a very similar feature, or the development of the novel feature has been straightforward, then it may be difficult to argue that the invention is not obvious. If, however, development of the novel feature has presented some difficulties or the novel feature produces some unexpected result, then it can be argued that the invention is not obvious.
- Decide if the existing knowledge within the student group company of other similar known inventions (prior art) is sufficient or if prior art searches are required.
- Carry out prior art searches as appropriate, for example, a ‘toe-in-the-water’ search could be used to check on the novelty of an invention, or a more detailed search could be used to assess the obviousness of the invention. If any external searches are to be commissioned, the cost of these should be compared with, and kept below, the cost of filing a patent application and the obligatory patent office search.
- Reassess the novelty and inventive step of the invention in light of information from any searches.

The business case for patent protection should then be assessed. Essentially, this gauges the value of the invention to the company and should include at least the considerations

given below. Using the information acquired from the above, a decision can be made as to the existence and strength of a business case for seeking patent protection or another type of protection for the invention.

Business Case for Invention Protection

- Consider the source of the invention, for example created wholly or partially within the group, open source use, etc. For there to be any business case for patent protection of the invention, the rights in it need to be owned by the company.
- Assess whether the invention is easy or difficult to copy, for example is it disclosed by inclusion in a company product or service, is it unfeasible to reverse-engineer it, is it encrypted, etc. If there will be no effective disclosure of the invention outside the company, then protection of the invention, other than by know-how, may be unnecessary.
- Gauge the projected lifecycle of the invention, for example short 1–4 years, medium 5–15 years, long 16–20 years. Under normal circumstances, a patent application can take 3 to 6 years to be granted, and the granted patent will exist for a further 17 and 14 years, respectively. If the lifecycle of the invention is short, patent protection of the invention may not be worthwhile.
- Consider the envisaged business relevance of the invention, for example core, peripheral, etc.
- Assess the cost of developing and delivering the invention and the estimated value of the invention to the company, the latter needs to outweigh the former for patent protection to be advisable.
- Assess the immediate and projected costs of obtaining the desired patent protection for the invention against the estimated value of the invention to the company. The latter again needs to outweigh the former for protection to be advisable.
- Consider the purpose of protecting the invention, for example to discourage copying of the invention, to prevent competitors from protecting something similar, to enhance the reputation or value of the company.
- Are there any other factors which should be considered for the invention, for example a requirement to protect the invention to attract investment in the company or provide an asset which can be sold or licenced?

When an invention has a strong business case and has a strong IP case (in particular, good arguments for why a person skilled in the field of the invention would not consider the invention to be obvious), then it would be appropriate for a student group company to include patent protection in its business plan. When this type of protection is chosen for an invention, it is usual to seek protection in several countries where your company intends to have markets. Therefore, there need to be sound IP and business cases for protection to justify the time and expense involved in gaining and maintaining the patent protection.

7.6 What to Do to Protect Your Intellectual Property

7.6.1 Copyright

Copyright protection should be relevant to every student group company participating in this course, due to creation of, at least, original material describing their engineering product and their business plan.

Copyright protection is granted without the requirement to apply for registration, so there is no need to prepare any specific documentation for such a process. Copyright works should be marked with the copyright symbol, ©, and the year in which the work was created. Good records of the development history of copyright works should be kept, storing initial, intermediate and final versions of a work, if possible, along with evidence of the date of creation of each.

7.6.2 Design Right

As with copyright, design right protection is granted without registration, and again there is no need for documentation for such a process. Designs protected by design right should be marked with 'Design Right' and the year in which the design was created. Good records of the development history of any designs should be kept, again keeping initial, intermediate and final versions, if possible, along with evidence of the date of creation of each.

7.6.3 Registered Designs

Details of the necessary requirements for registration vary from country to country, but generally, at least one illustration of the design product will have to be provided, which must clearly show the design for which registration is sought either the shape of the product or its surface decoration.

Registered design protection, or a right equivalent to this, can be obtained in most countries which might be of interest to the student group companies. Costs for obtaining registered designs, or equivalent protection, comprise official design fees which vary by country. The amount of these fees is usually available on websites of each national registration office, such as the UK Intellectual Property Office, OHIM for European Community designs and the USPTO for US design patents. Costs for design registration may further comprise draughtsman fees and IP attorney fees, when either of these is used. An estimate for the latter can be obtained by application to a suitable attorney, located via national associations such as the Chartered Institute of Patent Attorneys (CIPA) for the UK.

7.6.4 Trademarks

Not every name, or other sign such as a logo, which can be used for your company will be suitable for use as a trademark. When deciding on a trademark, two main issues should be considered – the mark should be distinctive and should be free for use by your company. That is, it should not be the same as or similar to other marks used for the same or similar goods/services.

A full freedom to use search would be beyond the scope of this course, but each student company should demonstrate that some attempt has been made in this matter. This can be done by searching a number of national trademark databases, such as those listed below.

European Community Trademark Database:

http://oami.europa.eu/CTMOnline/RequestManager/en_SearchBasic

UK Trademark Database:

<http://www.ipo.gov.uk/types/tm/t-os/t-find/tmtext.htm>

US Trademark Database:

[http://tess2.uspto.gov/bin/gate.exe?f\\$tess&state=4801:zl1ple.1.1\\$](http://tess2.uspto.gov/bin/gate.exe?f$tess&state=4801:zl1ple.1.1$)

In the first instance, a search can be made for any registered marks identical or similar to the proposed mark. If this raises a number of relevant trademarks, then the search can be limited to marks registered for classes of goods and/or services which your company intends to offer under the proposed trademark. These classes of goods/services can be determined using the international trademark classification, as detailed below.

Trademark goods and services classification system:

<http://www.wipo.int/classifications/nice/en/>

If a trademark is located which is identical or similar to the proposed mark and is registered for goods/services identical or similar to those your company wishes to market, then the proposed trademark should be changed to another mark and the process repeated. Once a trademark for the company has been chosen, it can be used without registration, although registration is recommended. The distinctiveness of a mark substantially increases the chances of gaining registration.

Details of the necessary requirements for trademark registration vary from country to country, but generally an illustration of the mark along with a list of one or more classes and goods and/or services within the classes is required for the application for registration. To decide which class or classes and goods and/or services are appropriate, use is again made of the Nice classification.

Costs for obtaining registered trademarks comprise official fees which vary by country. The amount of these fees is usually available on websites of each national registration office, such as the UK Intellectual Property Office, OHIM for European Community trademarks and the USPTO for US trademarks.

Costs for trademark registration may further comprise IP attorney fees, when an attorney is used. An estimate can be obtained by application to a suitable attorney, located via national trademark attorney associations such as the Institute of Trademark Attorneys (ITMA) for the UK.

7.6.5 Patents

As with other IP rights which have to be applied for each country has its own set of requirements for granting patent protection in its jurisdiction.

Whilst it would not be expected that student group companies draft invention specifications for patent applications, it is important to know what the basic components of a specification should be.

The specification of an invention for a patent should include an introduction describing what the invention is (device, system, method, software, etc.) and a short description of the background to creation of the invention, a full description of the best known embodiment of the invention with reference to diagrams and flow charts as appropriate, a set of claims which set out the scope of the protection being applied for and an abstract.

It is essential to be able to decide how wide the scope of protection applied for should be. This should not be so wide that it encompasses inventions which are already known, nor so narrow that it provides little meaningful protection for the invention. In deciding whether patent protection is relevant to your company, searches of previous inventions will have been carried out. The results of these can then be used to define appropriately the scope of protection in the patent application. Further details of requirements for UK patent applications can be found on the UK Intellectual Property Office website (www.ipo.gov.uk) and other jurisdictions similarly provide such information online.

A strategy for when and where to file for patent protection of an invention should be an integral part of any business plan. To decide when to file for protection, several factors should be kept in mind. An invention must be new to be granted a patent, and therefore it must remain confidential before a patent application is filed.

If disclosure is necessary before filing, for example, to discuss the invention with a potential collaborator or supplier, then a confidentiality agreement should be put in place to cover the disclosure. Once a first patent application has been filed, the invention can be disclosed without the need for confidentiality.

The development status of the invention must also be considered in deciding when to file. Whilst delaying filing risks another party getting there first, filing an application before a workable embodiment of the invention has been created risks the application being refused or the protection afforded being limited.

To decide where to file for patent protection for an invention also requires consideration of a number of factors.

- When a company wishes to market the invention, ideally it will want to protect the invention in each country in which it has, or proposes to have, a market and in countries where competitors might wish to manufacture competing inventions (to enable closing down of the competitor's operation at source).
- If the company has decided to earn revenue from the invention by licensing it, then it will need to try to predict the countries in which the licensee will want to market the invention and where the licensee's competitors may wish to operate.
- If the company's business plan is to develop the invention to attract sale of the company or attract investment, it will need to try to predict the countries which will be of interest to a potential buyer or investor.

In all of this, the company will need to balance the desire to have wide country coverage for patent protection of the invention with the resource spend, which will be required to achieve this.

In practice, for new companies who often have limited resources and market knowledge, it is customary to use the patent system in a way to keep the country coverage options for patent protection open as long as possible whilst minimizing the initial spend on patent applications.

This is commonly realized by using two patent filing schemes – priority and the international patent application system. In the former, a patent application can be filed initially in one country and further applications filed in other countries are able to claim the date of filing of the initial application, if the further applications are filed within one year of the initial application. In the international patent application system, a single, international, application is filed which keeps open the option of filing multiple national applications at a later date.

A typical patent process for a new company is illustrated in Fig. 7.6. This comprises filing an initial, priority, patent application for an invention in one country, which is usually the country of residence of the company, for example the UK. As an initial patent application has been filed and further applications can claim the date of filing of this application, the company is able to disclose the invention (e.g., to investors) and is able to put the invention into the UK and other markets and gauge the customer response over several months.

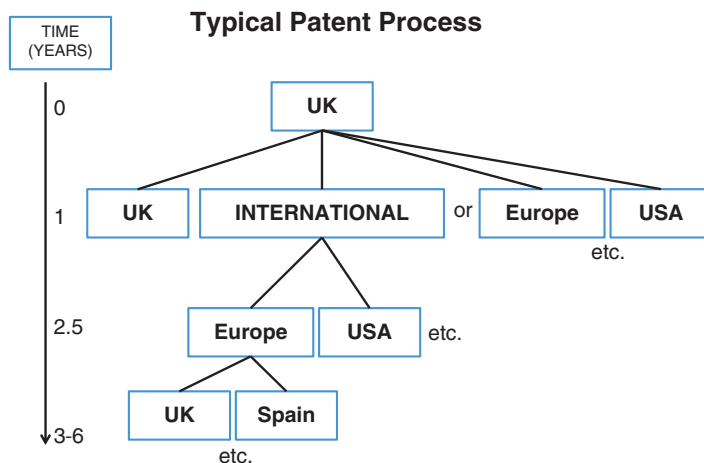


Figure 7.6 Patent protection process

Assuming that information gained from disclosure of the invention is positive, the company would proceed with seeking patent protection at (or before) one year from the filing date of the initial application. At this point, the company has a number of choices.

- If it is decided that the market for the invention will only be the country of initial filing, then the company would proceed with the initial application on its own.
- If it is decided that there is potential for multiple markets, but these are not definitively known, the company would file an international patent application.
- If it is decided that there is potential for multiple markets, and these are known, the company would file a national or regional (e.g., Europe) patent application in each country/region of interest.

These options are not mutually exclusive, for example the initial application could be proceeded with in addition to filing an international application or one or more national applications. This would be particularly valuable if the country of initial filing operates any innovation incentive schemes, such as the tax reduction scheme, Patent Box, in the UK.

When an international patent application has been filed, this cannot proceed to grant of an international patent. At 2.5 years from the date of filing of the initial application, one or more national applications must be filed from the international application (or the possibility of patent protection for countries other than that of initial filing given up). Each national, or regional, application will claim the filing date of the initial priority application.

Filing multiple national applications, either directly or from an international application, is expensive, especially if applications are filed in any countries where translation of the invention description is required. For this reason, new companies often use the international application system to delay this cost.

For the initial patent application and each of the national applications, the process of the application from filing to grant (or refusal) is substantially the same. This process comprises several stages: filing, search, publication, examination and grant/refusal.

In some countries, the search and examination stages may be done together. The search stage of the process involves looking for previous inventions (usually described in the form of previous patents and applications) which are considered to be relevant to the novelty and inventive step of the invention. In the publication stage, the description of the invention (usually as filed) is officially published, this takes place at 1.5 years from the date of filing of the initial application.

The examination stage involves checking that the invention meets especially the novelty and inventive step criteria and that the application meets various formalities. The rigour of the examination varies greatly, with some countries effectively granting a patent after examination of formalities and other countries applying the requirements for novelty and inventive step very strictly.

After a patent is granted, renewal fees have to be paid to keep the patent alive. In Europe, renewal fees must be paid for the patent application, and after grant, the European patent is brought into force in European countries of interest and renewal fees paid in these countries. Overall, the process can take from approximately 3 to 6 years, or longer.

Costs for obtaining a granted patent comprise official fees for at least the filing, search and examination stages and often the grant stage. These fees and the fees for renewing a granted patent vary by country. The amount of these fees is usually available on websites of each national registration office, such as the UK Intellectual Property Office, the European Patent Office and the USPTO for US patents. Costs for patents may further comprise patent attorney fees, when an attorney is used. An estimate can be obtained by application to a suitable attorney, located via national patent attorney associations, such as CIPA for the UK.

7.7 Summary

Overall, each student group should be able to demonstrate that it has a good grasp of the basics of IP protection and how this applies to their company and engineering product. This could be achieved by including an IP section in the business plan, comprising:

- Copyright and design right – what works created by the company are protected by these rights and how this protection is maximized.
- Registered designs – if appropriate, explanation of why this protection is important to the company, and details of the information that will be used to obtain protection and costs.

- Trademarks – name, logo, etc. chosen for the company (and any other marks to be used by the company), summary of freedom to use searches, and details of the information that will be required to obtain protection and costs.
- Patents – outline of invention(s) created by the company, summary of the prior art searches carried out and the results, summary of infringement considerations, details of the strategy used for deciding what, if any, patent protection will be sought and where, and costs.

Finance

Kirk Shilliday

PURPOSE

Finance is only one element of your overall business plan, but it represents the translation of the business subject matter into numbers. This chapter explains the purpose of the financial plan, business structure and financing and financial component elements; it considers key concepts with simple examples, modelling aspects of financial planning (and how to test them) and financial planning pitfalls (and how to avoid them).

TOPICS

- Introduction to financial vocabulary
- Understand the purpose of the financial plan
- Core elements of a financial plan
- Planning pitfalls and traps and how to avoid them

The chapter is organized as follows:

- The reason for a **financial plan** and the types of **business structure** are given in Sections 8.1 and 8.2.
- The sources of **finance** are given in Section 8.3.
- The main **components** of the **financial plan** are given in Section 8.4.
- Sections 8.5–8.9 cover **sales forecast**, **profit and loss account**, **break even**, **cash flow** and **balance sheet**, respectively.

- Key insights into how you build the **financial model** are given in Section 8.10.
- In Section 8.11, **traps** and **causes of failure** are highlighted.

While finance will be only one element of your overall business plan, the financial plans represent the translation of the subject matter of the other chapters into numbers. The financial plan is not separate from the rest of the components of your business plan, it is built on and from all the research you have undertaken.

8.1 Why Do I Need a Financial Plan?

There are really good reasons for putting together financial plans; it gives you the discipline of posing and answering questions, and brings focus to your business aims and objectives which represents a critical examination of your business. With regard to the product and the company, the author will need to consider:

- Is it viable?
- What will be required in order to launch and sustain?
- Is it worth doing? Could you be making a better return by doing something else with your money, your time and indeed your talent?
- What is the best way to exploit this idea? Perhaps, instead of setting up a manufacturing and distribution operation, it would be better to sell or licence the technology.

A financial analysis gives you the opportunity to explore the figures before you actually commit to any significant investment in the project. In addition, even though there is inevitably some cost and effort involved in putting together a financial plan, if you build your model effectively, you will be able to ‘flex’ your figures and assumptions and so test the robustness of the business to changes in circumstance. The planning process requires you to clearly set out and justify business assumptions and establish specific targets that provide a yardstick against which the progress and profitability of the business can be measured. This is particularly important once you launch the business.

The business plan figures represent what you expect to happen. Things will almost inevitably not work out as you expect and you need to be able to:

- (a) recognize that fact
- (b) explore and understand why the actual figures differ
- (c) respond to the changes.

The financial plan will inform you of your financing needs. Few people have the ability to fully self-finance a new venture and will need, at some point, to raise additional finance. If external financing is required, then possession of a good business plan is critical to making your case to a financier, venture capitalist or business angel.

Producing a well-thought-through financial plan will allow you to provide assurance where required and demonstrate to:

- yourself and your family that you are doing the right thing;
- your partners/senior employees that this is a venture that they should want to be part of;
- your suppliers that you have good credit terms;
- your major customers that you are not going to be 'here today and gone tomorrow';
- investors that they can invest in this trading relationship.

Everything you will have done up to this point is aimed at exploring and testing your idea as a practical proposition. Will it work? Is there a market for it? Who are my competitors? This is all vital information in putting together a business plan, and the more research you have done and the more evidence you can show then the more credible your proposal will be.

For the engineering students, this aspect tends to be the most challenging of the exercise largely because the aspect is new to them given their background and the terms can be confusing. To this end, we have included a Glossary at the end of the book, to explain many of the terms used in this book and in particular, in this chapter.

The financial plan builds on and enhances this credibility. You need to be careful not to manipulate the figures to give you the result you want to see, or even those you think your bank manager might want to see. At some point you can be sure the figures will be tested, if not at the planning or even the financing stage then at least in real-life trading – you need to have confidence that your figures are realistic.

8.2 Types of Business Structure

This is essentially a decision about the business vehicle for owning and managing the business. The main choices are:

- sole trader
- partnership
- limited company.

We will not go into detail on these options, but noting some of the advantages and disadvantages may be helpful. A short assessment is given in Table 8.1.

8.3 Sources of Finance

Whether it requires one thousand or one million pounds, all businesses will require finance. It is essential to look ahead, and to be realistic when doing so. The business does not need just enough finance to allow for things going to plan, it is important to plan for contingencies and allow some flexibility in finances in order to be able to respond to changing circumstances.

Table 8.1 Company comparison table

Structure	Advantages	Disadvantages
Sole trader	Simplest and least expensive way, which gives freedom and flexibility to make all the decisions. All the profits (after tax) belong to you.	As business grows, you will become liable for higher taxes. Increased risk as you are personally responsible for all liabilities.
Partnership	‘Two are better than one.’ More people provide support, backup and a mixture of expertise.	Partnership agreement needed in sharing of liabilities/ownership/profits to cover arrangements if a partner leaves. All partners are jointly liable for debts.
Limited company	Gives credibility to borrow money and limits personal liability as the company bears financial liability. Corporation tax rather than personal tax applies.	Greater bureaucracy as there are statutory and taxation requirements that must be complied with. Organizational needs may incur legal professional advice.

Remember that if you were to run into financial difficulties then, at best, you would pay dearly for fresh finance, perhaps in the form of expensive overdraft interest. At worst, you may lose control over your business through having to give up equity share in return for fresh capital, you could even lose the business altogether and face bankruptcy.

The financial plan will enable you to assess your financing requirements over time and allow you to plan in advance to meet those requirements.

The most common sources of finance include the following.

Own Finance

You may start your business using your own funds. Depending on your circumstances, this might be from savings or possibly you may launch while still having another source of income, such as a full-time or part-time job. There are obvious constraints (the depth of your savings, the resource demands of the new venture), but this might at least facilitate a startup phase. It is not recommended that you use personal overdrafts or credit cards as these tend to be short term and very expensive.

Family and Friends

They may wish to back you but it is important to protect them. Can they afford to support you? It is best to have a formal agreement drawn up to protect their interests should your venture fail.

Both the above sources of finance have the advantage that they should be low cost and with flexible terms. They will also demonstrate a personal commitment and belief that should support any application for funds from other external sources.

Banks or Other Financial Institutions

The two main forms of finance from this type of source will be business overdrafts and business loans. Bank overdraft facilities should be negotiated based on your cash-flow projections. They are a flexible, if expensive, way of covering short-term cash fluctuations caused by the timing of money coming into and going out of your business. Bank loans will usually be for a given period of years and with fixed or variable interest rate and repayment terms.

With loans you will be required to repay over time the capital sum loaned plus the interest on that capital. The lender may look to secure their loan against assets, such as your home. These are best used to fund specific transactions such as the purchase of premises or other assets.

Grants

There may be a number of local, national and even international grant-awarding bodies willing to make funding available to you. Startup and business expansion phases, particularly where job creation is involved, will often attract grant support.

Private Investors

Private investors, sometimes also referred to as business angels, very often will be individuals who have had significant personal business success and are interested in financing other entrepreneurs with the potential for high capital growth. They will generally wish to take an ownership stake in the business and share in the expected profits, perhaps with an eye to sharing in the capital gain if the business is subsequently sold. They may also be willing to contribute their experience and contacts and can bring business acumen as well as finance. They will therefore bring sound business experience and positive commitment, as they monitor what is happening to their funds.

Venture capitalists (VCs) will usually look to invest in a venture that has been established and are looking to get a quick (three to five-year) return on their investment. With private investors, the company should be under no illusions that the reason for investment is to get a return on their investment and if they feel that the company is being poorly run, they may look to replace the management, which can typically be the founders.

Any investor is looking for a return on investment. The amount of the company the investor wants to own will depend on the potential of the product/service, the financial projections to support this and the business ability of the founders or current investors to negotiate hard.

TRY THIS

Explore what grant support is available in your desired geographical setup location to assist with business startup. Typically, this might include product development and protection, market testing, marketing, premises costs, etc.

8.4 Main Components of the Financial Plan

There is a well-understood foundation for the financial aspects of a business plan and there are certain components that must be included, otherwise the business plan will not be treated seriously. Some commentators will separately identify startup costs or refer to a startup budget. This could be shown separately but, in principle, there is every reason to incorporate it into the profit and loss account and cash-flow forecast. In this case those forecast statements would simply show the startup costs and cash flow, on a monthly basis, leading up to the commencement of trading.

The main component elements of a financial plan are:

- sales forecast
- profit and loss account
- balance sheet
- cash flow.

Another statement, particularly recommended with small startups, is the personal survival budget. This is really more of a personal financial plan, prompting the entrepreneur/owner to consider what finances he, she or they will need to be able to draw from the business in order to survive and have a reasonable standard of living. This might seem obvious, but even the obvious can sometimes be overlooked or taken for granted. Do bear in mind that it is important to assess personal need on a realistic basis. Once again, these costs can be incorporated into the profit and loss account and cash flow under a single heading such as salaries or drawings under both the pre- and post-trading commencement projections.

For the purposes of the financial plans, it is recommended that you forecast for:

Year 1	Detailed and monthly
Years 2–3	Quarterly or annual
Years 4–5	Annual

This is obviously dependent on whether you actually need to forecast beyond three years and the purpose to which you need to put those forecasts – does the funder require it? It is probably best not to go beyond three years unless required to do so. In a startup situation, there is no actual history to support your sales and marketing assumptions anyway, and forecasts even beyond one year are necessarily speculative.

In essence there is little difference between the methodology applied to a one-year forecast and those for years 2–5. The modelling tools you use will be the same. However, you do need to be aware of those things that may change over longer periods of time, and plan for these in your assumptions and projections. This is demonstrated below.

- Sales volume – might be expected to grow, and could grow quite significantly. Be aware that some assumptions may change as a consequence, as there may be economies of scale and supplier discounts may vary. There may also be expansion into new geographic areas.
- Selling prices – may vary over time. We may plan for price increases to take account of cost inflation in cost of goods sold or labour costs. Prices might conceivably fall with economies of scale in production being passed on to customers, perhaps to grow market share.
- Product lines, sales mix – perhaps after launching the business with a single product there will be plans to bring out new products in the future.
- Expenses – will change over time. Inflation will impact on costs and different rates of inflation may apply to different costs, for example wage inflation, raw material price inflation; some costs may be fixed over the short term but vary over the medium to longer term (e.g., rent). Along with growing sales may come a need to expand production or warehousing capacity, and these step-up cost increases should be anticipated and planned for. For example, current plant will produce 10,000 units per month and so if projected monthly sales begin to rise above this then we need to plan as to how we manage capacity.

The examples following show only a four-month forecast for ease of presentation, the important thing is to understand the methodology and the principles applied. The standard model for forecasting will cover a 12-month period since the normal accounting period for any business, the period for which it will be required to produce formal accounts for reporting and taxation purposes, is a year.

8.5 Sales Forecast

This is a critical part of your financial plan; it forms the foundation of a business plan as sales revenue affects practically every aspect of a business.

Sales forecast will outline your expected sales figures in terms of quantity, mix of products, mix of customers, timing, markets and value. These will influence your costs, such as production costs, marketing, storage and distribution, wages and salaries, selling costs (commission or discounts), financing costs and even taxes. If your sales forecast varies wildly from your results, your cash flow and profitability forecasts will be inaccurate.

Ultimately, a sales forecast represents an informed guess but it will be important to refer in the notes to your sales forecast how you have gone about arming yourself with the information to support your forecast. The level of detail you go into will depend, of course, on the nature of the business and the sales proposition.

Note that the *sales forecast* is not necessarily the same as a *sales target* or a *sales budget*.

A *sales target* or *sales goal* is set for the sales force as a way of defining and encouraging sales effort. Sales targets are often set some way higher than estimated sales to ‘stretch’ the efforts of the sales force.

A *sales budget* is a more conservative estimate of the expected volume of sales and is primarily used for making current purchasing, production and cash-flow decisions; they need to take into account the risks involved in sales forecasting and are, therefore, generally set lower than the sales forecast.

Marketing and sales was addressed in Chapter 5 along with the types of research that may be undertaken to determine sales potential. This groundwork is essential to support sales assumptions within the sales forecast. Your basic business proposal and the work you have undertaken to assess your market will inform not only your stated assumptions but also the way in which you break down and present your sales forecast. To illustrate:

- You may have a single product or service or indeed multiple products/services.
 - You may have multiple routes to market (direct sales, web sales, third-party websites, stores, agencies).
 - You may have particular customer-groups (wholesale, retail).
 - Sales may be to multiple regions – UK, Europe, India, China, Middle East, North America, etc.
- If you have multiple products/services you will need to show sales forecasts for each of them.
- You will probably need to forecast for each of these, particularly if selling price, commission, etc. differ for each route.
- Each group may again have different pricing, discount and growth potential.
- Your projections may involve different assumptions, pricing, exchange rates, market strength/potential, competitors.

Clearly, a number of factors will influence the amount of detail that you will need to show in your sales forecast, and it can become quite detailed. This might seem rather complicated and

time consuming but it is critical to the planning process. It is important to provide sufficient detail to allow you to present a persuasive argument for your sales projections.

This will be an area of your financial plans that will come under intense scrutiny should you be seeking finance.

It is also a key document for management control of the business. This is vital management information and it is important that your management information systems themselves collect data at a level of detail that will allow you to compare actual sales against projected budgets. If your projections are by product line, distribution route, key customers, regional, geographical then you will need systems to allow you to capture your actual sales at that level of detail. Sales forecasts need to be kept under regular review against actual sales and variances investigated and explained. This process will help inform changes in sales forecasts and management action.

To illustrate what is happening to sales and why, consider the following scenarios:

SCENARIO 1

Your product launch has gone even better than expected, one of your main competitors is about to leave the market as a consequence and your actual sales are far outstripping forecasts.

Implications – there is a capacity for sales expansion that you were not planning for and are not prepared for. You may need to seek additional finance to expand production capacity and to fund additional working capital requirements.

SCENARIO 2

Your sales income is below target. Where is this happening and why? Is it a particular product that is underperforming? Is a key customer buying less than you had anticipated? Is a particular market underperforming, North America perhaps?

Implications – you need to know where it is going wrong in order to identify and address any problems. Perhaps a competitor is undercutting your price on a particular product; you may need to consider your response to that threat. That key customer may be experiencing trading difficulties; do you extend credit or do you aggressively seek alternative customers? In North America, perhaps your distributor or sales representative is not pushing your business; do you seek to replace them?

You can now appreciate the importance of your sales forecasting.

8.6 Profit and Loss Account

When in 'looking forward' mode, the profit and loss account will represent a budgeted or predicted set of figures. It will show what you expect to happen in terms of income and expenditure.

When in *looking back* mode the actual, historical, profit and loss account will represent a record of your actual income and expenditure. This looking back process is very important and should be done on a regular basis, at least monthly, as well as at the end of the financial year. This enables you to identify what changes you may need to make to your assumptions and will guide you in your management decision making. If your sales are below target due, for example, to competitor activity in price cutting then at the very least you need to be aware of this, and you may need to react. You will be expected to document and explain your assumptions in arriving at those predicted figures and this forms a pivotal part of your financial plan.

The simplest form of this type of financial statement deals simply with income and expenditure – money in and money out. This may be sufficient in the very earliest stage of developing an idea.

Very often, a simple financial statement is based on being self-financed. The income may be from personal savings, a small cash injection from family or friends, earnings from other sources that you can use to develop the very basic proposal. It is nevertheless essential that these startup costs are properly estimated and planned for, as this can be a critical phase for any venture. Effective planning and financing of this phase will support IPR protection, speed to market and income-generating sales.

It is important to record these costs and to keep any receipts or other paperwork for accounting and tax purposes. Inevitably, however, if the initial idea proves viable, the financing requirements will escalate and you will need to develop more comprehensive financial projections and statements, as any funder will require these. Often the form and detail of these financial statements will be specified by the funder.

In essence, the profit and loss statement simply shows the various sources of income (sales, etc.), and the costs or expenses associated with generating that income. As an important aside, there is also a general accounting principle of matching within the time period the income generated with the expenditure required to generate it. This is known as the concept of 'accrual' and means that, for example, where equipment is used to generate income in a given time period, then the extent to which that equipment is 'used up' or depreciated in generating the income is a cost that is accounted for in the same period. The P&L account will show:

Sales	Income from services or goods provided.
Cost of goods sold	Cost of labour and other resources, such as raw materials, directly involved in creating the goods or services sold. The elements of this can obviously differ from company to company.
Expenses	All other costs of running the business.

A basic, but by no means exhaustive, checklist of costs is shown in Table 8.2. The subdivision between those costs that might be startup, cost of goods sold (COGS) or operating expenses as shown in this table is not necessarily fixed but merely a guide.

In the example shown in Table 8.3, for ease of presentation we have shown a forecast for four months only. The principles will be exactly the same when you are working on a full-year forecast. In this example, our assumptions are:

- Sales volume will be constant.
- The selling price is set at £200/unit and will not change over the forecast period.
- The cost per unit is set at £80/unit and will not change over the forecast period (there is no indication whether it is bought in or manufactured and of course it would be important to state this along with any subsidiary assumptions being made regarding cost of goods sold).
- Selling price is stated before VAT (if VAT is applicable).

We have not shown the detail behind the lines in our P&L account and indeed, if more detailed workings are required, then it is often a good idea to show them on a subsidiary

Table 8.2 Checklist of costs

	Startup	Cost of goods sold	Operating expenses
Advertising, marketing, website	✓		✓
Bad debts			✓
Bank fees and charges			✓
Commissions on sales			✓
Depreciation			✓
Entertaining	✓		✓
Employee costs		✓	✓
Insurance			✓
Interest payments	✓		✓
Legal and professional services	✓		✓
Office expenses (postage, stationery, etc.)	✓		✓
Raw materials, bought-in components, purchases for resale		✓	
Rent or lease expenses	✓		✓
Repairs and maintenance			✓
Research and development	✓		✓
Travel expenses	✓		✓
Transport, shipping, distribution costs			✓
Utilities	✓		✓

Table 8.3 Example of a profit and loss account

	Month 1	Month 2	Month 3	Month 4		Totals
Sales volume (units)	100	100	100	100		400
Selling price per unit	£200	£200	£200	£200		
Cost per unit	£80	£80	£80	£80		
Sales	£20,000	£20,000	£20,000	£20,000		£80,000
Cost of goods sold	£8,000	£8,000	£8,000	£8,000		£32,000
Gross profit	£12,000	£12,000	£12,000	£12,000	60%	£48,000
Operating expenses	£16,200	£6,850	£7,350	£6,850		£37,250
Net profit/(loss)	(£4,200)	£5,150	£4,650	£5,150	13%	£10,750
Fixed costs element of operating expenses						£18,000

worksheet linked to the summary profit and loss account. This is in fact how most company accounts are presented; summary figures for main headings shown in the profit and loss account and balance sheet are cross-referenced to more detailed explanatory notes contained elsewhere in the financial statements – referred to as ‘notes to the accounts’. This approach has been adopted by many of the student groups.

The gross profit line is calculated by deducting the cost of goods sold from the sales. The net profit shows profit after further deduction of operating expenses.

If your sales price were to remain constant, then the gross profit percentage (gross margin) will provide a useful indicator of the organization’s purchasing or manufacturing efficiency and the net profit percentage (net margin) will provide an indicator of operating efficiency.

Both gross and net profit percentages are calculated by expressing those respective profit figures as a percentage of sales. Deterioration in gross margin may be caused by higher material or production costs or increases in supplier prices. It could also be caused by a reduction in selling price where, for example, there is price competition with competitors. A decrease in the net margin may, of course, simply reflect a reduction in the gross margin but it may also signal rising operating costs.

You can see then that net profit could be enhanced by:

- higher pricing (often through marketing, providing it is not offset by those higher operating costs);
- more efficient purchasing or manufacturing;
- managing (reducing) operating costs.

I am sure you will recognize these as strategies pursued by many companies: brands that command premium pricing, companies who outsource or relocate manufacturing to low-cost economies or simply put pressure on their suppliers to reduce prices, organizations that announce substantial redundancies to cut operating costs.

One final piece of advice in respect of expenses in the profit and loss account is to include a line in expenses for contingencies. Despite your best efforts, you will not be able to predict your costs with absolute accuracy. Inserting a line for contingency costs will give you, and those who need to see your financial plans, a degree of comfort that the figures are prudent and that you are realistic and credible in your approach to the business.

8.7 Breakeven

An important milestone in any startup is the breakeven point. Estimating when you will reach this point is an expected part of your business plan. This requires you to work out exactly how much you will need to sell each month, and at what price, to break even.

The breakeven point is the point at which sales are at a level that will cover:

- the cost of sales;
- the variable costs required to generate those sales;
- the total fixed costs – for a startup, this will include the startup costs.

In order to do this we must distinguish between fixed costs and variable costs (see Table 8.3). For the purpose of this illustration, we have simply assumed that the fixed-cost element is £18,000. There are a number of ways to calculate the breakeven point, but the one we will use here is based on the formula: Sales = Variable Costs + Fixed Costs + Profit.

Selling Price	£200
Variable Cost	£80
Fixed Costs	£18,000
Breakeven sales in Units	U

$$\begin{aligned}
 200U &= 80U + 18,000 + 0 \text{ (since at breakeven, profit = zero)} \\
 200U - 80U &= 18,000 \\
 U &= 18,000/120 \\
 U &= 150
 \end{aligned}$$

The breakeven number of units is 150 and this will be reached in month 2.

Of course, it is not that common to have a single product or service line. The following example (Table 8.4) shows how the breakeven would be calculated when there are three products. We will assume again that the monthly sales volume and mix remains constant

Table 8.4 Financial example of three products

	Sales Volume per month	Selling Price per unit	Cost per unit
Product A	50	£200	£80
Product B	20	£150	£70
Product C	30	£175	£60
	100		
	Sales Volume per month	Selling Price per unit	Cost per unit
Product A	£10,000	£4,000	£6,000
Product B	£3,000	£1,400	£1,600
Product C	£5,250	£1,800	£3,450
	£18,250		

(50, 20, 30 per month); this is not entirely realistic but if your volumes change over the months then simply take the total volumes over the projected 12-month period.

Average Selling Price	£182.50
Variable Cost	£72.00
Fixed Costs	£18,000
Breakeven sales in Units	U

$$\begin{aligned}
 182.5U &= 72U + 18,000 + 0 \\
 182.5U - 72U &= 18,000 \\
 110.5U &= 18,000 \\
 U &= 18,000/110.5 \\
 U &= 162.9 \text{ (round to 163)}
 \end{aligned}$$

8.7.1 Fixed Costs

Although, for the above example, we have simply set the fixed costs arbitrarily at £18,000 (this bears no relation to the actual costs), it is of course essential that fixed costs are properly identified for the purpose of your own business plan. Fixed costs do not change as output varies. In other words, they are fixed even if output moves up or down from period to period. These may include:

- rent and business rates
- wages and salaries (although some elements may be variable – bonuses, overtime)
- marketing
- insurance
- loan interest
- legal fees
- professional and consultancy fees

- design and development
- equipment costs.

Remember that this is not an exact science, there is no definitively correct answer. We are dealing with forecasts and to make matters more complicated some cost headings, such as wages and salaries above, may have fixed and variable components.

The important point about a cost like rent being considered fixed is that it has to be paid, whatever the level of sales achieved. The higher the level of fixed costs in a business, the higher must be the achieved output in order to break even.

A good strategy for most startups is to focus on controlling and minimizing fixed costs. Consider carefully before you rent those expensive premises, buy expensive equipment, award high salary packages (better to make part of remuneration bonus driven perhaps).

TRY THIS

- List and estimate the costs that you consider necessary (including startup) for the first 12 months of your business.
- Identify those costs which might be regarded as fixed.
- Now consider how you might reduce them by, for example, 20%.

8.8 Cash Flow Statement

The cash flow statement or forecast is very much derived from the profit and loss forecast except that where the profit and loss account is concerned with predicting the income and expenditure, the cash flow forecast is concerned with the cash flows arising from those transactions. This is a forecast as to when it is expected, on the basis of stated assumptions, that payment will be received for sales and other sources of income, and when the business expects to make payments for expenditure incurred.

The purpose of the cash flow is to confirm and plan for solvency. There must be sufficient cash available to the business to be able to meet its liabilities as and when they are due on a month-by-month basis. Failure to manage cash resource properly is one of the primary causes of business failure. The cash-flow projection will identify the cumulative cash/position on a monthly basis. If the cash position becomes negative then action must be taken. For example, this could mean deferring discretionary expenditure where possible – for example, expenditure on equipment. It is more likely, however, that such a deficit might be addressed by negotiating in advance an overdraft facility, at least equal to the projected cash deficit, and preferably somewhat higher to allow for errors in forecasting.

The example in Table 8.5 is a simple illustration of a cash-flow projection. Again, we will use a four-month period, as the principles to be followed will be exactly the same for a full-year forecast.

Note: The adjustment for depreciation reflects the fact that depreciation does not result in a cash flow. Only fixed-asset (capital) purchases and disposal proceeds will be rejected in cash flow. Depreciation will be referred to in Section 8.8.

Assumptions

Sales: Let us assume that 50% of the sales are cash sales because they are paid for through our own website. The other 50% are credit sales because they are sold through third parties (again, remember that all assumptions must be capable of being explained and justified through your research into the market).

Cost of goods sold: Let us assume that we have negotiated one month's credit from our supplier. This means that payment for month 1 purchases will be made in month 2 and so on.

Operating expenses: Essentially, for each item of expenditure (rent, insurance, salaries, etc.) you must determine when payment will be made. It is probably most prudent to assume that payment will be made in the month that cost is recorded in the P&L account.

Note that some costs might be spread monthly in the P&L account but are actually paid for differently – for example, you might pay your insurance by monthly installments or you might pay it as a single lump sum in say month 1. It is important to recognize this in your cash-flow workings.

8.9 Balance Sheet

The balance sheet is a 'snapshot' in time, on a specified date (usually the last day of an accounting period), of who owns what in the company, and what assets and liabilities exist at that point.

'Liabilities' is a general term for what the business owes (trade creditors, bank, tax authorities, etc.). An asset is an economic resource, something that is owned by the business and that can be used to generate cash (although cash itself is also an asset).

The information contained in the balance sheet, the way it is presented and the notes to the accounts that expand on the detail of what is in the balance sheet are specified under generally accepted accounting principles (GAAP).

As with the profit and loss account and cash flow statement, it is of course possible to need a level of detail and complexity that would require the services of a professional accountant.

Table 8.5 Example of a profit and loss account/cash flow

	Mth 1	Mth 2	Mth 3	Mth 4	Totals
Sales volume (units)	100	100	100	100	400
Selling price per unit	£200	£200	£200	£200	
Cost per unit	£80	£80	£80	£80	
Opening cash position	£50,000	£18,300	£20,450	£22,100	
Sales	£20,000	£20,000	£20,000	£20,000	£80,000
Cash sales 50%	£10,000	£10,000	£10,000	£10,000	£40,000
Credit sales 50%		£10,000	£10,000	£10,000	£30,000
Cash in	£10,000	£20,000	£20,000	£20,000	
Cost of goods sold	£8,000	£8,000	£8,000	£8,000	£32,000
Payment for supplies 100%		£8,000	£8,000	£8,000	£24,000
Cash out	£0	(£8,000)	(£8,000)	(£8,000)	
Operating expenses	£7,000	£8,500	£6,750	£7,500	£29,750
Payroll	£2,000	£2,000	£2,000	£2,000	£8,000
PAYE, NIC	£850	£850	£850	£850	£3,400
Pension costs	£250	£250	£250	£250	£1,000
Depreciation	£7,500				£7,500
Office supplies	£500		£500		£1,000
Transport and travel	£1,000	£1,200	£1,200	£1,200	£4,600
Rent	£1,750	£1,750	£1,750	£1,750	£7,000
Insurance	£1,550				£1,550
Utilities	£300	£300	£300	£300	£1,200
Interest payments	£500	£500	£500	£500	£2,000
Cash out	(£16,200)	(£6,850)	(£7,350)	(£6,850)	(£37,250)
Capital purchases	(£30,000)				(£30,000)
Owners, drawings	(£3,000)	(£3,000)	(£3,000)	(£3,000)	(£12,000)
Adjustments					
Depreciation	£7,500				
Closing cash position	£18,300	£20,450	£22,100	£24,250	

In the cash-flow example above, we started with an opening cash position of £50,000 which we can assume was funding that you put up to get the business started. This represents money owed to the owner and if this were a limited company, it would be referred to as equity.

At the end of the four-month trading period, we can also see that the closing cash position is £24,250. This cash is an asset of the business. Do we have any other assets or liabilities?

Well, we had assumed in respect of our sales that 50% of our monthly sales would be on credit and that the customer would take one month's credit. That must mean that at the end of

Table 8.6 Example of a balance sheet

Fixed assets	£22,500	
Current Assets		
Debtors	£7,000	
Cash	£24,250	
Total current assets	£34,250	
Total assets		£56,750
Current liabilities		
Creditors	£8,000	
Total current liabilities		£8,000
Net assets		£48,750
Share capital	£50,000	
Retained profit	£10,750	
Less: Drawings	£12,000	
Shareholders' funds		£48,750

month 4, when we take our balance sheet snapshot, 50% of our month 4 sales will not have been paid for and so we have a trade debtor amounting to £10,000.

In respect of our purchases from suppliers, we stated the assumption that we would take one month's credit. This results in us not having paid for the goods that we received in month 4. We owe our suppliers for the £8,000 worth of goods we received. This represents a trade creditor.

We also see that we spent £30,000 on a capital purchase, equipment perhaps. This equipment represents an asset to the business, called a *fixed asset*, and is acquired for use in the business rather than for resale. It will typically provide an economic benefit to the business over a period of years and will be 'written off' or charged to the business via the profit and loss account over its expected useful economic life. This gradual writing off is referred to as depreciation.

In this case the equipment cost is £30,000. Let us assume its useful life is four years. The depreciation charge in its first year of use will then be: $£30,000/4 = £7,500$. We have assumed in our example that the charge was made in month 1. As the asset gets depreciated, its asset value reduces by the amount of depreciation. The original cost less the accumulated depreciation on that asset leaves a net value referred to in accounting terms as the net book value (NBV). The NBV of our equipment is $£30,000 - £7,500 = £22,500$. This £22,500 also then represents an asset of the business.

Look now at Table 8.6 for a simple balance sheet (note that a balance sheet must balance).

8.10 Building the Financial Model

It is essential, when developing your plan, to fully think through what is likely to happen and then flex the model for best-case and worst-case scenarios. This also means taking care to construct your model so as to allow you to easily modify your assumptions, and determine the impact of those modifications on your business plan.

In practice, although you might indeed wish to build your own financial model linking sales forecast to profit and loss account and through to cash flow and balance sheet, there are plenty of free or relatively inexpensive models available via the web. There are even some useful instructional videos available.

The purpose of the financial model is to project what you expect to happen, based on those assumptions that may be made with a reasonable degree of certainty, at least in the short term, but may become more uncertain in the medium to long term. Nevertheless, it is important that you recognize these uncertainties as you plan.

Indeed, if you are seeking finance, many banks will supply such models with guidance and instruction and you will be expected to use their model to support your presentation. Our purpose in this chapter is primarily to explain what the financial statements comprise, how they work and how they are used. Whether you build your own model or use a third-party resource, it is helpful to consider what to look for in an effective financial model. Most models will be built using spreadsheet software.

8.10.1 Structure

Keep it simple and develop detail only where this is required to understand how and why the figures are as they are. Use summary statements to accumulate detail built in other worksheets and use cross-referencing to indicate the link. The model will usually consist of a financial planning workbook consisting of several linked sheets, with separate sheets for:

- sales forecasting (which should ideally also calculate cost of goods sold)
- profit and loss account
- cash flow
- balance sheet.

Use of cell referencing within formulae and linking between cells within a sheet and between sheets will allow for figures to be automatically generated without having to be manually transcribed. Care must of course be taken when inputting formulae and links and it is essential to do some simple testing coupled with a ‘sanity check’, so that you can be satisfied that the figures produced actually make sense.

If you expected a profit of £100,000 and the model shows £1 million, then the probability is that you have put a decimal point in the wrong place in a formula somewhere rather than that your business is suddenly 10 times more profitable than you expected! Many of the best models will have control checks built in to highlight if something is wrong; there is, however, no substitute for simple commonsense.

8.10.2 Variables

Where there are key variables that impact on your figures – variables such as selling price, sales conversion rates, rates of inflation – these should be recorded in individual cells that can then be referenced in formulae. This referencing in a formula rather than ‘hard-coding’

a variable into a number of formulae will allow you to flex that key variable and instantly see the resultant impact throughout your model without having to change all the formulae that contain that variable.

One possible way to do this might be to have the variables (and perhaps the stated assumptions supporting the value of that variable) on a separate sheet within your workbook. Another method is to place them on your worksheet in such a way that their position will not be affected by the addition or deletion of rows or columns. To illustrate:

Variables are located in the top left-hand corner

The main body of your model is contained in this section of your worksheet and formulae will reference the cells containing the key variables

This method of construction enables ‘what-if’ or sensitivity analysis to be conducted on the figures (we will look at this later in this section).

8.10.3 Assumptions

State your assumptions clearly and concisely, explaining your reasoning. Be prepared to question your own assumptions and, if necessary, to defend them.

The variables in your model will generally be the product of assumptions you have made. You will have made assumptions about selling price, sales volumes, inflation rates, initial funding, borrowings, rate of interest on borrowings, credit terms taken on purchases and given on sales and many other matters.

It is often good practice to state your assumptions and cross-reference them to the cells containing the variable. This provides the logical linkage between what might simply appear as a figure or a percentage and the reasoning behind it. Again, to illustrate:

Selling price £199.99

The selling price has been set by reference to the selling price of direct competitors. It takes into consideration product differentiation in respect of functionality and build quality, and has been market tested through discussions with key distributors and retailers.

The selling price is therefore explained to our target audience and the assumption supported with evidence. This builds credibility in the planning process.

8.10.4 Sensitivity Testing – ‘What If’

The model should be built or selected and assumptions stated and supported. Data is input and the results output and reported. If our assumptions and figures are based on our best

estimates of what we believe will happen, then the figures will represent our *realistic financial plan*.

It is important, however, that in developing our plan we recognize that this is only an estimate or a best guess. We must acknowledge uncertainty. The process of testing the sensitivity of results to changes in key assumptions is generally referred to as sensitivity analysis or what-if analysis.

A common error made in presenting financial plans is to present the figures as if this was the only way that the future could possibly turn out. Life, and business, is simply not like that. Anyone using your financial projections as the basis for investment or loan finance will expect you to have identified and tested the business-critical assumptions and figures.

Starting and managing a new business in particular, where there is no history or track record to guide you, involves uncertainty and risk. By using a financial model that allows you to easily change key assumptions and so facilitates this type of testing, you can run a variety of financial simulations. This will allow you to identify just how sensitive business profitability and cash flow is to changes in your assumptions and allows you to anticipate (and plan for) such changes. You may need to know, for example, what the impact would be if:

- Projected sales volume fell by 10%, 20%, 25%.
- Your cost of goods sold rose by 10%, 15%.
- Selling price had to be reduced by 10%.
- The average credit period taken by customers rose by 50%.

Of course, there is no point in running completely unrealistic scenarios – these benefit no one. It may be, however, that it is not unrealistic to speculate that:

- You are entering a new market and there is uncertainty regarding take-up of your product.
- Raw material prices are volatile or you are dependent upon a particular supplier and vulnerable to price increases.
- You have a major competitor who may engage you in a price war.
- That same major competitor eased their own credit terms.

For the most part, this scenario testing will be for the benefit of management decision making in the business and will allow you to make contingency plans. It will allow you to focus on the most critical business assumptions. Risk management strategies, contingency financing, sales and marketing options, cost management options could be put in place to manage the risk that changes in key assumptions may prevent the business from achieving its objectives.

The question can arise as to what scenarios to run and present to a potential investor or to a bank when seeking overdraft or loan finance. You may have heard reference to best/worst-case scenarios. In general, it is not helpful to make these part of your financial plan. By all means be in a position to answer the most obvious questions that might be asked – about sales, costs, cash – but it is probably best and sufficient to present the realistic case and the breakeven scenario. The latter might simply show how far sales would need to fall before the business will begin to operate at a loss.

TRY THIS

Search for and select a simple financial planning model from the web. Look for one that will allow you to easily change some key variables so that you can do some ‘what-if’ testing. Input test figures (keep these simple) including assumptions and then test for changes in: sales volumes, sales price, cost of goods sold and expenses. Observe the impact on profitability, cash position. Good to show this as changes in:

- sales volume
- selling price
- cost of goods sold
- operating expenses
- assumptions such as credit terms.

Observe the impact on profitability and, most importantly, cash position.

8.11 Traps/Causes of Failure

Estimates vary, but it is generally accepted that between one-third and a half of all new businesses fail within the first 12 months of set-up. The likelihood is that the rate has moved from the higher figure towards the lower figure because there is more information more easily and cheaply available to support new startups. From access to basic, and sophisticated, financial modelling packages to advice on how, and how not, to launch a business, the information is out there and available to help new business startups make the most of their opportunity to succeed. Avoiding the common errors, learning from other people’s mistakes makes sense.

As we have noted, the business plan is in fact a model of what is predicted and expected will happen to your business from conception, startup and first year through to perhaps five years from now. Obviously, the further out in time you project the less reliable those projections are. Nevertheless, this process of building a financial roadmap is critical to success as it does two important things:

1. It requires you to think and plan ahead in a disciplined way. It is like a virtual walk-through of the financial journey ahead. You must imagine it before you do it and that way you will have a better chance of reaching your goal. Undoubtedly, there will still be events and circumstances that were not in your forecasts, that you perhaps could not have foreseen, such as a generalized economic collapse, but at least you will have prepared to the best of your ability.
2. It sets milestones or targets against which you can measure your progress. Measuring your actual progress against plan will allow you to make informed management decisions about how to react and what to do next. It is important to use actual data to inform and update your business plan.

One general piece of advice is summed up in the often-quoted phrase ‘cash is king’. It is vital for the health of the business that cash resource is properly managed and it is probably the most

common cause of business failure when it is not. Having financial resource in place will allow you to make effective business decisions and even enable you to deal with the unexpected.

Let us look at some common causes of business failure.

- *Lack of planning – ‘Failure to plan is planning to fail’* Already covered above, it is critical.
- *Pricing – ‘Understand your market, and your place in it’* A significant error is to fail to properly understand the market and your business offering in that market. In a startup situation in particular, but also where an existing company is introducing a new product line, gauging the correct pricing strategy is essential.
- *Poor knowledge of finance/financing – ‘A little knowledge is a dangerous thing’* The purpose of this chapter is to introduce you to the basic concepts, principles and tools that underpin financial planning. Dependent on the scale and complexity of your business needs, you may, however, need to engage a professional accountant to guide you through the planning process, particularly if you are seeking significant levels of financing as lenders or backers.
- *Non-payment of taxes* A significant potential problem area for new business startups, is failing to budget and set aside funds for any taxes that are due as a consequence of your business activities. This is another very good reason to engage a professional accountant. It is also important at this point to note that, dependent on where in the world you are conducting business, the tax rules will differ. You must inform your relevant tax authorities promptly when you set up a new business; in fact, it is best to do this before you actually start trading. You will find the tax authorities themselves to be an invaluable source of information and assistance.

In the context of the financial plan, accounting for taxes would normally be recognized in the cash flow statement. This would take account of the timing of collecting the tax or the profit period on which tax is due and the due date for paying over to the tax authorities of any tax collected or tax owed on profits. There are penalties and interest charges for non-payment or even for late payment of taxes and these can be severe, so it is of course also essential to have in place the practical processes for making tax payments.

There are likely to be three main sources of tax liability for any business:

- **Sales tax.** In the UK, this is VAT and is applied to your sales of goods or services. The rules on VAT are complex and there are a number of rates and exemptions. If you have not consulted an accountant and you need to make an assumption then it is safest and wisest to assume that you will be liable to pay VAT on your sales and that you will have to pay it at the standard rate. The standard rate at present is 20%. If you do need to register for VAT then not only will you have to account for VAT on your sales (output VAT) but you will also be able to claim back VAT on your purchases (input VAT). Your selling price may be quoted as inclusive or exclusive of VAT but you will need to make this clear in your sales literature. The important point to remember is that although you will collect VAT on sales from your customers, it does not belong to you and must be paid over to the tax authorities. Using it as a primary source of cash to meet other liabilities is a major mistake.
- **Employment tax.** In the UK, this will have two main components: income tax and national insurance. Again this is a complex, specialist area in practice and changes in legislation and practice occur on a regular basis. You will need to account for tax deducted from the pay of any employee of the company. This will consist of income tax and employees’ national insurance. The basic rate of income tax at present is 20% but there

is a tax-free allowance for each individual and different tax rates at different levels of pay. The rate of national insurance again varies with pay. In addition to the employees' national insurance contribution deducted from an individual's pay, the employer must make a national contribution for each employee; this is referred to as employers' national insurance.

- **Tax on business profits.** When all expenses have been deducted from income, the balance left will either be a profit (surplus of income over expenditure) or a loss (deficit). In the case of a limited company, this tax is called corporation tax. Yet again there are special rules that apply to this particular form of tax and it is advisable to consult a tax specialist.
- *Lack of managerial experience – 'know your limitations'* Many startups are begun not by entrepreneurs but by technicians. It is wise to carefully consider the knowledge, skills and experience that will be required to manage your business. In the context of this chapter, of course, the advice is that, unless you are already an accountant and/or have lots of financial planning experience, you will inevitably need to work with a professional. If you don't have the technical knowledge you may need to find and recruit a Technical Director. If you don't have the requisite skills in marketing and sales you will need to recruit a Sales and Marketing Director. Recognize the strengths and weaknesses within your team and address the weaknesses. This will allow your team to concentrate on their strengths.
- *Expansion too rapid* This is again linked to cash flow. When demand for your goods or services outstrips your forecasts and expectations the temptation is to chase this demand. There are a number of problems that can arise as a consequence:
 - Growth in working capital requirements: you need to fund higher levels of stock, carry higher levels of trade debtors. These are non-cash assets and must be funded from somewhere.
 - Potential for escalation of fixed costs or capital expenditure (employment of more staff, bigger premises, more equipment, etc.).
 - Not all sales will be good sales. Some of your customers may default, resulting in bad debts. You may be tempted to relax credit terms in order to increase sales.

Sustainability of higher sales levels: a spike in demand, even a prolonged one, might not be sustainable, customers can and do fail, competitors may react.

Preliminary Design and Concept Prototype

Julian Murphy

PURPOSE

This chapter outlines the preliminary design and concept prototype phase. It details methods by which students communicate and describe their innovation, how the product differs from market competitors, their design and a prototype. Aspects of intellectual property, legal and ethical issues are reviewed with regard to new products.

TOPICS

- Finalizing ideas and last-minute idea review
- Communicating innovation and product differentiation
- Defining your product through a product definition
- Coverage of legal, safety and intellectual property considerations
- Initial product specification, design modelling and prototyping

The chapter is organized as follows:

- A discussion of how to finalize ideas is described in Section 9.2.
- In Section 9.3, the means by which to **communicate innovation** and **product differentiation** are presented.

- How to outline a **product definition** is given in Section 9.4.
- In Sections 9.5 and 9.6, **legal/safety** and **intellectual property** considerations are discussed, respectively.
- The **initial product specification** and **design modelling/prototyping** are detailed in Sections 9.7 and 9.8, respectively.

The preliminary design and concept prototype phase touches on a wide selection of engineering and supplementary topics, where ideas and developments are expressed as block diagrams, sketches and abstract descriptions together with computer or physical models.

9.1 Introduction

The preliminary design and concept prototype phase touches on a wide selection of engineering and supplementary topics. Typically, ideas and developments are expressed as block diagrams, sketches and abstract descriptions together with computer or physical models. Hence, a logical question is where does this phase stop? The answer is, it stops at the point where there is an agreement or declaration by your team of the ‘final design’ phase; thus, maintaining clarity between preliminary and final design. For this reason, the fact this phase touches upon an array of topics and aids the student learning experience. It is helpful to break the phase down into more digestible chunks, by identifying a set of distinct steps which can be more effectively focused on. This is the approach taken in this chapter.

The phase builds on what has been developed earlier in the design cycle. Creative aspects and any salient points of innovation and initial product differentiation should have been identified after considering your target customer base and demographic. The next step is to finalize your ideas, and leverage your previous groundwork in order to be able to successfully communicate your innovation and what differentiates your product. After this, the product definition can be defined together with relevant success factors. Any legal and intellectual property issues should then be considered, specifically in terms of how they relate to your product. The product specification for your product can then be mapped out to specify its precise limits and detailed requirements. This is followed by the design modelling and prototyping step, which is essentially the methodology for taking the product specification and exploring different possibilities to arrive at an initial and first solution. A roadmap of the chapter is shown in Fig. 9.1.

9.2 Finalizing Ideas

In today’s marketplace many different products compete in similar sectors for the same customer base and demographic. Hence, having a product that stands out against the competition from a design perspective can essentially make or break your business. If a product is average, it will command an average response from your target customer; everybody is looking for something special to spend their hard-earned cash on. This natural customer inclination

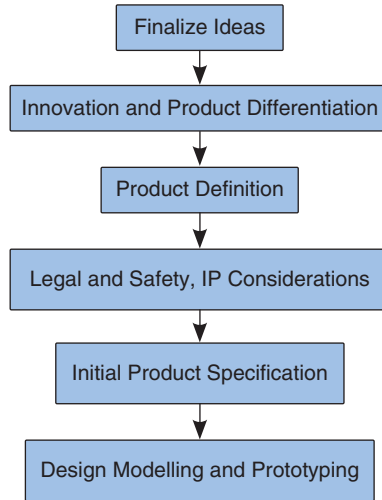


Figure 9.1 Chapter roadmap

is perhaps even stronger for university students, which is the customer base a lot of student products target, due to the fact that the team can easily relate to their peers.

Thus, to have an edge in the marketplace you really have to consider your precise points of innovation and product differentiation in order to stand out from the crowd. Sadly, innovating with respect to a new product is simply not a case of looking at what has already been done by your competitors, as their relative successes and failures are no prediction of the future. It is more about creating new means and mechanisms by which to build value into your product. Only this will drive long-term revenue streams and create a sustainable business. Your mindset should be to challenge existing norms and solutions by being creative. This will allow you to construct something that meets new, growing, untargeted customer needs and desires.

With the above discussion in mind, at this point you should have already completed the previous phases to filter and arrive at a collection of ideas surrounding your product. You should have crossed off the list each idea after evaluating it for its relative benefits and weaknesses, and combined some ideas with others if it seemed appropriate. Your selected and finalized ideas do not necessarily have to be ‘out-of-space’ disruptive, rather they should attempt to expand and push boundaries as much as possible – that is, with respect to innovation and product differentiation.

Asking ‘what if’, even in the latter stage of finalizing ideas, can help free you from current practices and provoke new ways of thinking to create a better product.

Once you have accomplished this, it is worth going over your chosen ideas thoroughly, to ensure the whole team is agreed and to consider any issues before moving on. Take a moment

to discuss any ‘what-if’ questions, since frequently innovation is limited only by imagination and thinking. Asking ‘what if’ even in the latter stage of finalizing ideas can help free you from current practices and provoke new ways of thinking to create a better product. Indeed, consider having an individual from outside challenge you on your ideas as another approach to finalizing your ideas. Even if you think collectively as a team that your final ideas are the best they could possibly be, you can be certain that your customers or people from industry will have a different perspective. Quite possibly these are strong opinions and insightful advice that you can leverage.

TRY THIS

Try listing your ideas in rows and put criteria to measure them by across the top in columns. Then, score each idea and sort your ideas in terms of scores. Finally, take a team vote on their merits.

The main aim of this method is to evaluate your ideas in accordance with several factors. Therefore, do not feel constrained by your initial scores, since there is value in discussion and the method helps to bring out different perceptions. A similar technique can also be used to assess your ideas based on three aspects: novelty, appeal and practicality; ideas are then ranked by scoring them on a scale of 1–10. As a team, ask: How novel is the idea really? How attractive is this as a solution? Does it solve a problem? How feasible is it to put it into practice, all things considered? This process is shown in Fig. 9.2.

In Fig. 9.2, a handful of selected methods have been suggested to help you complete the idea-finalizing step. However, it should be obvious that there is a whole host of tools available at your disposal. Therefore, you are encouraged to investigate other means to help you decide, if necessary. Indeed, it is worth completing one last final iteration just to be sure, since a key difference between successful businesses compared with those that stagnate over time is the adoption of consistent innovation techniques. Eventually, you should feel your product ideas

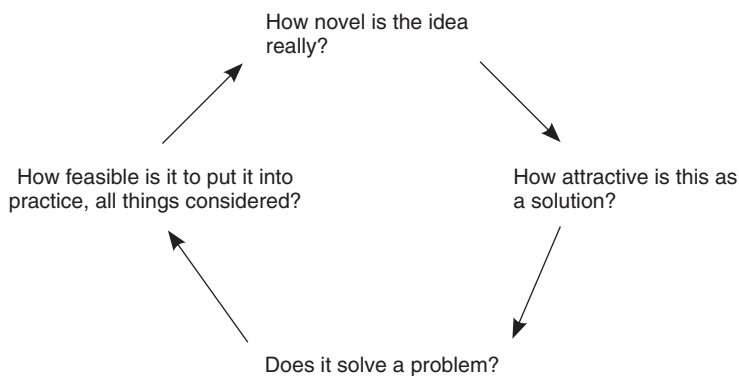


Figure 9.2 Assessing ideas on three aspects: novelty, appeal and practicality

have been readily finalized and everything has been explored, and you are ready to move on to the next step.

9.3 Communicating Innovation and Product Differentiation

Once a set of ideas have been settled upon, the next step is to be able to actively communicate your innovation and what differentiates your product to the target audience: your customers and any prospects.

Innovation and product differentiation can broadly be defined as follows:

- Innovation is the application of new solutions to meet new requirements or existing market needs.
- Product differentiation is the process of distinguishing the differences of a product from its competitors that make it more attractive to customers.

In most product development cycles this final step happens last. However, to be able to move forward efficiently, it is advocated here that it should be conducted early on as part of the preliminary design and concept phase. This is because, without the ability to effectively communicate what makes you different and how, your customers have no reason to choose you over your competitor. Since appreciating how you compare to your competitors is at the core of your customer's decision-making process, the clearer you are in outlining your actual innovation and product differentiation the better; you will then be positioned to win your customer's business.

The benefit of doing this is that it allows you to engage with customers and prospects to get their feedback earlier, and allows you to advance your own understanding. Both these benefits act to mitigate risk and resolve any problems sooner rather than later. An understated point of running an effective business and developing winning products is that it is often a matter of managing and controlling risk.

To achieve this, you should aim to demonstrate ways in which you are adding value, and in a manner or way your customers understand. Consider, as a team, how you can make your customers – based on your finalized ideas – appreciate your product's USPs and attributes. This is vital as, in reality, there is often not much that is very different from competitors or the existing state-of-the-art; and, even if there is, your competitive edge can vanish as quickly as it came to you. In contrast, a product may have some *je ne sais quoi* but the inventors do a poor job of communicating and highlighting what the innovation actually is, and the things that differentiate the product. Ultimately, it is your role to pitch all of the reasons that make your product innovative and different compared with your competitors. If the best you can do is to be the same as your competitor, then there is no reason to choose you over them. Therefore, if there are not clear and visible differences that translate into a meaningful difference for your customer, they will simply decide on price.

TRY THIS

To get started, and since it is often not easy to say concisely what makes you unique and different, try to identify five key differences and write them into a single statement (strap line) so that you are able to answer without hesitation the question: ‘What makes you different?’ Ensure your statement does not end with a feature, but rather stresses the benefit for your customer and how it addresses their need or pain. If it is difficult to arrive at a suitable statement, attempt to answer the following statements first:

- The one thing that makes the greatest difference to our customers is _____.
- The one thing our product does better than anyone else is _____.

Now you should have the ability to tell your customer precisely what makes you different and how it benefits them. The next step is to make an effort to gather together proof points, visuals, examples and stories that will support your claims of innovation and product differentiation – that is, to provide tangible evidence.

TRY THIS

Identify five key differences and write them into a strap line so that you are able to answer without hesitation the question: ‘What makes you different?’

Of course, this will be unique to each product and best left to your own creativity. However, a possible first approach is to try to capture the big picture. Sketch out all the elements of your product on a canvas/whiteboard so you can immediately give viewers the overall big picture. This provides just the right amount of information to allow a viewer to grasp the idea, yet not enough to distract them. It visually simplifies the reality of a product with all its points, processes, interactions, features and benefits to make a compelling argument to support your claims. At the same time, it becomes a powerful enabler for focused discussion about the various aspects of your innovation and product differentiation.

Alternatively, a more powerful way is actually to explain everything by telling a story. You could do this by using Microsoft PowerPoint to allow the audience to follow the story of your product – where the visuals complement your explanation. In this way you can also include embedded testimonials and examples directly in your presentation. See Fig. 9.3 for how the elements and scenes in a story are structured.

9.4 Product Definition

Now you have decided upon a set of final ideas, and are also able to communicate your innovation and product differentiators, the next step is to map everything from an engineering perspective into a high-level product definition. Here, the aim is to concisely – but in broad engineering terms – articulate the product’s overall purpose and functionality. It is your compelling vision of the product based on your chosen ideas and forethought that encourages your

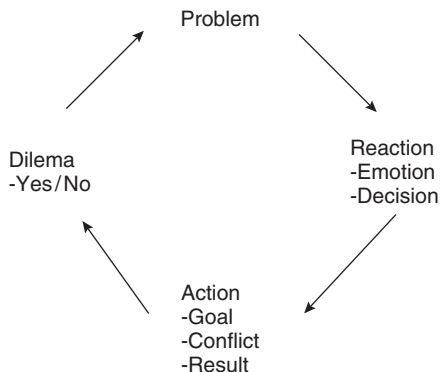


Figure 9.3 Elements of a story

customers to buy your product. Realize that the eventual success of your product relies in part on your own vision and investment in the product. Therefore, the product definition should also aim to communicate how your product addresses your target market’s need or pain using your knowledge from the previous step.

In simple terms, a technically minded person reading your product definition should be able to grasp what your product does and how it does its job. The key is to be as clear as possible about what success for the product looks like in terms of words. At the same time, it is essential to be clear and concise to embed your overall value proposition: what the point of this product really is. If you find you really struggle with deciding on a product definition, try taking a moment to construct a visual sketch or computer model of your hypothetical product.

Indeed, do not feel surprised if you find – when establishing the product definition – that your planned product appears to lack focus. Or that your product really has nothing in particular that stands out, which would give it an edge in the marketplace, or aspects that may not resonate with your target customers – even after completing the previous steps in this phase. Of course, this is not the ideal situation, but you should understand that every product goes through iterations and revelations that feed back to earlier steps and phases. Therefore, if this is the case, return to the relevant previous phases and attempt to refocus your ideas, etc.

Have confidence that you do not need to pinpoint every little detail when constructing your product definition, as these are specified later.

It is also possible to expand on the basic product definition approach described by actually specifying formally in the product definition particular objectives, which can be used later to measure the success of the product (i.e., ‘success factors’) and used to benchmark a product against its original specification. These are the essential areas of activity that must be performed well to achieve objectives or goals for your product. By identifying success factors you can create a common point of reference to help you direct and measure the success of your product, and also help everyone in the team know exactly what is most important in the long term.

However, in order to identify these key predictors of success, you first need to define success. For instance, success could be defined arbitrarily as the number-one-selling product in a set category one year after introduction. Although this success factor's definition is intuitive and easy to measure, it is problematic since the goal is effectively isolated from benefits, features and aspects of the product. Therefore, if you choose to use success factors in your product definition they should relate to the product and aspects that can be controlled and evaluated. Note that while there is no hard rule, it is useful to limit the number of success factors to five or less.

Together with success factors and since today's business world is constantly in a state of flux and becomes more complex every day, by its very nature it features risk. Therefore, it can also be beneficial to identify and attach points of risk to any success factors. Since increased legal requirements have forced businesses to use significant resources to address risk, identifying risks will provide a helpful mechanism for assessing the reality of your success factors.

9.5 Legal and Safety Considerations

It is important before embarking on any new product design, after the initial product definition has been finalized, to take time out to analyse in depth just what is required to realize the product and any potential pitfalls, in an endeavour to mitigate risk. The information here follows the previous steps to avoid clouding them, and since finalized ideas and the product definition can be moulded, or modified slightly, to meet legal standards and requirements. Note that since each product has its own unique characteristics and benefits, the following points should be considered as a minimum – that is, you are encouraged to pursue further investigation tailored to your product.

In the UK, under the Sale of Goods Act 1979, all products must be 'fit for purpose', of satisfactory quality and match their description. This should be interpreted as meaning: your proposed product must fulfil the purpose your customers expect and the reasons that motivated them to buy it – that is, your innovation and product differentiators. Be aware that the Act is purposely wide and also covers anything the customer may ask about when the product is purchased. The implication of this part is that, according to the Act, your product is guaranteed by the retailer to meet its purpose at the time of sale. Therefore, if your product is not fit for purpose, the customer is within their legal rights to have the goods replaced or repaired. You can find out more about the Sale of Goods Act 1979 on the Office of Fair Trading website (www.oftrading.gov.uk). In addition to the Sale of Goods Act 1979, if you are acting as a manufacturer in any capacity, you can also be held liable in any legal action for 'harm caused to consumers or businesses as a result of unintended side effects or the failure of products manufactured or supplied by you'.

Another important consideration is the CE mark, which is your claim (or your manufacturer's) that your product meets any specified and essential safety requirements set out in relevant European directives.

The following categories of products require CE marking, which may be relevant in this step if you wish to sell them within the EU or member states of the European Economic area (EEA); this includes toys, electrical products, telecommunications equipment, medical devices, machinery, equipment and safety components. Note that the requirement for CE marking and the exact process you will need to go through varies from product to product, since different types of product are governed by different European directives. Here an item of equipment is covered by more than one directive, it must be CE marked under all applicable directives – failure to do so can result in prosecution.

Further legal regulations cover all toys supplied in the UK, which must meet the requirements of the Toys Safety Regulations 1995. The regulations define a toy as ‘any product or material designed or clearly intended for use in play by children of less than 14 years of age, but excluding those products specified in Schedule 3 of the regulations’. Other laws relating to child safety to be aware of address: flammability, performance requirements regarding flammability are compulsory; choking risks, toys intended for children under 36 months must not present a choking risk; magnetic parts; and chemicals.

So, bear in mind the above information on the various legal and safety regulations which relate to your proposed product and the possibility of any niche legal implications. Even though meeting your legal obligations is the minimum required, it is a good idea to go further and take best practice on board. If you put time, effort and fore thought into your product’s design and any legal implications or standards, it will naturally lead to a legal and safe design. That is, taking into account the safety aspects of your products from the outset of design can help limit your liabilities as you may find it easier to comply with current and future legislation.

As well as the above, increasingly there is pressure from stakeholders such as the government, regulators, the supply chain and customers to design products that do not have a negative impact on the environment or society. When you are planning your product, consider the implications of any parts and materials; can your product be dismantled without causing harm or releasing toxic or harmful substances?

You should also check that your packaging is designed with safety in mind. The packaging should protect your product in transit and protect your customer from potential injury. Packaging includes all products used to contain, protect, handle, deliver or present goods. It includes returnable and non-returnable items such as boxes, pallets, labels, containers, tubes, bags, sacks, timber, glass, metals, plastics and ceramics. It can also include tape, wrapping, binding and tying materials. The Consumer Protection Act 1987 makes manufacturers strictly liable for death, injury, loss or damage caused by defective (unsafe) products. It covers and is intended to protect the public by: prohibiting the manufacture and supply of unsafe goods; making the manufacturer or seller of a defective product responsible for damage it causes; allowing local councils to seize unsafe goods and suspend the sale of suspected unsafe goods; prohibiting misleading price indications.

The Trade Descriptions Act 1968 also makes it an offence for a trader to make false or misleading statements about goods or services. It carries criminal penalties and is enforced by Trading Standards Officers, making it an offence for a trader to: apply a false trade description to any goods; supply or offer to supply any goods to which a false trade description has been applied; make certain kinds of false statement about the provision of any services, facilities or accommodation.

9.6 IP Considerations

Specific details on IP have been covered in Chapter 7, however, a discussion is provided here and related to actual examples, since it forms an essential part of the preliminary design and concept phase. This section is about practical considerations, rather than extensive legal background theory and legislation.

When you create a new product, a frequent worry for the inventors is that a competitor will unscrupulously copy the product and any points of innovation. Indeed, this is an extremely valid concern since it plagues every business, large or small (for example, consider the 2013 legal wrangles between Apple and Samsung over interface design). The answer is a legal concept termed intellectual property, which attempts to assign exclusivity and legal rights to the IP owner – that is you, the inventor. The type of IP can be wide ranging, from simple phrases such as ‘I’m so proud of it I put my name to it’ – the infamous slogan for the George Foreman Lean Mean Grilling Machine burger makers – to complex technical inventions, such as a biometric sensor.

Aside from providing a first-line defence against copying and counterfeiting, IP protection aims to provide an incentive for inventors to disclose their work. This is because IP grants you time-limited but exclusive rights for disclosure of your IP regardless of its nature. As such, as the holder of exclusive rights you can leverage the IP for financial gain, which is the reward for the investment in building an IP portfolio. Note, however, that seeking IP protection can be a very expensive process depending on the IP type. An overview of the various types of IP is now discussed within the context of the UK, encompassing copyright, patents, registered designs, trademarks and trade secrets.

Having the copyright to something means the inventor has exclusive rights to the ‘works’, whether creative, intellectual or artistic, for a preset period of time.

A key point, however, is that it only covers the form or some means of expression. Meanwhile, and unlike a patent, it grants a right to copy as long as the copyright holder is credited for the work. For instance, if your product was an embedded system that featured some visually animated characters on an LCD display that was critical to your product and brand (i.e., an electronic children’s toy), you could consider copyrighting the animation characters or sequence. This would provide protection against anyone else being able to make copies or creating derivatives. This approach would also be beneficial if later you planned, as part of your marketing strategy, to launch a soft toy version of the characters.

A patent gives the inventor exclusive rights to prevent others from producing and selling an invention for a preset period of time if maintenance fees are paid, and their reward for disclosing the invention into the public domain.

A patent differs from copyright in that it covers some form of technology aimed at solving a problem. For instance, it could be a part in a product, a method of computation or a process.

To be valid, a patent must include a set of claims that map out the novelty, allowing the patent to stand up under scrutiny and be used to seek compensation if the patent is infringed. The claims are particularly important as, to defend the patent, the owner is required to actually prove one or more of the claims have been violated. This is why patenting is widely known to be expensive, as experts are needed who are versed in the art and can draft the patent suitably so it is legally meaningful. Indeed, the costs associated with patenting are often significant due to the various stages: preparing, filing, granting and maintenance.

It is likely that various aspects of your product could be patented, however, you should try to work out just what the novel aspects are that could broadly be patented.

Your product will have various things that make it innovative, but this does not necessarily mean they should be patented. Consider it in terms of adding value to your offering as a business. If you were going to be acquired by a larger company would a patent, perhaps on a different way of interacting with a sensor, justify a larger buy-out price? The answer is probably not, however, a patent that covered the apparatus and method of a sensor and its usage in a specific field of invention would be of higher value. This perspective and thought process is also worth adopting if you are considering raising investment.

Registered designs give you exclusive rights to a design in the UK for up to 25 years.

This means you can stop people making, offering, putting on the market, importing, exporting, using or stocking a product applying or incorporating your design. You can protect two-dimensional designs or surface patterns as well as shape and configuration with a registered design.

A trademark is an important part of the IP puzzle and also worth investigating. It covers some recognizable sign, design or expression that differentiates one product from another.

For instance, the Virgin brand is trademarked and is clearly known to be different from others. A trademark itself is flexible and can be positioned on a product's packaging, labels or hard-wired onto the product itself. Thus, trademarks are often an aspect of corporate identity and you should approach this IP avenue perhaps from a branding point of view.

The last IP that is worth covering is trade secrets. This is essentially a business's 'secret sauce' that is so critical to their operation it should not be divulged, and such that it allows you to obtain an economic advantage over competitors or customers. A good example is Coca Cola, who closely guard the recipe for their drinks. Since trade secrets are by definition not disclosed, owners of trade secrets seek to protect trade secret information by instituting special procedures, one example is non-disclosure agreements (NDA).

9.7 Initial Product Specification

Communicating product design processes and features can be an art in itself. Over the years, engineers and designers have arrived at all manner of mechanisms in an attempt to solve their common challenges. However, the same issues occur over and over. Because of this the majority of these mechanisms can be forgotten and rather focus put on a single item, namely the initial product specification.

While the product definition outlines the purpose of the product, functionality and success factors, the initial product specification goes further to specify the precise limits and detailed requirements with regard to the product being designed. It communicates exactly what the product has to do, how it looks and its implementation. Effectively, the initial product specification is the roadmap for your product. Consider, if you were buying a new car you would think about the type you want, where you would drive it to and perhaps on what terrain, what it would look like and how speedy and economical it should be. All these points or desires are what the initial product specification might detail.

A key benefit of constructing this document is that it prevents your team from missing any critical points or issues; overlooking any item significantly delays most product development projects. At the same time, appreciate that it is not a requirement for everyone to know the answer to all issues upfront. Therefore, it should be considered a work in progress as opposed to being static, and more of a positive feedback loop to the product definition since more information can easily be added as and when required.

The initial product specification document prevents your team from missing any critical points or issues, since overlooking any item significantly delays most product development projects.

The actual structure and level of detail you put into the document depends greatly on the nature of the product. It could be as simple as a set of Microsoft PowerPoint slides, which is often the case for software products. While this is not being formally recommended here, it is actually a good starting point in the early stages to flesh everything out, and will readily allow input from members of your team to address any questions early on.

Before starting the initial product specification to enable you to arrive at a sensible and practical document, it is recommended that you first of all conduct a brief product analysis. Here, you investigate and research how well your product will fulfil its intended role, which allows you to use your findings to ensure quality of design and that the end product is fit for purpose. You should consider questions along the lines of the following, together with the product definition:

- What are the different components of the product?
- How do the different components interact?
- What components and materials are needed to make the product?
- How is the product to be made?
- What are the different parts of the product and how do they work together?

Once a product analysis has been conducted, the initial product specification can easily be mapped out. It is left as an exercise to choose the structure and presentation format. However, an ideal initial product specification should include:

- product functionality
- dimensions
- materials
- an outline of the appearance of the product
- user requirements
- details of the source of power (if needed)
- any anthropometrics and ergonomics
- possible production methods
- legal and IP requirements
- environmental considerations and requirements
- working drawings.

Note: Anthropometrics is the study of the size of people in relation to products (e.g., chairs) whilst ergonomics is the relationship between people and the products which they use.

It is likely that your product has both electronic and mechanical aspects, and perhaps underneath is some form of embedded or mechatronic system. Therefore, the initial product specification should be appropriately partitioned to reflect details of the different engineering fronts. From an electronics point of view, the document should provide an overview and description of the functions any electronics will perform. The following would be expected to detail the electronics:

- architecture overview
- design partitioned into blocks and rationale
- interactions between the blocks
- internal protocols and data formats
- interfaces and protocols to external devices or ports
- memory mapping of software-controlled parts
- flow diagrams.

From an interface and software perspective, any relevant use cases should also be detailed in the document and labelled with tasks, for instance ‘touch sensor for 2 seconds’. The identified use cases also need to be analysed for exceptions, that is, to cover situations where the user does something different from what you expect – things that can occur if the user does not do what the use case specifies. For example, touching control buttons in the wrong order, in which case a suitable error message or action needs to take place. Extra and alternative use cases may need to be introduced to cover the identified exceptions.

One of the most important aspects of the initial product specification is also the working drawings. These are normally implemented as orthographic projections, featuring a front view,

a side view and drawings of any detailed aspects using a first-angle projection or third-angle projection. Some products may also need a section drawing to give extra structural information, or assembly drawings to show how parts fit together.

In addition to all of the above, the document also needs to detail constraints relating to safety; how to handle functional, reliability and robustness defects; any constraints imposed on other system elements such as software; and testability.

9.8 Design Modelling and Prototyping

Design modelling and prototyping is essentially the methodology for taking the initial product specification and exploring different possibilities to arrive at the ideal solution. It is a central part of the preliminary design and prototyping phase, and follows the initial product specification step to help gain an understanding of what is missing early on. Hence, even with an initial product specification mapped out, this step can lead to completely different solutions and new possibilities. This allows the right one to be easily identified and the initial product specification to be updated accordingly.

This stage effectively forces you to address issues of structure, relationship and logic in an endeavour to truly understand the advantages and disadvantages of your earlier choices. Indeed, interaction with models and prototypes produces ideas far more readily than discussion since it frequently provokes new streams of thought.

It allows you to focus on key questions, such as:

- What would be the benefit of adding this?
- What are the consequences of removing this?
- What if we replaced this with something more innovative?

Your aim in this step is to produce, based on the design specification of your product, something tangible to present your product ideas to your customers and manufacturer. Ideally, something they can touch and feel, or at minimum visualize, so they can appreciate fully what it is you are offering. These can be in the form of a:

- Model, a scaled-down graphic representation or computer-aided design (CAD) drawing of the design.
- Prototype, a life-size working model of a design used for testing development and evaluation.

TRY THIS

A physical model can be a very quick and cheap method of bridging the gap to producing a prototype. It is possible, together with a little creativity and inspiration, to produce something tangible using simple materials like paper, card, foam, wire or medium-density fibreboard (MDF).

The benefit of a physical model is that it is obviously three-dimensional and can be touched by your customers to let them evaluate your ideas, and allows you to assess if it meets your original initial product specification. The alternative is to construct a software-developed CAD

model, which can be implemented in either two dimensions or three dimensions for viewing from any angle. The benefit with this approach is that it can readily be changed and perhaps interactively modified on-screen with your customers. It also allows you to develop a more detailed model than would be possible using the basic physical model approach – that is, PCB and mechanical parts can also be modelled. Lastly, software CAD modelling lends itself to simulation, which allows you to test your design against certain parameters. For instance, if your product has to be used in an industrial context or outdoors, it could be possible to model how it would interact or be affected by its environment.

Your aim in this step is to produce, based on the design specification of your product, something tangible to present your product ideas to your customers and manufacturer.

A full prototype goes further than just a model by delivering a full life-size working model of your product. This is very useful as frequently there is a high probability that a design will not perform as expected. A prototype acts to mitigate this risk, while also having the benefit of being able to give your customer something to actually touch and feel which they can use to give you precise and constructive feedback. Indeed, it makes your abstract product concepts tangible and allows for the exploration of new ideas to improve your product. At the same time, it can actively be used as a thinking tool to allow you to explore different directions in which the product could be developed further, to test theories and validate performance before mass production.

A common approach to prototyping (and modelling) is to develop a series of prototypes over time using iterative improvement. Alternatively, through a series of prototypes of aspects of the product. For example, proof-of-principle prototypes are frequently used to test aspects of the product design without developing the aesthetics or manufacturing. This would be appropriate if the design has embedded aspects which can easily be tested on development boards. Meanwhile, form prototypes can be used to explore the actual shape and dimensions without being concerned with functionality.

With respect to electronics, prototyping means building an actual circuit to verify that it works, and to provide a means to debug or improve your design. Electronic prototypes can be constructed quickly using breadboard, PCB rapid prototyping or development boards (i.e., the Raspberry-PI or Arduino).

It is key to realize that prototypes will always differ in representing some compromise from the final production design. Owing to differences in materials, processes and design fidelity, it is possible that a prototype may fail to perform acceptably whereas the production design may have been sound.

9.9 Conclusions

This chapter has broadly outlined the preliminary design and concept prototype phase. By breaking down this phase into steps, it has detailed methods to describe innovation and product differentiation after finalizing ideas, then how to form the product definition together with relevant factors for success. Legal and intellectual property issues have then been considered and finally, the initial product specification and prototyping steps have been reviewed.

Full Product Development

Paul Hermon

PURPOSE

This chapter describes the next stage in the technical development of a product. It will necessarily involve detailed design, leading to the building of a prototype capable of realistic in-service testing. Commercial viability continues to be monitored during development. Iterations refining the design may be required, based on testing against a product design specification, before a final product definition is achieved.

TOPICS

- Student experience of the industrial project exercise
- Translation to viable mass-production-ready design
- Tools facilitating rigour in design detail

The chapter is organized as follows:

- The challenges of undertaking **product development** in an educational environment are given in Section 10.2.
- In Section 10.3, the importance of **functional prototypes** is highlighted.
- The **product design specification** and detailed design are discussed in Sections 10.4 and 10.5, respectively.

- **Learning from your mistakes** is then covered in Section 10.6.
- **Mass production, automated assembly** and **testing** are considered in the next three sections, Sections 10.7–10.9.
- Some insights for the final product are given in Section 10.10.

A phrase that might typically be heard in a conversation attempting to unpick what went wrong with a failed product development is that the idea ‘looked good on paper’.

10.1 Introduction

Inherent within the above comment is an understanding that there is a fundamental difference between thinking of an idea and realizing it as a physical or operational entity. An experienced expert in a particular field develops over the space of many years an automatic sense of what will and will not work. In the opening chapter of Malcolm Gladwell’s book *Blink* (Gladwell, 2006), he describes the almost subconscious ability of art experts to recognize forgeries, a skill which they develop through years of meticulous and detailed study in their area of expertise.

Undergraduate students are extremely unlikely to be able to make expert judgments due to lack of practical experience of product development.

To help foster skills and knowledge, it is therefore important to provide opportunities for the development of prototypes which are much closer to final products, much more realistic in terms of how they will be manufactured and much more than just paper exercises. Aligned with this is the need for effective mentoring and support from knowledgeable supervisors who can facilitate understanding by passing on some of the experience they have gained; a type of innovation apprenticeship.

Not every student project will be a world beater, but if the processes of investigating the business possibilities and developing a technically viable prototype are conducted correctly then if nothing else, the students’ level of expertise in the discipline will have been raised. On the product development side of the process, there will almost inevitably be complications and setbacks as the design detail gets added to the concept prototype. So far, the prototype has served its purpose of proving that there was something worth taking to the next stage of development. These setbacks are a normal part of the process and students need to be mentored to recognize this and rise to the challenge of solving these problems.

The skill of problem solving is, after all, one of the key characteristics of being an engineer. It is one of the expert qualities that will grow and develop over time, but it is a skill and therefore can be developed with practice.

10.2 Full Product Development in an Educational Context

Full product development as carried out in an industrial context is both expensive and time consuming. Student projects typically have only limited budgets and a set period of weeks, at most running to a full academic year for a senior project. There is a fundamental challenge to make this part of the project authentic, while still managing to operate within the educational system constraints. This time limit means that the project supervisors need to call a halt to the growing number of concepts and associated prototypes, and force convergence on a single concept to take forward to this more detailed phase.

In the commercial world, it may be more normal and indeed desirable to continue to iterate and evaluate concepts and prototypes until a greater degree of certainty in the level of breakthrough innovation of the new product is achieved. In the long term, successful companies need to deploy their resources on projects leading to products that are successful in the marketplace. To do otherwise means that their revenue stream will dry up as competitor products better meet customer expectations and the old established brands get replaced by the next big thing.

A key factor of success in top companies is the killing off of projects which are identified not to provide a significant advantage in their market sector. If this culling is carried out in the early phases of the product development the amount of resources wasted is minimized and the commercial risk is managed effectively.

Robert Cooper, *Winning at New Products* (Cooper, 2001)

The constraints of academic structures and assessment requirements do, however, mean that many projects will need to progress with a reduced chance of success. This is not necessarily a problem because the emphasis is on learning the process of creating innovative products or systems. The ability to learn from failures and mistakes is regarded by many as a key component in the psyche of an innovator.

In the ethos of the design company Ideo, experimentation is encouraged in the first instance to gain a deeper understanding of the problem and hence inform the designer to be able to better recognize viable solutions. This design thinking approach to engineering is summed up in the mantra ‘fail fast to succeed sooner’.

Tim Brown, *Change by Design* (Brown, 2009)

10.3 Functional Prototypes

While it is entirely possible that student teams can come up with world-beating solutions, it should be recognized that such factors as team size, composition and project timelines at the outset essentially constrain the project in a way that could inhibit the outcome.

This becomes particularly important in the full product development stage, as the level of detail and precision of a fully working prototype using production intent materials may require significant resources, time and finances that might not be available to the student teams.

You should, however, aim to iterate quickly towards a prototype which is capable of functional testing, and which is a very close equivalent in terms of user interface or other forms of interaction, such as weight or touch. Only by making a tangible prototype can the fine detail of the design be fully evaluated and to this extent the closer to a series production version the better.

Figures 10.1 and 10.2 gives example of prototypes. In Fig. 10.1, the relationship between the concept, CAD model generated and the final functional prototype can be seen. In the case of the aircraft seat in Fig. 10.2, a prototype is vital for demonstrating and evaluating the concept.

A word of caution is required here; you should not put all of your resources into a single prototype which takes a lot of time and money to produce. Too often, third-party suppliers will let you down and subcontracted manufacturers will miss their quoted delivery dates, leaving you with insufficient time to evaluate your design in a meaningful way and hence reduce the chance of producing a breakthrough innovative product. Better to design in adjustability or upgrade potential to a sequence of prototypes which increase in fidelity or accuracy. Disassemble old prototypes and reuse what you can from older versions, replacing or upgrading the elements which were found to be lacking in your testing and evaluation.

Some products lend themselves to prototypes which are more accurate in relation to what the final product will be, for example a mobile phone app. Of course, the operating system and development platform infrastructure behind phone apps has a lot to do with this and provides the business model to allow potential developers to bring a product to market.

This is not the case for an electric power tool with a cast aluminium casing, where tooling costs for large pressure diecast aluminium components can run to hundreds of thousands of pounds; however, it is difficult to produce prototype components which have exactly the same mechanical properties by other methods. Investment castings can be made from a wax prototype pattern or sand castings from a wooden pattern but both produce a casting with reduced strength and stiffness, with internal voids, lower density and less dimensional accuracy. Even in a commercial development situation, designers wait nervously for the first-off tool castings or injection mouldings due to the difficulty of producing a truly representative prototype of the production components.

It is a good idea to establish early on where your product sits on a map of infrastructure and capital investment such as in Fig. 10.3. It is important to realize what limitations you will face in making a viable functioning prototype and where you will need to compromise. This is particularly important when developing an innovative product rather than an incremental improvement on a product in an existing range.

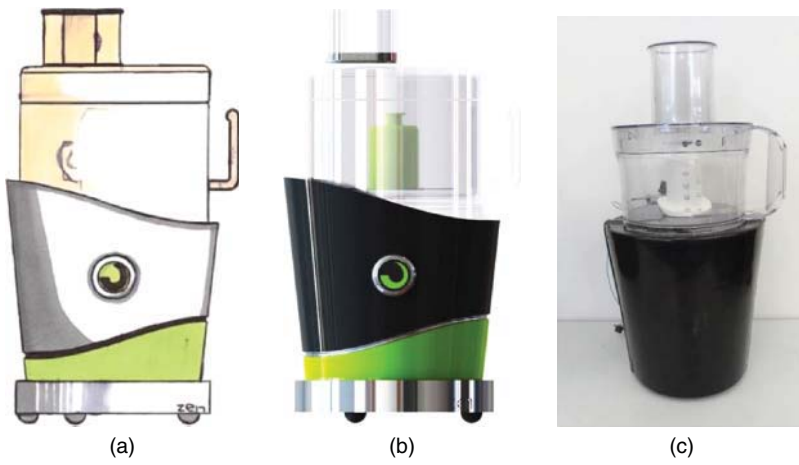


Figure 10.1 (a) Concept, (b) CAD model, (c) functional prototype Quieter Food Processor



Figure 10.2 CAD model and functional prototype of an innovative economy-class airline seat

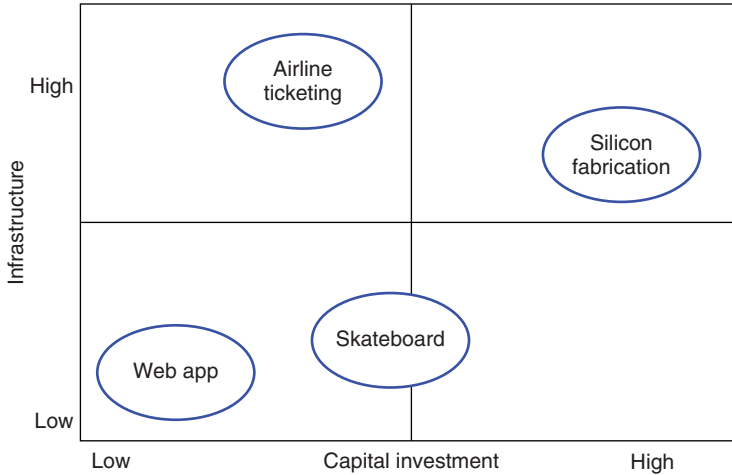


Figure 10.3 Matrix for infrastructure versus capital

An innovative product by definition will solve a problem or need in a novel way. You will not know how this is to be done when you start the process because all you have on your desk is a definition of the problem. As you experiment and iterate towards a viable solution you may well head down a route which has not been trodden before and for which there is no roadmap. Knowing where you sit on this matrix map will help you understand what is feasible and what is not.

Prototypes and computer simulations are in essence only approximations of the real world. A more realistic prototype will generally be more expensive and take longer to develop and test. A pragmatic approach as to how much and how long must be made early on, so that timeframes and budgets can be decided. This is particularly relevant in determining what is feasible within the constraints of a student project.

Computer-Assisted Dispatch System

This ill-fated system was introduced in 1992 by the London Ambulance Service. In a pre-GPS world, a software solution was envisaged as a means of improving the response rate by logging accurately the location and status of all vehicles in the fleet. Unfortunately, due to a number of factors not fully anticipated until full implementation, the system quickly became unworkable and had to be switched off after 9 days with the service reverting to a paper-based backup system.

Remember that a simulation is only a simulation and requires sufficient knowledge and understanding of the environment being modelled to get realistic results. The odd adage of the computer programmer, 'rubbish in, rubbish out', holds true equally well for advanced simulations and computer analysis of new product developments. Imagine, for example, a team of

students conducting a finite element analysis (FEA) stress analysis of a bicycle frame. They might establish material properties and load case scenarios based on their assumptions and interpretation of the forces in play. They could iterate many times seeking to optimize the structure and minimize the weight but if they have failed to include the torsional forces induced by the pedalling of the bicycle while in motion and only included the static loading situation, then they will be in for a surprise and a disappointment when they first ride their bicycle, made only on the basis of an inadequately considered computer simulation!

For this reason, simulations should always be backed up by validation through testing of physical components.

10.4 Product Design Specification

It is perhaps not logical to expect that all innovative products can be fully developed within the multiple constraints of the academic world, but executed correctly all can make significant progress in the right direction and eliminate gross errors and oversights. What is required is a really good prototype which is as close to the production version as you can make, within the allocated time and budget.

To assist with the design of innovative products, a standardized mechanism of keeping this full product development phase under control is needed. The product design specification (PDS) is just the tool to perform this task but it needs to be well written if it is to carry out this role effectively.

The PDS provides measurable and unambiguous descriptions about all aspects of the product to be designed in a comprehensive formal document. It should not, however, be considered as something carved in stone which can never change, but rather a living document which can be updated as your understanding of the problem grows and your appreciation of the scope of solutions improves during the prototyping stage. The physical dimensions and weight of a product might appear on the packaging or data sheet, but such exact values would not appear in the PDS. It would be more normal to state values for the maximum size and weight deemed acceptable for a product in the PDS, having determined through market research where your product needs to be to gain a competitive advantage.

You might, for example, be looking to design a thinner mobile phone but find during prototyping that the ultra-thin case you had envisaged proved too vulnerable to permanent deformation. You would then consider that you need to relax the dimensions in your PDS and this would be permissible as long as it does not impact on your original key objective to the point where you lose market advantage. If you find that you are having to compromise on several of the original targets set in the PDS as you progress through the product development process then you need to reassess whether the project should be allowed to continue on a path towards mediocrity or whether a new direction is required.

The PDS should also not be confused with the product specification, which is a statement of facts and figures describing such things as the measured performance of a product.

A PDS is not a marketing wish list. Take care not to let a PDS grow out of control. If you allow all possible features to be added you run the risk of making the product impossible to make or at least impossible to make at a commercially viable price. Complexity can also make a product less reliable as multiple points of potential failure creep in. Stick to the key unique selling points which you have identified in your previous research stage of the process. If these are strong enough then there will be no need to add the bells and whistles.

To illustrate this point, try the following exercise. Move on to the next numbered task only after you have completed the previous one.

1. Make a list of commercially available items which fasten two or more sheets of A4 paper together. (You should be able to identify six or more within a few minutes.)
2. List the advantages and disadvantages of each method.
3. Draw up a wish list for an ideal device for joining sheets of paper.
4. Compare each product against the wish list to see how many tick all of the desirable feature boxes.

It is very unlikely that any of the commercially available products you thought of in task 1 meet all of your desirable features. Staples provide a secure solution, for example, but require an additional tool (stapler) to join the pages and also do not allow for easy reordering or removal of pages. Paper clips are simple and cheap but the pages are not held as securely as you might desire. Treasury tags require a hole punch but do allow reordering or removal of the pages. Foldback clips are a reasonable solution but you need different sizes depending on how many pages you need to collate. The lesson here is that all of these products, and more, are available in most stationery stores and at some point represented an innovation in this sector. None of them meets all of the desirable features which you might include in a PDS if you were starting with the objective of designing an all-singing, all-dancing paper-joining device. This is why you need to be careful and discerning about what makes it into the PDS and more importantly, what makes sense to leave out.

10.4.1 *Preparing a PDS*

So how do you even start to write a PDS? What should be considered? What if you proceed deep into the product development process before realizing that you have made a major omission? Fortunately others have pondered these questions before you and have solutions. Companies working in a sector will have lists of what they know is important to their products and will use these as templates in their new product developments. Employees working in a company may have access to previous examples which they can modify for the next incremental improvement model in a range. However, if you are trying to produce a truly innovative product, there may not be anything for you to base your PDS on or indeed get access to.

In such instances you should look to the work of others, such as Stuart Pugh (Pugh, 1991) who has produced a comprehensive 35-point checklist which is generic and can be applied to a huge range of sectors and disciplines. It includes fundamental performance indicators such as speed, weight and size, but also items related to logistics and operation such as storage conditions and service requirements. The important thing is to have some form of template to work from and apply it methodically and rigorously.

TRY THIS

Look through a checklist such as Pugh's and identify which items are relevant to your product. A few hours spent in deep discussion focused around the precise details of these key performance indicators can save a lot of time later on when you realize that the targets you set were inappropriate or ill considered.

Some of the values for items in your PDS will effectively be determined for you by definitions or requirements set out in various standards, for example the British Standards (BS), European Standards (EN) and International Organization for Standardization (ISO), for the type of product or sector you are designing for. You should have identified the relevant standards for your product earlier in the process and kept the relevant parameters in mind as you developed and evaluated your concepts. Now you should embed these into your PDS, which is now the controlling document for your innovation as you progress its development through the necessarily rigorous process towards full production.

Other items in the PDS will be entirely under your control and will have a big impact on the direction that your product development will take. Consider, for instance, the implications of decisions related to production volume and profit margins. A high-volume, low-margin objective will end up impacting many other decisions such as material selection and dimensional tolerances in a different way from a product aimed at the luxury market with a low-volume, high-margin business proposition.

Take care not to define targets that you cannot achieve, or cannot achieve at a reasonable cost.

Working to a checklist helps ensure that no important considerations are overlooked. Initially, you may not be sure of what is achievable in some of the categories so you should define a range of acceptable values as you can always refine them later.

10.5 Detailed Design

There is a key point in all product development projects when there needs to be a fundamental switch in the level of detail, precision, quality and finish that is applied to your design.

For an electrical circuit, this might be the change from a breadboard mock-up to the etching of a circuit board in copper. For the chassis of a child's pedal car this might be the point where you weld up the first tubular steel frame. Up to this point, the prototypes made have been unique creations, almost like works of art, which have served the purpose of allowing a full evaluation of the viability of the concept. It is now, however, time to design for mass production.

There is no hiding from the fact that at this point, you need to have a full understanding of exactly how your product will be mass produced. Unless you know the capabilities and limitations of all the viable processes that could produce your product in the form, finish and volume at the target cost, there is a strong possibility that you will make mistakes in your design. Mistakes that might only become obvious whenever you attempt to assemble production pieces. This is something which you absolutely do not want to happen. The delay and inevitable cost implications of changes to design detail close to the launch date for your product can dramatically change the profitability and chance of success for your product.

Many successful companies have learnt that eliminating manufacturing problems early on in the detailed design stage is the way to reduce time to market and cut expensive retooling changes close to launch.

Nokia had been the number one mobile phone manufacturer in terms of the number of units sold worldwide. They achieved this position by releasing a large number of new models suitable for specific markets each year. The achieved dominance was by being first to market with phones offering new features but which were also reliable and robust. To achieve this they needed to quickly develop ideas into viable products in a short timeframe, since a few months in this sector can see significant changes in offerings from the competition. They analysed their new product introduction process and identified a number of phones that had necessitated late changes in the injection mould tooling, which had proven to be both expensive and time consuming, adding 3 to 4 months to the schedule before production was ramped up to full capacity.

Nokia's solution in the late 1990s was to hire an experienced toolmaker called Victor Mumby to pass on his 36 years of tool design experience to their team of industrial designers who were responsible for the design of their phone casings for new models. These designers were put through an intensive training programme with tool design content and practical hands-on experience of actual tools.

This style of training was normally only given to tooling engineers and had not been part of the formal education of these industrial designers, which typically placed more emphasis on elements of design such as form, ergonomics and material finish. The designers were aware of the fundamental principles of the injection moulding process and were not making gross errors but they lacked the experience of the toolmaker who – over a career – can learn the subtle differences in tooling which can result in higher-quality mouldings and can hold tighter tolerances over long production runs.

The policy highlights that successful companies like Nokia recognize the benefit of utilizing the experience of experts. Students should be encouraged to be confident in their ability but also to be respectful of the detailed knowledge that a specialist in a field can gain through many years of practice. In tandem with this is the need to develop the intellectual trait of humility and to learn how to communicate with the likes of workshop technicians or production operatives, so that through a collaborative dialogue they might learn a little of the knowledge the experts have acquired over a longer period of time than they have to spend on their product development project.

What is also important to remember is that detailed design is exactly as it states, detailed, and requires rigour and careful attention. It may well be that it is not the phase of the project that most excites the participants. A lot of people find the ideation and innovative phases of coming up with concepts the most exciting and stimulating, and often enthusiasm and motivation can start to wane in the detailed design phase.

A useful analogy may be to think of the whole process as being like the Olympic athletic event decathlon, where the competitor needs to be able to perform each discipline very well in order to be the overall winner. It is the same with developing innovative products, if one of the phases is performed poorly the result will be an inferior product. If you start to get sloppy in the detailed design, it will hurt you significantly since decisions here dictate what capital equipment costs will be required to bring the product into full-scale production.

10.6 Don't Repeat the Mistakes of Others

As has been stated previously, time is not on the side of students undertaking projects to develop innovative products within the scope of their curriculum. What should be encouraged is to learn from the experience of others who have been through the process and been successful. However, the selection of suitable case studies needs to be approached with care. Often successful inventors and charismatic characters are held up as exemplars but these stories may not offer a template that you wish to follow. For example, the story of how James Dyson brought his bagless vacuum cleaner to market, as described in his autobiography *Against the Odds*, makes fascinating reading but the construction of 5127 prototypes over 15 years to get a solution which worked for all types of floor dirt is not a process that everyone would want to rush to follow.

Dyson's determination and persistence is unquestionable and his success has undoubtedly been in large part down to this aspect of his character. What should be of greater interest to a student should be how his company now operates and has delivered a range of very successful products to market since the original dual cyclone vacuum cleaner.

A case worthy of study is that of the R&D department at the German company Braun. In his keynote presentation to the FEI 2010 conference in Amsterdam, Peter Hilfinger gave an honest and detailed description of the development process behind the Braun/Oral B range of electric toothbrushes. Peter's role was as the manager of a development team responsible for taking a mediocre product and engineering fundamental changes which turned it into a world beater.

By Peter's own admission, the existing electric toothbrush produced by Oral B (the D3) offered no advantage over a competent user of a manual toothbrush and cost considerably more. His objective was to produce a product with novel benefits for the customer. In 1986, they carried out market research to assess the customer perception of the D3:

- The movement of the head simply copied the movement of manual brushing.
- It didn't feel any more pleasant than manual brushing.
- It didn't make it any easier to brush than with a "best practice" method.
- The recommended 3 minutes of brushing was boring – 90% of users brushed for less than 1 minute.

Improving on all of these became the design brief for the new toothbrush. A key design decision was to base the shape of the new head on the rubber cups used by dentists for polishing teeth. There was top management support, but the R&D team was given autonomy to determine the direction of the development work. Early prototypes of rotating heads proved difficult to control and resulted in a lot of bleeding gums. The team persisted, however, and next tried an oscillating head which was found to be easier to control, removed more plaque and left the user's teeth feeling polished. Production-quality prototypes were required to fully prove the best method and this meant high-precision prototype components.

Another problem which became apparent through extensive testing was the rapid wear of the POM polymer bevel gears, which translate through 90 degrees the motion of the electric motor. Unfortunately for the team, this only became apparent with the testing of components during pre-production when the injection mould tooling had already been purchased. The oversight had been not to include toothpaste in the earlier testing phase and during more realistic in-service testing, the abrasive in the paste was found to cause the plastic gears to quickly wear to such an extent that performance was impacted. Such admission of failure during development is remarkably honest and somewhat rare from a major company. This honesty does, however, provide a valuable learning experience for someone less experienced in new product development, such as a student.

Failure during the testing of prototype components is always likely and may even be desirable if it helps build a deeper understanding of the problems and issues.

What is important as a design engineer is how you respond to this new understanding of the problems you face and your ability to create a solution. The solution the Braun team found was to use metal injection moulding (MIM), which is how these components are still produced. This was not arrived at immediately, however, and the engineers first examined all the potential alternatives to plastic injection moulding that they were aware of. In the end they had to develop a special process, which they did in collaboration with the company Schunk – one of the most experienced companies in terms of metal sintering and ceramics in Germany.

The example of the Braun electric toothbrush highlights that even with the best planning and with accurate functional prototypes, there are times when your best efforts are thrown off course by something unexpected or overlooked!

You can simulate and prototype to good effect and eliminate many potential errors, but no simulation is quite the same as the real thing. You should look upon the detailed design and development phase as being the outworking of your best understanding of a viable solution to a problem or need. Remember, however, that with innovative breakthrough products there is every possibility that you will be pushing the envelope in the area you are targeting and it is impossible to predict or simulate what you don't yet fully understand.

Your full product development should reduce the risk of failure if it is carried out with rigour and precision.

Other successful companies are also aware of the benefit of identifying product failure, but prefer to avoid it happening rather than learn the hard lesson of needing to effect a successful solution late in the development process. The established methodology of failure mode and effects analysis (FMEA) is a structured approach to identifying the component or step in a product or system which is most likely to fail in service.

From there, the focus shifts towards refinement of the design to reduce the chances of this happening. Companies such as Logitech make the use of FMEA a key part of their iterative design, prototyping and testing loop, resulting in computer peripherals with improved durability and reliability, and in the longer term, a stronger brand and a more successful business.

10.7 Mass Production Considerations

At the heart of the detailed design is a detailed knowledge of the manufacturing processes used for mass production.

Volume or series production is very different from making a one-off prototype for proof of concept purposes. The spectrum of materials and manufacturing processes is incredibly wide if we are considering all products in all sectors; this may be more of an issue for different disciplines of engineering. For example, a mechanical engineer might need to have a broader understanding of materials than a structural engineer to be able to design products that move or have moving parts and involve a broader range of materials and processes. There are certainly more materials and more processes than there is time to fit into an undergraduate curriculum. What therefore becomes the core requirement is to be able to identify a list of potential materials and the processes which can be used to create the desired forms with these materials in a mass-production environment.

So many materials and processes, so little time! What is required is a method or tool to filter and sort the myriad possibilities efficiently so that comparisons can be made based on objective facts and figures. One such tool is the Cambridge Engineering Selector (CES) software, which has extensive materials and processing databases that can be sorted, filtered and displayed in graphical format with respect to a long list of physical and other properties. Additionally, it has functionality which enables comparisons of manufacturing processes against production volumes, indicating when it makes commercial sense to switch from one method to another.

For example, sand casting might be more cost effective for low volumes of aluminium components but the higher tooling costs of pressure die casting will be offset by the lower piece part costs at some specific volume. Very low-volume metal components might more efficiently be made by CNC machining but there will also be a volume where a process like sand casting becomes more cost efficient.

10.8 Automated Assembly

Another consideration that comes into play with volume production is whether the product will be assembled by hand or by automated assembly machinery.

This is likely not to have been of primary concern earlier in the concept prototyping stage where the focus was on getting the thing to work, but it certainly should be a consideration now. New products, particularly if being produced by a startup company or under licence by a third party, will most likely be assembled by hand. The reason for this is that there will be increased risk if a lot of capital equipment is bought for automated assembly before the product is proven to be a success in the market.

The corollary is that it is much harder to prove the market success of a product without getting a lot of them out in the market for customers to buy. There are many examples of products launched with huge investment in capital, expectations of huge sales and huge capital investments in production equipment already in place only for the product to flop.

In the area of personal transportation, the Sinclair C5 in the 1980s and the Segway more recently would be examples where technically sound equipment failed to win public confidence and ultimately fell well short of the paradigm shift in human behaviour anticipated by their inventors. The cost of production-line equipment, the associated infrastructure to supply components and distribute goods as well as the employment and training of staff to operate such complex systems can easily run into millions or tens of millions of pounds.

Committing to a high level of investment and then ending up with a product that does not sell really is not an option. The introduction to market of any new product therefore requires careful planning, and that may well include a pragmatic and staged ramp-up of production volumes based on the growing success of the product in the market. What you do not want to do, however, is have to redesign your components for automated assembly just as demand for sales increases quickly, otherwise you might not be able to respond to this demand in time and the eager customers may simply look elsewhere.

A better approach is to design components for automated assembly from the outset. These should be easier to assemble by hand anyhow, since the principles of design for automated assembly seek to simplify and foolproof such things as orientation and alignment so that a machine with less intelligence and sensory capability than a human can perform the task.

Of course, this perception of the dumb robot is rapidly being challenged as the processing speed of computers follows Moore's law and rapidly speeds past the processing power of the human brain, which has been more or less a flat line on a graph over the period of recorded history.

Robots and other assembly machines in many ways already outperform human operators. They can work longer shifts, even as much as 24 hours a day, 7 days a week in cold and unlit factories. Parallel kinematic robots are incredibly quick at 'pick-and-place' assembly tasks, populating the likes of electronic circuit boards, and easily outperform humans. In tasks such as spray-painting car bodies in particle-filled environments that humans would find intolerable and a health risk, the machines do not falter and production continues relentlessly.

As more and more assembly tasks are performed by machines, the cost of the machines, will naturally come down due to market forces and as the performance of the machines continues to race ahead of the flat line of human performance, the likelihood is that more and more future products will be assembled automatically.

There is therefore an imperative to educate all designers in the guidelines for automated assembly as this will increasingly become the mode of product assembly in the future.

The principles of design for manufacture and assembly (DFMA) were pioneered by Geoffrey Boothroyd and Peter Dewhurst in the late 1970s at the University of Massachusetts with a grant from the National Science Foundation (Boothroyd *et al.*, 2002). Their methodology and database, which helps manufacturers save money and make better products, is now widely adopted by leading companies around the globe. It allows engineers to analyse product designs while they are still sketches or computer models and before anything gets built in volume.

By predicting assembly time and labour costs, DFMA challenges designers to simplify the product structure. Designers can then determine assembly and manufacturing costs in advance. It works particularly well later on in the design process, when a fuller description of the product assembly detail exists. The basic principle of reducing parts by identifying a theoretical minimum part count based on three key criteria facilitates systematic analysis of a product most likely designed with function, rather than assembly, in mind. A further level of analysis then involves consideration of what components are left with respect to suitability for automated assembly.

Guidelines exist for standard features that should be avoided – which, for example, would be more likely to cause entanglement in an automated vibratory bowl-feeder mechanism. Component symmetry, rotation and orientation are examined to facilitate more flexibility and therefore shorter assembly times whether done by hand or machine. The application of the methodology is necessarily precise and rigorous but needs to be so in order to achieve even small gains in efficiency during assembly. These small savings per component then become large savings when production volumes are in the thousands or millions of units.

10.9 Testing

Throughout the full product-development process, testing should continue and should aim to be as realistic as possible.

The example quoted earlier of Braun not including toothpaste in their initial durability testing came back to bite them hard later on when the stakes were higher and the cost of change and delay was amplified. You should therefore aim to always make your testing as authentic as possible, within the constraints of your time and budget. Accelerated lifecycle testing is particularly important and should continue right through to when off-tool or production parts are available.

If your competitors are offering a five-year guarantee on all parts and components of their product, you will probably need to match this offer if you wish to be competitive in the market. If, however, your product is not sufficiently robust to meet this level of endurance then you face major problems. Products being returned to base under warranty for repair will place a significant burden on resources, and the product developer's nightmare scenario of product recall may well be enough to sink you or your company. The type of testing will vary considerably depending on the type of product, and how much and for how long may well come down to a financial decision measured against the risk of failure and recall.

A number of media sources estimated that in 2010, Toyota's recall of millions of vehicles due to a faulty accelerator pedal component cost the company approximately US\$2 billion.

10.10 Final Product Definition

The outcome of all this detailed design, analysis, simulation, application of rules and guidelines and in-service and accelerated lifecycle testing will be that your understanding of the problem that you are trying to fix and your realization of the solution in the form of your new product will have been enhanced significantly. As this knowledge grows, you should update your PDS incrementally and, at some point, you will decide to lock down the design. Any further changes will be for version 2.0 but for now you have to decide on a final product definition and this is what you go to market with. You may consider your new product to be like a work of art and feel that it can be improved even further by continuing to refine and revise it even further. You do, however, necessarily need at some point to 'push the button' and go to market accepting that it may not be perfect, but that it is as good as it can be given the available time and resources.

Full product development is the phase in the birth of a new product where it all gets very real. Everything needs to be done to a professional level, because customer demands are not likely to be met by something that looks like a student project. Rigour and precision are the key words to remember. These are not the most inspiring and exciting watchwords for a team of individuals who some months back had a spark of imagination and a burst of enthusiasm. If they wish to be successful, however, they need to be able to switch their mode of working

several times during the process. Now is the time to put on the seriously hardworking hat, because irrespective of what has gone before if this phase is not executed correctly, then the product will be unlikely to succeed.

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Case Study: Buteos

Judy Black

PURPOSE

This chapter outlines the experiences of a group of electrical and electronic engineering students in creating a product and a company to produce and sell it. The perspective is given by the team's CEO, Judy Black, who describes how the ideas were developed and the final product created. The chapter covers the challenges of creating the product, forming the company, generating the business plan and preparing to convince investors.

TOPICS

- Student experience of the industrial project exercise
- Insights into how the team developed the initial ideas
- Experiences of interactions with mentors and other team members
- The realities of creating a brand identity
- The process of developing the product and future versions of it

The chapter is organized as follows:

- The basis on which the **team** was formed is given in Section 11.1.
- In Section 11.2, the **idea generation** or 'conception' is covered.
- The basis on which the team developed or '**gave birth to**' and '**baptized**' the idea is outlined in Sections 11.3 and 11.4.
- Key aspects of developing the **business plan** are outlined in Section 11.5.
- The interaction with the **course mentors** is discussed briefly in Section 11.6.

- Section 11.7 relates the **experiences** of giving the presentation.
- Some final insights are then given in Section 11.8.

Lord Alan Sugar sank himself infamously amongst the engineering community in the UK back in July 2011, when he boldly stated that ‘Engineers don’t make good business people’. The experience of the course that this book describes, dispels that misconception and strongly suggests that engineers are entrepreneurially minded and capable of working as part of a business to solve everyday problems and generate hype with the solution. This is the story of Buteos.

11.1 Marriage

The Buteos company was created in 2011 by five undergraduate Master’s students specializing in Electrical, Electronic and Software Engineering at Queen’s University Belfast. The team formed the company as a result of their participation in the Industrial Project module which challenged the students to create and manufacture a product and then create a business around it.

The company members comprised Judy Black (me), James Coalter, Declan McAuley, Jason Cardwell and Peter Johnston. The team had originally met in 2007 through studying at the university. I had taken a year’s placement in 2009/10, while the four guys all took their placements in 2010/11. September 2011 would see us all return to the same class for ‘final year’ of university and involvement in the Industrial Project.

Knowing from previous years the hardworking ethos of each of the guys, I contacted the individual members in the summer of 2011 to ask if they would consider joining the team. To my delight, they all agreed and I felt that I was ‘on to a real winner’ with this group. We felt that the early creation of the team, with members who were all dependable with varying degrees of expertise, was a critical aspect of the performance that we achieved through the exercise.

Buteos formed (in the eyes of the university) in October 2011. Like all marriages, everyone enters with the best intentions in the world but of course, they have their ups and downs! However, we quickly realized that our shared interests would complement the company’s objectives very well.

At our first few meetings we battled out who would do what within the team. We set out the roles of the company and tried to fit our individual experiences, strengths, access to resources and importantly, personalities to each of the roles. It was crucial for the team to have the right person in the appropriate role to maximize the benefit to the company.

11.1.1 Team Roles

'If you think you can do a thing or you think you can't, you're probably right'.

Henry Ford

I performed the role of the CEO, leading the group and ensuring the team's objectives met the appropriate timelines. Being the only girl in the group, I'm sure this was difficult for the guys but my attitude to the role would be the determining factor. I did not want to be the 'Hitler of the Industrial Project'; this team would be a democracy! This made the role of the CEO a lot easier since it meant that everyone had a fair share of the decisions made and hopefully no one felt left out. The most important role of the CEO in our group was chairing meetings and taking minutes. Then, of course, at the end of the experience the CEO compiled the 'quick-pitch' presentation (see Chapter 3) and the business report (see Chapter 4).

James, the software expert (even by Google's standards!), was tasked with the role of CTO due to his keen eye for all things practical including software development and CAD. Having served a year at Schrader Electronics (the TPMS global leader), he had valuable resources at his disposal. It made sense for James to lead the technical side of the project. The group agreed that James would write the technical feasibility report (outlined in Chapter 9) on his own – which with hindsight was a big undertaking for one person.

Declan, proficient with figures, landed the job of CFO, with the help of Peter, the COO. Declan has always prided himself on being a thorough person, exactly what is required when working with finances. His family also had a background in chartered accountancy and they kindly offered advice on our financial projections. The tasks of the CFO should not be taken lightly, which is why we had two people on the job. I am probably oversimplifying this by a 'long mile', however, Declan made the balance sheets stack up, while Peter dealt with all things corporate like staff numbers and sales figures.

Last, but certainly not least, Jason, practised in international marketing, fitted the CMO role nicely. Jason had completed an IAESTE (International Association for the Exchange of Students for Technical Experience) placement in China, where he performed a similar role developing his marketing skills. He was the obvious candidate for the job. However, the nature of our target markets would require quite a bit of work in market research, so aside from my CEO duties, I helped Jason out. Jason quantified our European market, while I broke this down into the key market segments, which sounds a lot more straightforward than it actually was!

A secondary role for the CEO is not unheard of in this project since the CEO role really only develops near the end of the project in writing the business plan. Moreover, the above description highlights the importance of choosing the team members with suitable experience, and this was essential in being able to progress well in the exercise.

11.2 Conception

Without giving the team members a chance to settle in to their roles, the first task on the agenda was mind-mapping a plethora of different products or service ideas. Several didn't 'make the cut' based on other similar products on the market and the practicalities of actually designing and building the prototypes.

Ambitious thoughts were welcomed in the first stages but the team quickly realized that some ideas were unrealistic. For example, one of our ideas was a new piece of gym equipment never before seen on the European or American markets. The concept was bold, but cracking the standards, tearing down the 'red tape' and jumping the safety hurdles would be virtually impossible. Other ideas we came up with had already been dominated by market leaders who, with their trusted brands, would be tough competition for our SME.

A team the previous year had come up with a genius idea of making dirty water clean using ultraviolet light. A water bottle would have two compartments, you would fill one chamber with dirty water, rotate a lever and the light would clean the water as the device pumped the water into the other chamber. This concept would revolutionize the 'third world'. Unfortunately for the group, the idea was so brilliant it had already been given a Dyson award one month earlier! Not letting this deflate them, they moved quickly on.

Like many other groups before us, all of these issues were important to recognize at an early stage and since time was ticking, we all had to move on to the next bright idea, no matter whose pride was hurt along the way. At the time, everyone wanted their idea to be the one that was picked. However, looking back on it, the team were very mature in deciding what was best for the group and which idea would ultimately get us the highest marks in the project.

This is probably the most critical stage of the course. The teams coming after us should not underestimate the amount of thought and indeed angst that this stage of the process creates. In the mentor's opinion, we attempted to be impersonal in the selection of the ideas, which meant that we ensured the best idea and not an individual's personal favourite was selected.

11.3 Giving Birth

I'm told the best ideas are always the simplest ones, and that can be said for our winning product.

While there are many proximity sensors for vehicles on the market, and the odd camera mounted at various difficult angles on bumpers, none of these offered a simple, quick, guaranteed trailer hitch first time and every time. Our solution would be a simple concept, within our ability to prototype and test.

James came to the group with a problem he had first-hand experience of. He and his family had spent many frustrating years reversing passenger vehicles up to trailers with little success. Hitching often resulted in dented bumpers, fiery tempers and the odd back injury from the user giving up reversing and instead resorting to pulling the heavy trailer closer to the car. We all agreed that there was a need for a device on the market that would allow this process to ‘go off without a hitch’, without damaging the vehicle or injuring the user.

It must be said though, not owning a trailer myself and never having experienced this problem before, I was impartial to the product at the start. If I am honest, I was dubious that it would work, but I knew we could capture an audience with this product, so I went along with it. The more I drove around Belfast, the more I started to notice cars with tow bars and the characteristic dents in the bumper that were part of owning a trailer. Before long, my concerns were silenced – especially when I had seen the concept sketches. My concerns were totally dispersed when I saw the product in action.

By simply optimizing the viewing angle of the camera by means of mounting it on the tow bar itself and translating the image via WiFi to a smartphone, the Oculus was born.

Early on, technical research unveiled valuable information regarding the international standards for different countries. A different ISO standard for tow bars made in the USA meant that tow bars in the USA are a different size from those in Europe. It made financial and geographical sense to target the European market first, and as we expand in the future we might want to move in to other markets.

While designing the product, what it would look like and what it would do, we started drafting the business plan along our journey. The business plan would need to form consistent story telling that would captivate the investors and convince them that they needed our product.

Interrogation of the market began in order to determine if there was a European market for our products, and if we could capture it. We looked at quantifying the market by researching the number of vehicles in Europe and also the proportion of vehicles with tow bars fitted. We weren’t convinced that the data around the number of vehicles with tow bars fitted was from a reputable source, so we decided to carry out our own investigation.

All five of us, armed with clipboards, took to the streets and car parks of Northern Ireland and, like goons, surveyed the number of vehicles with tow bars. Luckily for us, the data from this survey lined up with the data we already had.

Realizing that those who use a tow bar could potentially benefit from using our product meant that our key market segments were touring caravanners, horse owners, farmers and small boat and jet-ski owners. Our aim was to prove to our investors that capturing 10% of this defined market would be bold but still conservative, given the economic storm facing SMEs in this country at present.

Other things such as the age demographic and social class of our customers were all carefully assessed. No stone was left unturned!

In 2011, we had a hard job to convince our investor that our customers would have access to a smartphone or tablet to operate the phone application (app) that converses with Oculus, otherwise our product was defunct. We had to convince them that the smartphone market was one of the fastest growing markets on the planet; really, we should not have panicked. The technology market changes shockingly fast. Just 20 months on, my two-year-old nephew has his own iPad and my 91-year-old granny can 'Facetime' chat.

11.4 The Baptism

Brand definition was crucial to what our company stood for and what ultimately an investor would buy in to.

We wanted our company name to signify strength and virility, so that our customers could be confident that our products would be durable and would last. In reality, the rest of the team did not really mind what the company was called; they nodded and smiled when I presented a list of potential names and reasons why I had chosen them. We all took a vote and ended up with 'Buteos'. Buteos stems from the word 'buteo', which is a bird of prey much like an eagle only with a longer wing span and a shorter tail. The harsh-sounding consonants would reflect our sturdy products appropriately.

Note that the company name has nothing to do with our products; this was a conscious decision that would allow our product portfolio to expand beyond our current ideas.

Every company needs a logo and it was important for us that the logo reflected the company statement, obviously it needed a bird of prey in it. See Fig. 11.1.

This tale highlights a possible issue for engineering students in that they may not consider branding to be important but, as Gillian Colhoun has indicated in Chapter 5, the teams 'must consider branding in order to make a successful product'.

The first of our products, the Oculus, got its name from the Latin word meaning 'eye', fitting for the all-seeing view that it provides when hitching a trailer. At the time, no other



Figure 11.1 Buteos logo

company had coined this word as a product, but over the last few months the ‘Oculus Rift’, a virtual-reality gaming headset, has just come on to the market. We should have trademarked the name!

11.5 Growth

You will notice referral in this text to ‘products’ (plural). We decided to write our business plan to reflect product changes with the different stages in company growth.

Oculus Mark 1 would require very little R&D above what had already been achieved through this project; the device was at the prototype stage and we had proved its feasibility. At the end of the project it was close to being ‘market ready’.

The Mark 2 version would be a cost-cutting exercise for the company. The idea was to reduce the material costs by bringing some programmers in-house to write the WiFi protocols for the WiFi module when the company and thus expertise expanded. This removed the requirement for an expensive WiFi chip that had been pre-programmed with the protocols, thus cutting costs. Oculus Mark 2 would have no obvious differences to the end user but would save Buteos 17% in costs compared to the Mark 1 version.

Realizing that when tow-bar manufacturers and fitters saw our retrofit device they would want to improve its functionality by integrating the camera within the tow-ball itself, we decided to ensure that we protected this idea until we were financially sound enough to develop it. Therefore, the Mark 3 device would be a totally integrated solution, protected by IP from day one of startup. Our IP strategy formed the back-bone of our business plan.

‘In order to succeed, your desire for success should be greater than your fear of failure’.

Bill Crosby

The key of the business plan was to be ambitious without being ridiculous. We realized that if each individual put in the necessary time and effort then everyone would get a well-deserved mark at the end of the exercise.

This is your chance to create a colourful expression of the investment opportunity on offer. Some things you might want to consider are:

- Believe the company will work.
- Get the executive summary word perfect.
- Write your business plan with an investor as your audience.
- Make sure there are no holes in your arguments.
- Give evidence of market research.
- Prototype and test your product.
- Create a colourful read to engage the investor.
- Over-emphasize without over-exaggerating.
- Make sure that the document ‘flows’ well as there will be at least five individuals each writing separate sections.
- Avoid using clichés and colloquialisms.

Interaction with the course mentors throughout the process proved crucial for Buteos.

11.6 Questioning your Motives

The mentors would question almost every decision we made as a team from the fundamental, ‘Why should I buy an Oculus?’ to the more thought-provoking, ‘How many people in your key market segments actually have a smartphone to use with your product?’ Some weeks it was very frustrating doing the work that was pointed out as lacking one week, then the next week being asked why you did it that way.

Ultimately, looking back, the mentors were trying to make us take ownership of the project, while guiding us down the right path towards what we didn’t know at the time was our destination.

Weekly, and in some cases bi-weekly, meetings with the mentors were valuable in structuring our research and keeping momentum going. Before we met with the mentors, we would meet as a team to gather the group and ensure each person knew what the aims of the mentor meeting were.

Minute taking was essential and actions were agreed against individuals with deadlines attached.

The time set aside in this course for interaction with the various business leaders in areas like IP law, finance and operations proved very useful to Buteos.

To get the most out of the time with the financial contact, Declan and Peter decided to prepare financial forecasts, sales predictions and corporate development plans ahead of the meetings.

Advice on the feasibility of our projections provided a chance to adjust our figures accordingly to suit our company requirements. For example, some of the mentors reckoned that our proposed captured market wasn't ambitious enough, so we increased it from 9% to 10%.

We also made use of the Queen's SEU, gaining access to a vast amount of information on business acumen. The staff at the Student's Union also offered to critique our pitch presentation, which provided us with that boost of confidence before the real thing. They even prepared questions for us, on which they grilled us at the end of the presentation.

The facility that we made most use of, however, was the time with an IP lawyer due to our unique IP strategy, which formed the basis of our corporate objectives.

Even after the project had finished and our degree grades were 'in the bag', Rosi Armstrong (the author of Chapter 7) advised on how we could write and file our own patents in order to protect ourselves when we entered the marketplace. Not having proper IP in place was something we would live to regret when we reached the final of an externally funded competition, the Enterprise Ireland 'Think Outside the Box' awards in Dublin.

Note that each of the contacts provided by the course was protected by a non-disclosure agreement, which allowed us to be open and honest about our product details and meant that we were able to get sound advice tailored to our needs.

11.7 Flying the Nest

Buteos's aims for the pitch presentation were simple: excite and impress. Dressing smartly and behaving professionally gave the impression that we were serious about our company getting investment. We arrived 20 minutes before our allocated time slot to prepare the room with our live demo.

The pitch was simple and snappy, nothing fancy. We had practiced at every opportunity we had and eventually we got it 'word perfect' (with the help of 'Presenter View' on Microsoft PowerPoint).

We delivered a pitch with a comedic video of the problem and a commentated video of the solution. Colourful slides with minimal writing ensured that the audience listened to us and didn't focus on reading the words on the screen.

Three out of five of our team members presented, while the other two members facilitated the live demo. All five individuals were available and joined in the group discussion at the end. We had prepared answers for several questions at the end of the pitch and had some additional slides which we thought we might have been asked about. Rather surprising to us, the first comment was, 'I could use one of those'. Success!

After making an impression at the pitch we were advised to enter the Northern Ireland Science Park's '£25k competition' and the Enterprise Ireland 'Think Outside the Box Awards'. After what seemed like a rigorous selection process, we were privileged to be placed in the top 10 of both competitions.

The Enterprise Ireland awards were disappointing for Buteos but we still came away with a merit award, a crystal trophy and €1500 prize money. As I mentioned, we didn't have the appropriate IP in place before entering the competition, which left us open to some harsh criticism.

The involvement with the NISP £25k award was a huge honour and the mentorship we received was invaluable. We received extraordinary advice on how to capture a European market, not just going to the countries with the largest amount of cars, particularly since one of those countries was Greece which was in the middle of one of the worst recessions in history!

11.8 The Big Bad World

Upon graduation, all five members of Buteos landed full-time jobs in the industry. In the current economic climate each of us made the sensible decision to accept our job offer. However, that doesn't mean this is the end of Buteos!

We might not have the time to set up the company as we projected, however our mentors at the NISP have advised that we change our business plan to focus on selling our IP for the Oculus range. With investment available from every avenue, this seems the shrewdest evolution for Buteos. To be continued ...

Student Project to Commercial Project: A Complex Journey

Kyle Crawford and Stephen Dowling

PURPOSE

The case study describes some of the problems and delays that can be encountered when students attempt to take the next step and turn the results of a student project into a real, commercial product. It reflects the multitude of areas in which potential entrepreneurs need to become proficient if they are to be successful and discusses the lessons learned along the way.

TOPICS

- Student experience of the Industrial Project exercise
- Insights into how to develop an initial prototype
- Transition to viable mass-production-ready design
- Challenges in dealing with big organizations
- Real experiences of branding and finances

This chapter is organized as follows:

- The **evolution** of a **new product** for pouring beer is given in Section 12.2.
- In Sections 12.4–12.5, the process of turning it into a **viable product** is addressed.

- The dilemma for students **commercializing products** is addressed in Section 12.6.
- The challenges of dealing with **perspective customers** and **licensees** is addressed in Section 12.7.
- **Optimizing the product** was undertaken and is described in Section 12.8.
- Branding and finances are covered in Sections 12.10 and 12.13.

Style PD LLP (Limited Liability Partnership) was formed by two Product Design and Development degree students, Kyle Crawford and Stephen Dowling. It was the inevitable result of an undergraduate project that turned out to be ‘what this degree course was all about’.

12.1 Introduction

It was a final Engineering Innovative Products: A Practical Experience year project which aimed to produce innovative products that ‘had legs’, or in other words, commercial viability. Our inspiration was a response to the challenge set as part of the degree. By developing a new innovative means of pouring stout beers at lower dispensing pressures, we developed new products suitable for both the domestic and commercial markets.

The product involves some technology which is the subject of ongoing IP applications and, therefore, is not described in detail. The nature of the product means that it may be sold or licensed to a number of third parties and, due to commercial sensitivities, the names of these companies have been omitted from the text.

12.2 Evolution of the Product

In 2009, enrollment on a third-year course in our Product Design and Development degree programme gave us the opportunity to conduct project work similar to that of professional product designers; it prepared us for the professional environment where a task is defined, analysed, realized, presented and reported.

As part of a group of four, we set about identifying the customer need for a product; we short-listed a range of acceptable areas that we felt suitable for progression. The project supervisor helped us to select a final task. It had to be viable within the timescale, resources provided, degree of difficulty and predefined learning outcomes of the module.

The team began brainstorming and we came up with ideas such as edible bun cases, golf-ball trackers and automated petrol pumps, but these were all disregarded in favour of an idea that sprang from observation during part-time bar work.

We realized that unless barmen (often under pressure) took a keen interest in their job, the quality of the pint of beer or stout poured and the amount of beverage wasted could easily differ from the standard expected by the brewer, and that of the customer. We identified

an opportunity for a product that directly improved delivery cost and service quality. Extensive market research and interviews with local and major brewers more fully defined the problem.

12.2.1 *Serving Beer*

Taking notes, making sketches and archived details allowed us to develop a project file which continually grew because of technical changes, product testing and experience gained through pitching the technology to potential investors.

Through market research, another gap became apparent. This was the quality of a pint of stout available in the offline market, otherwise known as the home market. Attention focused on the widget technology for surging canned stout beer, which was nearly 15 years old and whose novelty was beginning to fade. The substandard quality, particularly the flavour, was noticed by many discerning customers.

Around this time, large brewers were introducing mini-kegs to the market which were proving successful. We allowed our project definition to evolve into a combination of pouring the perfect pint at home and utilizing the market potential of a new 5-litre mini-keg for stouts and the wider range of all other nitrogenated, smooth beers.

From the beginning, the group's customer research, technical inquiries and financial investigations caught the interest of the major Irish stout brewers. The storing and dispensing of stout beverages was as valuable an area of interest as the flavour or showmanship and theatre that is the delivery of the perfect pint. All this buzz came to the students' aid after pitching to a large company, resulting in an introduction to the company's Innovation Department. As the project developed, a design was evolved that gave the group reason to believe that they had a different means, within the safety restrictions of the offline market, of pouring to brewers' standards the perfect pint of stout beer.

12.3 Product Development Insights

By 12 weeks into the project, the conceptualized solution proceeded towards a rough prototype and by the close, a fully functioning apparatus provided practical proof-of-concept ready-to-pour beer at a presentation given to the faculty judging panel. Pictures of this prototype are shown in Figs 12.1 and 12.2. The success of the project could be measured immediately and spontaneously from the reaction of the panel and audience when a pint was physically poured in front of them. Interest and excitement increased further when they discovered their sense of ownership by pouring the beverage themselves.

A co-requisite module undertaken in the degree programme focused on developing a business plan and a financial forecast for the product. The business plan steered the development of the idea from the beginning and governed the profitability of the design. We gradually found that the business plan would have to be a continuously evolving document that matched the



Figure 12.1 Early cardboard prototype



Figure 12.2 Functioning concept prototype under construction

reality of the situation. It was affected by customer modifications, availability of funding and an increase in the students' experience.

The business plan provided a framework for the whole project and was crucial to ensure its short-term viability. It was utilized as a reference guide throughout the university module with regards to time and resource management.

A clear set of objectives and limitations meant that the boundaries of the project were defined and each team member was confident with the path the project followed, helping maintain motivation and ultimately a higher attainment. When the module finished in June 2010, the training and experience gained confirmed the necessity of a well-planned project.

The working prototype confirmed that the technology could be applied to both the domestic and commercial markets. In the home market, the group's technology as used within a compact beer dispenser containing a miniature keg would mean that for the first time, the fun of pouring the perfect pint of stout could be made available to the home user. In the pub and hotel market, it could be integrated into the traditional delivery system and in removing the high-pressure gas supplies needed to pour stout beers, offered a clear advantage by simplifying the delivery system.

Yet another application was confirmed in the bar market. The technology could be implemented into a Kegerator system. This is a small bar system, used with half-size kegs and similar to home use but extended to outdoor events such as fairs and festivals where transportation and ease of setup are important.

12.4 Going Beyond the Requirements of a University Project Module

During the summer months of 2010, between stages 3 and 4 of our degree, we decided to progress with the product opportunity available and to ascertain if there was anything which was patentable. To do so we contacted many companies involved with offering support to young first-time entrepreneurs and inventors. This led to frequent talks and inquiries, which resulted in a meeting with the Head of the Technical Advisory Unit, Invest Northern Ireland.

12.4.1 *Securing Protection*

The Business Innovation Link (BIL) programme, which is managed by Invest NI, was recommended to use for help on product proposal, lack of financing and the possible project directions. Our ability to network had been developed as part of the university experience, whereas the gradual building of confidence to analyse and present projects and ideas was developed as part of the degree.

BIL provided a service to encourage and support individuals through the processes of patenting and licensing, including access to patent searches needed in order to establish whether an idea could be patentable. For the first time, we felt that we were no longer under the control of the university and would therefore have to rely on our own knowledge and abilities obtained from our engineering course. Work commenced immediately towards developing a

new business plan, complete with financial projections and a pitch to fit the needs required for the initial meeting with BIL.

Learning from the course content at QUB and with detailed knowledge of our subject area, we felt confident to formally present our idea and answer the challenging questions on the technical and commercial feasibility of our proposal.

Furthermore, we have belief in our product which – due to our practical knowledge and experience of the mode of operation – also convinced the BIL panel.

This led to a successful offer for a patent search from BIL. For the ultimate writing of the patent, we were also given advice and the opportunity to choose our own patent attorney. The results from the BIL-sponsored search, however, disappointingly revealed that the idea was not patentable as it did not clearly demonstrate an inventive step. How would we get around this setback? It was here that determination to overcome this ‘lack of an inventive step’ became our new motivation.

12.4.2 *Product Rethink*

The following months involved a complete rethink of the product. We dissected the product into various subdivisions and brainstormed these key areas of the design to obtain divergent thinking and promote creativity. Other work included scrutinizing existing patents, which provided rich sources of technical details of how similar products functioned. Finally, an alternative solution emerged and was presented to our patent lawyers, Murgitroyd & Company, for another patenting opinion.

Much to our delight, this time the idea was deemed to have an inventive step leading to eligibility for filing a UK provisional patent application.

Credit for help and advice should be awarded to Invest NI and in particular BIL. For inventors and potential entrepreneurs who are undergoing their first major product development, BIL’s smooth-running scheme proved an essential factor. So, by qualifying under this scheme, grants became available. In addition to obtaining a UK patent application, the cost of writing and insertion fees (the next step) was covered.

12.4.3 *Protecting Intellectual Property*

The introduction of a change to a design can have implications not immediately obvious when creating a patent. Because the technology of this new attempt was in its primitive form, it was extremely difficult to define the patent claims and mosaics. Therefore, the patent attorney suggested setting a list of claims describing the overall product idea while further development would focus on defining the technological data which could then be added to the

application. This information was necessary to ensure that the claims covered every aspect of future development.

Securing intellectual property protection on the technology was of crucial importance to the business. Through developing a detailed business plan and setting clear goals, the original objective was to pitch the new technology to local and major stout beer brewers and receive royalties for sales of the technology, whether in the online or offline market. This would mean presenting the technology to a number of drinks manufacturers and striving towards a relationship with them as either partners or clients.

12.5 Part-Time Student or Full-Time Innovator?

Inevitably, we found that spending time on the project was taking us away from our studies, which in turn would be detrimental to the final degree mark.

By this time, we had returned to university for the fourth and final year of our MEng course and after discussions with the Programme Director, we were granted temporary withdrawal from the university. Primarily this withdrawal was for a year, but the project continued into a second year and enabled us to work full-time on our new ideas and allowed us time to give our full commitment to what lay ahead.

Yet another prototype was necessary which would be suitable for pitching to companies to attract interest for future funding or possible technical collaboration. The aim was to create a mobile and attractive beer dispenser; an appliance capable of fitting into a domestic kitchen yet compact enough to contain the necessary technology for pouring a high-quality nitrogenated beer. In the meantime, enquiries were made for more immediate funding of these developments, which led to uncovering the Technical Development Incentive Scheme (TDI), again provided by Invest NI. TDI grants were only available to properly constituted businesses so, for plans to continue and to receive a grant, it was mandatory to establish a company or partnership and become an Invest NI client.

The setting up of the business was another steep learning curve, but one which was helped by the abundant information available online. The flexibility of a traditional partnership was the most obvious choice, added to which the protection of limited liability enabled the creation of Style PD LLP. While discovering which form of business structure best suited us, we were able to call on the services of a business adviser friend.

From now, existing basic manufacturing facilities were no longer adequate to produce the new prototype. A specialist prototyping company was outsourced to make the redesigned dispensing system.

A San Diego-based company, Leardon Solutions, was selected; there were many positive factors from choosing Leardon Solutions, but difficulties arose associated with prototype production. They had an extensive network of production facilities covering different aspects of

prototyping, including various manufacturing processes, fabrication of casing components, machining of small intricate parts and advice on the technical details of electronic design. They had experts on hand to advise a startup company generally on designing for manufacture and most importantly, their services were more cost effective than if Style PD undertook the prototyping.

The design brief for Leardon Solutions was as follows:

- Leardon Solutions would design and engineer a proof-of-concept prototype for a beer-dispensing system concept developed by Kyle Crawford and Stephen Dowling.
- The resulting prototype would be used to further develop and qualify the concept through real-world testing.
- The prototype would function properly and meet all the requirements.
- One fully functional, proof-of-concept prototype would be fabricated, integrated, tested and delivered.

A number of problems slowed the development progress:

- A long-distance relationship acted as a barrier as it was impossible to meet face to face and speed up the productivity of the prototype development. It was also difficult for us to apply pressure to meet the deadlines scheduled in the business plan via Skype and email.
- Hidden charges such as bank charges for international payments, prototype shipping charges and other elements associated with design development had not been considered and incurred unexpected costs for a young startup business that needed to closely monitor its finances.
- The appreciation of industry and real-world scenarios – such as setting up a contract with Leardon Solutions and establishing an NDA to protect Style PD LLP intellectual property – incurred a time and cost factor that acted to slow progress.

12.5.1 Covering the Legal Aspects

Leardon Solutions had a wealth of experience with startup companies and quickly provided their own NDA as a reference guide, but it quickly became apparent that formal legal advice was required.

To this end, the services of Forde Campbell LLC, a practice specializing in IP law, were secured. They gave us a thorough understanding of the character of the product and pointed out the future directions available, if the patent application was successful. The meetings set clearer objectives for the business and more importantly highlighted legal timeframes that needed to be met.

The Head of Contracts and Licensing at Queen's University Belfast provided vital time and support in advising us on the preparation of an NDA to enable the partnership with Leardon Solutions to be formed. This whole experience was a lesson and an encouragement to search within the body of the university for assistance and to take advantage of the connections made across the preceding academic years.

12.6 Dealing with Potential Customers and Licensees

Style PD began early to develop the relationship with the relevant innovation departments of major brewers; this involved finding the right person within the company and interesting that individual enough to get a meeting arranged.

Initially, the hardest part was to convince people to take enough time away from their schedule to meet, but when a meeting was secured, the functioning prototype and the accompanying talk were intriguing enough to arouse the brewers' curiosity.

Showing them they could have something they did not have before, drove them to inquire how the technology behind it operated.

It was found that the smaller local brewers were willing to sign Style PD's NDA but not globally operating major brewers who had their own legal department; one particular brewer insisted that they would only be willing to sign their own standardized two-way mutual confidentiality agreement, which was far from mutual as it favoured them.

At any level, whether as students on a university project or young people struggling to become entrepreneurs, be very cautious of free handouts!

A number of changes were necessary, as some clauses were too restricting. For example, the donation of free beer given by one corporation for us to do with as we pleased now seemed to be an attempt to acquire some kind of right over the students' ingenuity and inventiveness. It appeared that by trying to reclaim ownership of the beer, the corporation might acquire ownership of a potentially viable product that offered a solution to a particular problem.

Sensing a trap for the unwary, we deferred this matter until we met with our legal adviser. Style PD gave some consideration to offering a first option of the technology to a large global setup but only for a limited three-month period, to avoid this company restricting Style PD's growth by simply choosing to sit on the technology and prevent the company from entering the market.

A further setback that occurred with the same NDA was that the case was reallocated under another solicitor from the brewer's legal department, incurring a number of weeks' delay. This reinforced the need to start the process of establishing an NDA much earlier, before the technology was ready for presenting. In one major case, it took five months to get the NDA signed by both parties!

While work with Leardon Solutions continued, Style PD had set their own targets for further research and development. When engaging in the product design process, it is effective to split any project into smaller and more easily handled ones.

To illustrate this, the Wright brothers divided the problem of flight into three critical knowledge areas: lift, control and propulsion. Before building their aircraft, they conducted thousands of tests to learn every topic and generate solutions to each one. Then they chose and combined the most successful solutions to create the finished aircraft.

In a similar way, Style PD split their project into smaller subprojects. These subprojects were obtained by dismantling and analysing beer dispensing systems normally operating in any public bar. Questions were asked, such as: What pressures are involved? What gases are used? What distances are involved from storage to delivery point? What is the design and construction of the equipment? Ultimately, what factors are required in order to obtain a perfect pint of beer? Style PD decided to use axiomatic design methodology (Suh, 2001) and analyse the product architecture of the dispenser in order to focus on individual components.

12.6.1 Axiomatic Design

The aim of axiomatic design methodology is to satisfy two axioms.

- The first axiom requires a product's features to maintain functional independence in a design solution. To do this, we created a hierarchical diagram, known as a *functional top-down means model*, which highlighted the physical elements and the functions of the product to obtain a full breakdown and distinguish the independence of each part. We then used this model to evaluate the product components and avoid conflicting design solutions. Furthermore, it helped to reduce the complexity of the end product, and ensure that the design was as efficient as possible. Once completed, functional statements were composed for each sub-problem to help the company analyse and understand the interactions and relations between functions. In an ideal world, a designer aims to have complete functional independence of product features, which means if a feature needs to be modified or replaced they can do so without causing negative effects on the rest of the design. This was extremely hard for Style PD to master. A component such as the gas mixture used in the dispenser is described as coupled because the gas was used to maintain the beer composition and provide pressure to obtain the correct flow rate.
- The second axiom requires a designer to create simplicity. To certify that a final design will be in its simplest form, an effort is made to use standardized components and suitable manufacturing processes. The product architecture was analysed and a simplistic geometric layout obtained to aid manufacture and assembly. A major difficulty Style PD came across was the intricacy of the electronics in the device. It was clear that the company needed to standardize these in order to reduce costs.

12.6.2 Product Architecture

The product architecture (Fig. 12.3) was explored to enable correct assignment of the functional elements to the physical components of the product. Defining the product architecture early in the project allowed for effective allocation of resources, making detailed design

Style PD Product Architecture

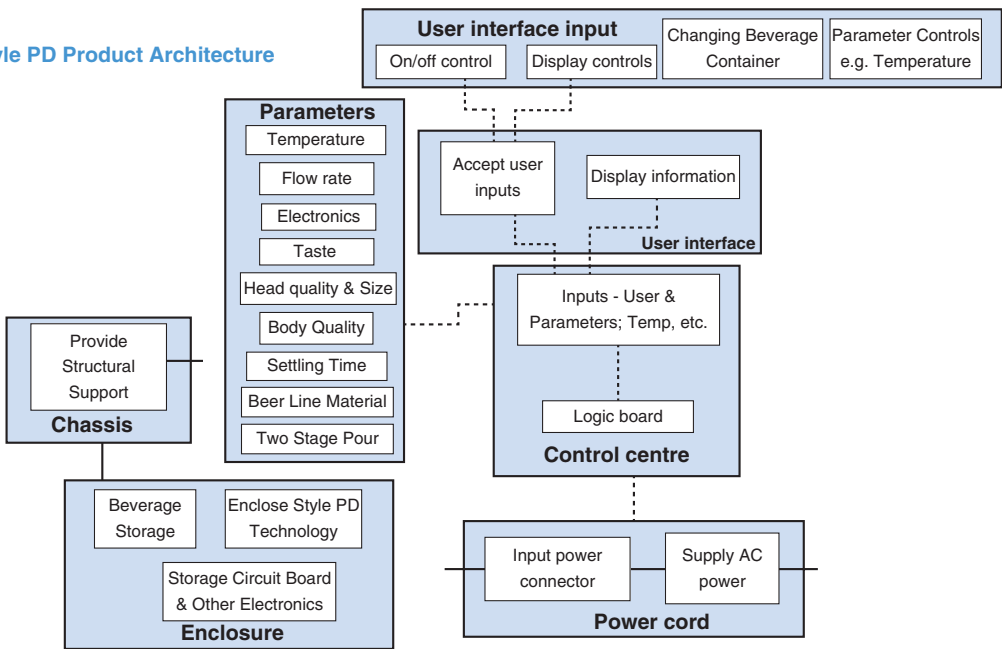


Figure 12.3 Product architecture

decisions and testing of physical components. This was done to be able to assign tasks so that various aspects of the product development could be carried out simultaneously.

The physical elements of a product were organized into several major physical building blocks, called chunks. The major chunks were beer line, refrigeration, casing, tapping method, pumping, drip tray, mini-keg and electronics. Under each of these major chunks the product architecture was further broken down to obtain functional independence of each chunk so that each one could be focused on separately.

Another benefit of exploring the product architecture was that it enabled the geometric layout of the final prototype to be structured to best suit the design specification. The geometric layout was defined using 3D CAD software and researching existing products. Other aspects accounted for when determining the geometric layout were the performance and manufacturability of the product. Components were analysed and the relationships between components distinguished.

As stated earlier, in an ideal world a designer strives for complete functional independence, however this is not always possible and it may be necessary to design a physical component to perform more than one function in order to reduce cost or improve design efficiency.

Areas where functional dependence occurred – such as the beer tap which performs more than one function, stopping flow and controlling speed of flow – were further analysed so that alternative solutions could become accessible. It was at this stage that the company realized it was possible to combine the enclosure and the support chassis of the dispenser, as defined by the architectural schematic. This is known as functional sharing as one part is performing two jobs, support and enclosure.

12.7 Optimization Through Testing

Style PD set up meetings with Valpar, a beer line manufacturing company based in Bangor, Northern Ireland. During these meetings, Style PD used the time to promote their product idea and learn as much as possible about current beer lines, materials and pressures involved in the system. Building upon their recent knowledge gained from Valpar, Style PD set about creating their own tests on many different materials of beer line.

While this testing continued there was also a need to keep costs to a minimum as Style PD was at this stage being funded through personal investment. They began networking through calling and emailing many beverage line manufacturers to obtain further information about what possibilities were available for the beer dispenser.

Companies would post lengths of their lines to Style PD so that tests could be performed to check suitability. It was found at this time that it was of great benefit to discuss the overview

of the project with the possible future suppliers of beer line. This helped towards building interest and enabling larger samples to be obtained for testing than the suppliers would normally provide.

Some line materials included polyvinylchloride, silicone and polyethylene. It was discovered that the rigid materials were more efficient when combined with the IP-protected technology of Style PD. Multilayer extruded beer lines were also tested, but it soon became clear that in order to keep costs low a monolayer extruded line was preferred. Testing revealed that monolayer lines allowed for increased flexibility without sacrificing end-product quality.

Temperature was mentioned earlier as one of the aspects of research and testing. In order to obtain a perfect pint, the temperature of the beer had to be kept within 5 to 7°C. If it was not kept at this temperature, the end customer would be able to taste the difference and it would therefore not be of the perfect standard required.

The main aim when dealing with beer temperatures was to aim for consistency; as it was important to maintain the temperature of the beer as this directly affects taste and the amount of head formed. Research led to a number of miniature refrigeration units that equally suited an efficient cooling method.

While the experiments were taking place, Style PD found there were areas of waiting time such as the period taken for parts to be delivered. The company used this time to create virtual prototypes with CAD software in order to portray to possible investors how a final solution could look and operate.

This helped to motivate companies to believe in the technology and its potential. CAD software could also be used to create focused analytical designs to determine manufacturing and assembly details (see Fig. 12.4). Tests included pressure vessel analysis of beer keg designs and thermal analysis of refrigerating materials. The company faced a number of problems which involved redesigning these subsystems to improve function and lower costs.



Figure 12.4 Virtual (CAD) prototype

It was a difficult time during research and development as areas of design kept being updated and changed due to testing results, which then had to be forwarded on to Leardon Solutions to be included within the prototype.

With hindsight, it would have been better to have carried out the experimentation and obtained the solutions before contacting Leardon, which would have resulted in a smoother prototype development process. This was a crucial mistake by Style PD and occurred through inexperience and eagerness to press on with development.

Solving problems in the Style PD technology involved many tests to obtain the ‘perfect pint’ specification. This held Leardon Solutions back from creating housing and mounting points for the technology in the dispenser. Being involved so closely with the project, it is often hard to step back and observe where possible problem areas are and how to reduce the delaying effects they may have on development. Being able to do this would have enabled more effective allocation of resources, which is crucially important for a startup company.

By the end of the collaboration with Leardon Solutions, the company had a much improved prototype that could now be used for presentations. Disappointingly, certain technical parameters in the electronics could not be dealt with by Leardon Solutions and those parameters required to pour the perfect pint had to be contained within a bespoke component. Although it performed the job well during presentations, it was still not a valid solution for mass production. The only remaining problem now was to refine the bespoke electronics component. To do this would involve specific translation of known data into a Mark 2 component and placing it within the appliance.

12.8 Branding the Company

The decision to build a brand for the company was inspired by the desire for the name to be short and easily remembered.

The brand must reflect in some way the ethos of the company and if possible suggest, if not include, the names of the partners. Lastly, it must be upbeat and hint towards modernism.

Choosing a name for the business was the first step towards building a brand. After a number of attempts to fulfil a combination of various criteria, the idea of joining the partners’ names seemed to shine out. Simply taking the ‘ST’ of Stephen and the ‘YLE’ of Kyle produced Style PD; the final initials stand for product development – abbreviated to keep the name short.

While it was important for the company name to be unique, it was necessary to investigate existing trademarked names to ensure no infringement had occurred and to check that the chosen name would be available as a web domain. This would open up two possible avenues to expand the brand, firstly the possibility of publishing a website for the company and secondly holding branded business email addresses.

12.9 Branding Websites and Emails

Creation of the website was a low priority as we were undertaking our first project and had limited information to advertise. Furthermore, the annual publication costs were felt to be better spent on testing and development of the technology. Registering the domain still gave the rights to the name and flexibility of opportunity to open a website in the future.

A negative of not having a website was that contact details for the company could not easily be found online and this proved to be an increasing worry for potential business partners.

To combat this, we both generated full LinkedIn profiles referencing the company and associated contact details. By permitting certain details to be viewed publicly, it made it possible to be a top search on Google. In Chapter 6, Graeme Roberts gives a good treatise on how to use social media effectively for advertising.

The benefits of having a personalized email for the company were noted from the outset. The presence of a formal email address assisted the establishment of Style PD on the business map and seemed to echo clear progress from student project to a more creditable business model. This was accepted naturally by subcontracted and other firms conducting business with Style PD. As well as aiding with branding, the business email accounts gave clarity to the internal organization of the business. For the partners, the distinction between business and university was reinforced.

The branding of the company was expanded by the creation of business cards. Used as a tangible, lasting reference to the company, these included networking contact details. The business card displayed the unique company logo, the company name and emphasized the acronym PD with the full title 'Product Development' (see Fig. 12.5). The logo further reflected the simple elegance of the brand and used a colour scheme that was also used consistently across all stationery.

12.10 Finances

To audit the finances of the business, we kept a running monthly cash flow for the business accounts. As the grants available from government funding body (Invest NI) were based on receipt, capital had to be raised to cover costs until the money was returned; this added extra pressure to raise funds and ensure every penny was accounted for. The monthly cash flow kept a tight fix on the business balance.



Figure 12.5 Virtual (CAD) prototype

The Professional Studies 4 module at the university had taught us how to create a basic balance sheet, cash flow and profit and loss account, but the strongest financial advice received by Style PD was from the ‘Go For It’ programme run by Invest NI. This programme of three specific information sessions given to each company in the programme took each particular circumstance into account. The programme facilitated an afternoon discussing the best practice for running the accounts for a startup business, including organization and management. The programme went into the operational detail and provided an electronic spreadsheet template for cash flow, which could be adapted for each individual business need. This electronic document was more than useful as it saved the business time in creating their own and, as it had been used previously, it gave a sense of confidence that the calculations were correct.

12.11 ‘Go For It’ Programme

Although Style PD had a business plan originally from university and developed a new plan for BIL, the local government business planning programme called ‘Go For It’, was our first opportunity to have the physical document analysed and reviewed. A new business plan with updated content and structure was created and went forward to being a part of the business application for an R&D grant, the largest source of funding to date.

The ‘Go For It’ programme discussed possible sources of funding with individual companies that attended. Although this did not open up any new direct avenues for Style PD, it gave the impression to the company that they were fully utilizing their external resources at this time. The future prospects of the business were discussed and, along with reviewing the future cash flow forecast of the business, future grants were noted that could aid in the long-term plans regarding business expansion after the development stage was complete.

Another positive outcome of the ‘Go For It’ programme was the networking with other local companies. Through these networking experiences money-saving advice was shared, for example, companies that presently had offers on for printing of business cards.

Whilst we received talks from HM Revenue & Customs and advice from KPMG, a smaller accountancy firm was eventually found. The project intrigued them and the basic level of the accounts that needed to be submitted led the accountants to file the company tax returns on a goodwill basis for the first year.

12.12 Pitching the Technology

This section will not focus on how to prepare for a pitch, but more on Style PD's experiences and reflections from promoting their product. Chapter 3 focuses on preparing and delivering the ideal pitch for business investors.

During the early stages of development, as we contacted breweries, electronic companies, universities, accountants and many more to help with development, we were able to perfect the pitch. The numerous presentations allowed us to build confidence in delivering an optimized presentation to a particular audience and pre-empt any specific questions that companies would have. The process was also helped by a family friend with considerable presentational experience.

One crucial question that arose was, when do you pour a pint from the dispenser prototype? Style PD before now had always saved the pint pouring until the end of the presentation to finish on a high, but experience taught us that this left the audience in negative anticipation and doubting if the Style PD technology even worked, so we changed it. Furthermore, the pitch was shortened to 5–10 minutes to create a wow factor. One thing that Style PD can take away from the presentation experiences is that it is not always a *Dragon's Den*-style scenario, sometimes getting your audience involved with your presentation can have a greater positive effect when entering discussions.

A couple of points emerged from the experiences:

- It was important to follow up after presentations to companies as this gave them the opportunity to ask Style PD any questions they may have missed during discussion. Following up after meetings proved to development companies that Style PD was enthusiastic about progressing the project and this tended to result in quick feedback and prompt delivery from these companies.
- On a number of occasions, it was found that exciting the recipients with the presentation encouraged them to work 'pro bono'. One example, mentioned earlier, was that the company accountants offered to file the company tax returns free of charge as they saw the potential in the business idea and hoped that Style PD would continue to give them future business!

Style PD felt it was time to present their prototype (see Fig. 12.6) to major brewing companies in order to spark interest. The technology had a very positive impact on the brewers as they could not believe that the same quality a consumer would receive in a bar could be poured from a low-cost dispensing unit. One problem that the brewers had was that, although there was a proof-of-concept prototype, there was no evidence that the electronic components could be commercially viable due to their technical nature.

The outcome from the meetings was that the major brewing companies would not commit to any licensing agreement until it was possible to refine the electronics. There was an offer of funding from one of the brewers to help with design for manufacture, however wanting to



Figure 12.6 Final, fully functioning prototype

remain as a separate entity with plans to licence the technology to more than one company, it was kindly declined. Style PD had also found R&D grants available to cover funding for the next development stages. It was, however, clarified that Style PD would be open to the possibility of collaboration work once a manufacturable component was created.

12.13 Design for Manufacture

The prototype had served its purpose in gaining a vast amount of interest from companies but in order to prove that the Style PD technology was capable of industrial application, we needed to source a specialist who could undertake the remaining electronics development work. The specialist company would also need to be able to measure the prototype's bespoke electronic component using equipment specific to a particular area of electronics.

Sourcing specialists who would be able to help was a lot more difficult than we had first imagined. A number of options were explored:

- After initial phone calls and Skype meetings with **company A** based in Germany and completion of an NDA, it was judged that they would be able to carry out the design and development work, but they would need assurance of payment in the form of a large

percentage of Style PD's business sales. Unfortunately, this was not an option we wanted to take as the development work was deemed to come at too high a price.

- With **company B**, it became clear that they were capable of completing the development work, however they would only invest in design and development work if Style PD could guarantee continued manufacture and sales. Since no agreement was at this time in place with brewers, Style PD had no guarantee of sales and could therefore not confirm sales for company B.
- A third option was **company C**, a design and original equipment manufacturer consultancy working specifically in the area of electronics. They had offered to develop a component at a set price, without needing the security of following sales. Unfortunately, the price was much too high for a startup company to afford and it was decided to continue searching for an alternative.

A different approach was needed in order to find a company that would not be interested in continuing manufacture and sales. In other words, a company that would focus solely on R&D, so Style PD decided to investigate university research facilities. Again a suitable partner was found and after an age to get the NDA signed, Style PD sent their prototype to the university labs to be tested. The objectives set by the university consisted of:

- testing the existing bespoke components,
- replicating the data obtained using specialized 3D software,
- creating more prototype solutions using 'off-the-shelf' components.

The university's services were secured using the 'Innovation Voucher Scheme', which required the university to be registered with Invest NI (which was granted quite quickly). The university team were very understanding of Style PD regarding funding and therefore took a relaxed approach, stating that they would continue with the research work and that the agreed payment could be sorted once the company had the money. This is another example of the outstanding generosity that this startup company has experienced when conducting business in Northern Ireland and indeed the rest of the UK.

The first of two grants suitable for the business at the design for manufacture stage was from Invest NI, namely the R&D grant. This grant covers a percentage of the costs that will be incurred throughout the remaining development of the product and until production is ready to begin. The percentage amount is dependent on a number of issues, including the level of risk that the project will succeed, whether any subcontracting is from local Northern Irish companies and the return of investment into the Northern Irish economy.

In order to receive funding for testing and analysis work carried out in-house from this point onwards, the business structure of Style PD had to be expanded. The R&D grant would have to be accounted for through a company rather than a partnership. This meant opening a second company, Style Product Development Ltd, which would act as a subsidiary company to Style PD LLP. By this time, we had filed many successful grant applications, although this grant would be considerably the largest to date. The application was drawn in a manner that covered a number of paths of progression. As the technology fell within a specialist area, the different paths allowed for the possibility of failure, with routes to sourcing an alternative component.

A number of smaller brewers had shown interest in the technology, who would not have the finance within their business to produce an end product for the technology. Style PD recognized this as a smaller market, and possibly a faster route to market, thus potentially acting as a cash injection for the company. Therefore, the R&D grant application was also designed to cover development of a final product that would make use of the technology.

Difficulties with writing this application for the R&D grant were found in the level of detail needed on the future plans of the business. It was advised that Style PD cover as many costs as possible, including aspects such as travel arrangements. This proved to be a difficult section of the application to complete as it was unknown to the company when they would need to travel to subcontractors for development meetings and to whom exactly the technology would be pitched. Hence, attempting to justify travel costs felt less structured and more of an estimation.

After a number of meetings negotiating back and forth with Invest NI, the application was finalized and entered for filing. This gave the opportunity to start this phase of development and all costs would be covered upon receiving the letter of offer. This was a risk for the company for multiple reasons:

1. It was not certain that the application would be accepted and the aid from Invest NI would not then be received.
2. This period extended the time until the first installment of money would be received by the company; this forced the company to raise bridging capital before the money would be refunded.

It took three months for the letter of offer to be received. This pushed the company to the limit with the funds they had raised. We learned from this experience that risks need to be taken and activities need to be continually pushed forward in order to make a successful business.

12.14 Conclusions

The present situation (September 2013) with Style PD is that the continuing work with the university has progressed from analysing the bespoke component to sourcing a final solution. The previously discussed grants are advancing and aiding the business with the project. We are still in close relation with several major brewers and are excited about finalizing the components and bringing the product to market.

Reference

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Assessment

Karen Rafferty

PURPOSE

This chapter describes the assessment methods that are currently used in the Industrial Project module and shows how they align to the exercise the students have been asked to undertake and as such, should underpin their own student learning. For this to happen the assessment strategy must be transparent and in line with the learning outcomes for the module.

TOPICS

- Learning outcomes for the Industrial Project module
- Assessment of the investment pitch and the business and technical reports
- Peer evaluation
- Assessment matrix based on role selected within the team

The chapter is organized as follows:

- The **learning outcomes** for the complete module are given in Section 13.2, which relates the activities within the module to the required **engineering life skills** of any new graduate engineer.
- In Section 13.3 we review the **assessment methodology** for the **investment** pitch. This is followed in Sections 13.4 and 13.5 with the **assessment protocol** for the business and technical reports. The protocol for the peer assessment is given in Section 13.6.

- The process by which the individuals take control of their own **assessment criteria** based on their role within the team is given in Section 13.7.

13.1 Introduction

Employability has been defined as ‘a set of achievements skills, understanding and personal attributes that make graduates more likely to gain employment and be successful in their chosen professions’. In the workplace, employers seek graduates who can cope with the broader demands of a rapidly changing environment, and who bring softer skills as well as specialist knowledge.

Employers increasingly value skills such as team-working, communicating effectively with partners and customers, and being able to adapt to new situations and develop new capabilities.

For the individual, the ability to continue to develop and apply skills throughout life brings the flexibility to adapt to new challenges, demands and uncertainties. There is now a well-documented list of skills valued by employers, which are increasingly recognized as generic transferable skills that need to be included in all higher education programmes.

Less well documented are effective methods and approaches to develop these skills (Dillon and Hodgkinson, 2002). Assessment of ‘softer’ skills can be more difficult than assessment of ‘harder’ technical abilities, leaving individuals (and their assessors) unclear of their abilities or potential. Assessment is a key topic within tertiary education, where essentially assessment can be viewed as a tool designed to observe students’ behaviour and produce data that can be used to draw reasonable inferences about what students know.

Present-day unseen examinations, which dominate assessment in tertiary education, may measure a student’s knowledge of basic facts and procedures and may produce an overall estimate of proficiency for particular subject knowledge. However, they fail to capture the breadth and richness of knowledge and cognition. Mislevy (1993) noted:

It is only a slight exaggeration to describe the test theory that dominates educational measurement today as the application of 20th century statistics to 19th century psychology.

Mislevy (1993)

Indeed, advances in the understanding and measurement of learning offer the potential for a much richer and more coherent set of assessment methods. Assessment of student learning is a fundamental function of higher education. It is the means by which we assure and express academic standards and has a vital impact on student behaviour, staff time, university reputations, league tables and, most of all, students’ future lives (Ball *et al.*, 2012). Students have also noticed how assessment fails to meet their needs, particularly in relation to relevance to

the world of work. As increasing numbers of students enter higher education with the primary hope of finding employment, there is a pressure to ensure that assessment can, at least in part, mirror the demands of the workplace or lead to skills that are relevant for a range of real-world activities beyond education, but this has been largely unreflected in the reform of assessment within many disciplines (Ball *et al.*, 2012).

Through this module we aim to address some of these challenges, not least by having a module which *mirrors* everyday real-world business activities. However, it is not only important that we develop a student's key skills; we also need to implement an assessment strategy that the students can take ownership of and understand, and therefore be in control of their own learning. To do this it is important to link the assessment procedure to the learning outcomes of the module so that we correctly assess students on the skills that we want them to develop. It is also necessary to use a mix of formative and summative assessment so that students are fully aware that their skills are being developed in line with expectations.

In Section 13.2, the learning outcomes for the Industrial Project module are specified along with the modalities of how they will be assessed. In Sections 13.2 to 13.6, the assessment matrices for each of the individual elements of the Industrial Project are presented. In Section 13.7, the module marking matrix is presented for the complete module. These modes of assessment, in principle, are summative assessment methodologies and so finally, in Section 13.8, we discuss how formative assessment is implemented within the module.

13.2 Learning Outcomes

Assessment should be an integral and enabling part of the learning process and is a tool by which learning is evaluated to determine if the objectives of the module have been met (Brown and Knight, 1994). It should be of value to both learners and teachers in matching their needs (Harris and Bell, 1994). The simplest way of improving assessment is to use multiple methods to assess multiple talents for multiple audiences. In deciding upon the assessment methods for this module, the mentors noted the conclusion drawn by Brown and Knight (1994) that student learning is strongly driven by the methods of assessment used and if you want to change student learning then you need to change the method of assessment (Brown *et al.*, 1997). The methods of assessment used need to be strongly linked to the defined learning outcomes of the module.

The following learning outcomes were defined for the module.

1. To enhance communication skills through:
 - (a) Using the written word in the form of a final business report and technical feasibility report – assessed via written reports.
 - (b) Using the spoken word in the form of a presentation detailing the business plan for the new startup – assessed via presentation.
 - (c) Using the spoken work to participate in group discussions when (i) developing the business idea, (ii) developing the business plan, (iii) presenting the technical feasibility – assessed via peer assessment.
2. To enhance information and communication technology skills through:
 - (a) Searching and obtaining information about technical design, innovation and intellectual property – assessed via technical report.
 - (b) Presenting information for the final business pitch – assessed via presentation.

3. To enhance technical skills through the development of an innovation into a business idea – assessed via reports.
4. To improve critical evaluation skills by evaluating the technical and business aspects in the development of innovative ideas on route to production – assessed via reports.
5. To enhance analytical skills through evaluating the feasibility of turning an innovative idea into a physical prototype – assessed via reports and presentation.
6. To improve business awareness through the development of a business plan for the establishment of a high-tech startup company along with associated investment pitch – assessed via business report and presentation.
7. To improve learning and performance through peer evaluation of completed work relative to the project objectives – assessed through peer assessment.
8. To enhance problem-solving skills by solving technical and organizational problems encountered in developing a working prototype of the product and working company model to commercialize the product – assessed via reports and presentation.

The professional engineer should be skilled in many areas, not least communication both in the written and verbal word.

Successful report writing requires substantially different skills from making a successful presentation. It was therefore decided that both skills should be assessed. Communication skills in terms of the written and verbal word are relevant to many jobs, in particular for engineers who usually have to explain complex theories to non-engineering personnel regularly throughout their professional career. Thus, this provides a very useful medium in student assessment where specific skills relevant to a professional engineer can be addressed. Race (2006) has indicated that it is advantageous to give students more insight into the assessment procedure. Therefore, at the start of the semester, students are issued with the learning outcomes and associated assessment criteria for the complete module as detailed in the remaining sections of this chapter.

13.3 Investment Pitch

The oral presentation is made to a panel with relevant experience of the processes in setting up companies. Each team has the opportunity to outline their product idea, innovation, market research, marketing, operation and finance with the aim of appealing to the panel members to invest in their startup venture. As such, the pitch should be similar to those that startup companies would give to potential investors and teams are strongly encouraged to follow the NISP CONNECT outline which is given and explained to them at the start of the module and also explained in Chapter 3 of this book. The recommended length of the presentation is 15 minutes, of which 10 minutes should be for the pitch with 5 minutes for questions and answers.

The panel are given the assessment form presented in Fig. 13.1 to complete after each pitch. The final team mark is based on a mean, should all panel members have similar ratings for each of the pitches. Since this evaluation is completed by people external to the examinations board of the university, it is important that the module owners oversee this process and ensure they are in agreement with the marks awarded. Should any of the panel members be out of

Presentation Assessor: _____

Company name:

Please include comments to back up the marks you have given for each section. In particular, highlight aspects which impressed you and issues that were not sufficiently addressed.

	Mark Range	Actual mark
Product innovation and justification: Issues addressed could include: outline of novel product, business case, key differentiation and innovation, product portfolio, future strategy, product protection.	25	
Operational aspects: creation of company, personnel and proposed roles, mode of operation, financial plans etc... May also consider if relevant, advisory board, website development	25	
Marketing: Marketing of product, primary/ secondary marketing, innovative marketing ideas.	20	
Quality of Presentation: How well was the pitch made? Was effective use made of 15 minutes?	30	
TOTAL	100	

Comments:

Figure 13.1 Assessment matrix for investment pitch

line with the other members, then the module owners have the discretion to either remove the marks from this panel member for the final assessment mark or moderate their marks.

TRY THIS

Each team will frequently practice their pitch. So why don't you record one of your practice sessions and then as a team assess the pitch using the assessment criteria given. If you are totally honest, this should give you a feel for what areas of the pitch need improving.

13.4 Business Plan

Each team must submit a business report, the main aim of which is to convince the reader that the team have considered all aspects for the setup and establishment of the startup company. In particular, the report needs to address the following points:

1. The outline of the problem or the need that the company and associated product(s) are attempting to address. What is the key differentiation of the solution? Why has it not been proposed before? What innovations come specifically from the electrical/electronic or mechanical engineering background?
2. The proposed solution (described in layman's terms, aimed at a non-specialist reader), highlighting particularly the novelty of the approach adopted and the innovation exploited.
3. The creation of an actual company, outlining the personnel and proposed roles, proposition for location and mode of operation. Outline of the work taken to date to validate any aspects of this, including registration of website, website development.
4. A detailed outline of the finances, highlighting how the company will operate profitably, how income will be generated, how, why, when and from where investment will be obtained to ensure successful commercial operation. The plan should give a decent estimation using tables wherever appropriate, of actual or projected costs. Please feel free to use Invest NI outlines for this.
5. What is the strategy to protect your product from exploitation by others? How has intellectual property been protected? Have costs been included to cope with this?
6. How the group propose to undertake the marketing. What are the key challenges? How do the group intend to address these practically? What level of primary/secondary marketing has been undertaken?

TRY THIS

If each team is well organized about generating the business plan, then it should be possible to give the members of the team not involved in its production a copy well before the due submission date. These members of the team should assess the report using the matrix given. This should provide useful feedback to the authors of the report regarding any aspect that requires further work or explanation.

The emphasis of the report is that, like the presentation, key points should be highlighted; although it is essential to convince the reader that an in-depth analysis was undertaken in order to arrive at the highlighted key points. A target page length of 20–30 pages is suggested, but the groups are not penalized for not meeting, or exceeding, this quota as long as it is not excessive. Moreover, the format of the report is not prescribed, although it would be sensible to have clear sections on products or service (including problems to be addressed), marketing, finance (including operational costing, sales projections), IP and competition. It is important that the report is developed to match the business proposition rather than be inhibited by a set format. See the assessment report in Fig. 13.2.

13.5 Technical Feasibility Study

Unlike many other business propositions and courses involving company formation or commercial exploitation, a key aspect of the Industrial Project has been a more detailed treatment of the technological aspects of the company product. This is expected due to the technical background of the candidates undertaking this course. Therefore, the second report targets the technical aspects of a business startup, in particular the product idea and its technical feasibility. This will vary considerably from company to company and may include the following to various degrees:

1. A more detailed outline of the problem or the need that the company and associated product(s) are attempting to address; this needs more technical detail than that given in the business report.
2. Product definition, including details of the innovation, how the product differs from competition and, if possible, a reasonably technical comparison. This would involve a well-defined technical specification.
3. A detailed description of any working or proposed prototype, including description of any evaluations undertaken to date. This section may also include an evaluation of any aspect of the prototype that may be problematic in manufacture and possible solutions for this.
4. Innovation of the work, giving technical insight in to the products and highlighting the technical differentiation needed to address the problem. Feasibility should also be included.
5. Review of IP aspects of the proposed product, giving a clear outline to the reader that protection has been considered in detail.
6. Further development and planned product migration should be considered, with as much detail as possible on these future products.

The technical report will need to include a sufficient level of technical description and would need to convince a technically aware reader that it is viable. For this reason, it is assessed by two members of staff from the relevant engineering school. It is expected that the format of these technical reports will vary dramatically depending on the proposed product. For example, it may use conventional technology that would need to be only briefly described or may use innovative technology that will need to be described in detail. However, it could be a software implementation, in which case the technical description should be a description of the algorithms implemented and a little of the code validation.

Business Report AssessmentCompany name:

Please include comments to back up the marks you have given for each section. In particular, highlight aspects which impressed you and issues that were not sufficiently addressed.

	Mark Range	Actual mark
Product innovation: Outline of "problem" addressed by the proposed company and associated product, key differentiation and innovation, product portfolio	30	
Start-up and operation: creation of company, personnel and proposed roles, advisory board, mode of operation, website development.	15	
Marketing: Marketing of product, primary/ secondary marketing, innovative marketing ideas.	20	
Financial plans: Successful company operation, income generation, financial planning projection over 5 years.	20	
Other considerations: Future strategy, product protection, novel company operation aspects, ethical issues, sustainability.	15	
TOTAL	100	

Comments:

Figure 13.2 Assessment matrix for business report

The focus of the report should be obvious to any trained engineer, following from the outline of the problem and the proposed solution. In terms of the overall mark awarded for this report, a mean will be taken of the individual assessors' marks. The individual assessor will use the assessment form shown in Fig. 13.3, which allows each report to be assessed on the technical content and coherency of presentation.

TRY THIS

It would be useful if the authors of the business plan could assess the technical report using the defined criteria. This will again provide useful feedback within the team.

13.6 Peer Evaluation

The need to provide a reliable, verifiable mark for each individual for each assignment can either limit the methods of assessment we use or create justifiable concerns about consistency and fairness in marking. Peer assessment is a case in point. While the use of peer assessment may cause alarm in some external examiners and those focusing on academic standards, the ability to assess self and others is an essential graduate attribute. Studies consistently report positive outcomes for well-designed peer marking, including claims from students that it makes them think more, become more critical, learn more and gain in confidence.

Encouraging self- and peer assessment, and engaging in dialogue with staff and peers about their work, enables students to learn more about the subject, about themselves as learners, as well as about the way their performance is assessed.

Ball *et al* (2012)

In the Industrial Project module, it is recognized that the module lecturers will have limited access to the knowledge base in each group and in many ways, each group member will have a greater insight into their fellow members' achievements. Each team member will be asked to grade other team members on their performance throughout the year. The module lecturers will only intervene in this process should there be no consistency in the assessment of a given team member by other members, or if it was judged that the exercise was not being taken seriously.

The academic staff will utilize their continual assessment of the teams to moderate the peer assessment mark. This is based on all their meetings with the teams and compared with the meetings with other teams. The peer assessment matrix is given in Fig. 13.4 and each individual's mark will be based on an average of their peer assessment plus an overall moderation by the module owners given their higher-level view of how all the teams interacted. To date, peer assessment has worked effectively within the module and the module owners would strongly encourage its use.

Technical Feasibility Report Assessment Sheet

Company name: _____

Please include comments to back up the marks you have given for each section. In particular, highlight aspects which impressed you and issues that were not sufficiently addressed. Please note that this is only a technical feasibility report and is not intended to have the same depth of material as a final year project.

	Mark Range	Actual mark
Technical validity: Detailed outline of "problem" and evaluation of practicalities and technical aspects of proposed solution.	25	
Product: Development of proposed product, viability, thoroughness of product evaluation, comparison to competition.	15	
Level of Innovation: Technical insight used to generate products, technical differentiation.	15	
Prototype: Evaluation of work on prototype, validity of approach adopted.	20	
Ethical and standard considerations: Implications of sustainability, commercialization in different countries, application to standards,...	15	
Other considerations: Range of products, product migration, consideration of IP protection (also considered in market report), etc...	10	
TOTAL	100	0

Comments:

Figure 13.3 Assessment matrix for technical feasibility report

Peer Assessment

Purpose:

With group projects, peers often are the better sources of performance feedback. In addition, working well with others is a prerequisite for success in the increasingly team-oriented work environment. Therefore, a portion (20%) of your grade will be determined by these peer reviews. Each group member will receive a mean score for each dimension listed below. The mean scores will then be combined into a grand mean. This grand mean will be used to determine the grade received by the group member for the peer review portion of the project. All peer reviews will remain confidential. Group members will only see means. Note that the overall grade for the peer review will be validated by the module lecturers based on the experience they have on individual and group activities.

Instructions:

- Use one (1) peer review form for rating each group member.
- Complete your forms on your own. Do not "grade-fix" with other members. Orchestrating high reviews for each other will not benefit those that have done much of the work.
- Rate each member's contributions to the project by circling the rating (0 to 10) which corresponds best to the person's performance.
- Be honest. Accurate ratings will help differentiate the grades received in accordance with each person's contribution. Giving everyone the same rating probably is unrealistic and will not help reward the better performers for their efforts.
- Your peer review forms are due along with the group project. Please hand in with the report. Submit the peer reviews in a sealed envelope.

Your Name: _____

Group Member You Are Rating: _____

Performance Dimensions and Definitions	Strongly Disagree		Disagree		Neutral			Agree		Strongly Agree	
	0	1	2	3	4	5	6	7	8	9	10
Attendance: Group member was present for group meetings, conference calls, Internet chats, or other scheduled meetings/conversations for working on the project.	0	1	2	3	4	5	6	7	8	9	10
Punctuality: Group member arrived at scheduled meetings on time; met project deadlines.	0	1	2	3	4	5	6	7	8	9	10
Quality of Work: Group member's assigned pieces were complete, thorough, covered the topic well, and were accurate in terms of content (e.g., work did not need multiple revisions or rewrites to improve the quality)	0	1	2	3	4	5	6	7	8	9	10
Quantity of Work: Group member took responsibility for completing integral portions of the project (which may have required more time to complete or consisted of a greater percentage of the total project relative to other group members)	0	1	2	3	4	5	6	7	8	9	10
Interpersonal Relations: Group member positively contributed to group performance (e.g., helped group move ahead, constructively resolved conflicts, was not destructive to group functioning, etc.)	0	1	2	3	4	5	6	7	8	9	10

Additional Comments about the group process _____

Figure 13.4 Assessment matrix for peer evaluation

13.7 The Assessment Matrix

Within a successful team the output will be consistently high across the business and technical reports and the investment pitch.

A successful team will realize that quality needs to be consistent throughout.

However, it is recognized within this module that different people will concentrate their efforts on one or more of the outputs. For example, it would be typical for the CEO to lead the investment pitch and contribute significantly to the business report and, therefore, it would seem appropriate that they are awarded more marks from these outputs. Likewise, the technical officer may have minor input into the business report but will lead the delivery of the technical report and again it would be appropriate that a higher portion of the module mark stems from the business report.

Therefore, the module owners developed an assessment matrix (Table 13.1) for the module which allocated certain portions of marks from each of the summative assessment outputs towards an individual role within the team. This, we believe, allows students greater ownership of the marks they will receive in the module and will enhance their learning. However, as stipulated, the successful team will realize that all output should have a consistently high quality and thus the ultimate goal of each team should be individual marks which are the same. Teams are given the right to challenge the marking matrix and alter it as appropriate. However, this request must be made in writing to the module owners before the investment pitch is given. Appropriate arguments for changing the matrix could be that the team have decided their CEO is not the best person to lead the pitch. Perhaps their marketing officer is the most confident and coherent speaker and will lead the pitch. In this case, it would clearly be necessary to alter the marking matrix appropriately.

13.8 Formative and Summative Assessment

Formative assessment is used to monitor student learning to provide ongoing feedback that can be used by module owners to improve their teaching and by students to improve their learning. More specifically, formative assessments are used to help students identify their strengths and weaknesses and target areas that need work and to help the module owners recognize where students are struggling and address problems immediately. The goal of summative assessment

Table 13.1 Assessment matrix per role within the team

	CEO	COO	CTO1	CTO2	CMO	CFO
Business report	35	35	25	25	35	35
Presentation	25	20	15	15	20	20
Technical report	20	25	40	40	25	25
Peer assessment	20	20	20	20	20	20

is to evaluate student learning at the end of the module by comparing it against some standard or benchmark which, in this module, is the two submitted reports plus the investment pitch. The assessment matrices for the summative assessment have been presented already. In this section, we simply highlight how formative assessment is implemented within the module.

The most obvious form of formative assessment is the weekly meetings that the module owners have with each of the teams. During these meetings feedback is given regarding progress and future work areas. In addition, this is also a great opportunity for the module owners to determine what areas of the Industrial Project the teams are struggling with.

To address this, the module owners often organize for specialists in that area to talk to the class as a whole and then individually with each of the teams. Weekly meetings with the teams continue throughout the module, right up until the formal investment pitch. During the weeks preceding this pitch, the teams will deliver their pitch frequently to the module owners and receive feedback on their pitch.

Towards the end of the module, the teams are also given the opportunity to submit draft business and technical reports for review. Typically with the Industrial Project module, two and three lecturers may be involved throughout. Thus the teams are invited to submit their reports for informal review to any of the module lecturers not assigned to the summative assessment of the reports.

Finally, teams are also given the opportunity to review their peers midway through the year. The peer assessment forms are distributed to the teams and all members are asked to review other team members confidentially. The module lecturers will formulate an overall response to teams. Note that this peer review will not count towards the summative assessment of the teams. Rather, this initial peer review is used by the module owners to identify any poorly performing students within the team and is also used by the students to view how their work is critiqued by their team members. The peer assessment forms are also distributed at the end of the module and this will be used towards the summative assessment of the module.

A note of caution to any lecturer thinking of implementing this module and to students taking it: The importance of explaining the formative assessment and what it is cannot be over-emphasized. Sometimes students believe that the only form of assessment feedback is a mark. This is not the case.

Students taking this module will receive weekly verbal feedback regarding their progress and the work that still needs to be implemented. This is the strongest form of feedback a lecturer can give a student.

13.9 Conclusions

The key principle for running the Industrial Project module is to enhance the key skills of students for application in their daily lives as professional engineers. The key skills that we try to enhance should be aligned with the assessment methodologies of the module and should be understood and accepted by the students. Within this chapter we have presented the learning outcomes and associated skill base to be developed as part of the module. We have also shown how these learning outcomes and skill sets are aligned with the formative and summative assessment methodologies that we use. The important point to note is that both module owner

and student should gain ownership of the assessment methodologies used in order to improve student learning and lecturer teaching. However, student assessment is a continually evolving field and we accept that whilst the assessment methodologies we present here work well now, we are still open to evolving our practices for the benefit of student learning.

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Final Thoughts

Roger Woods

This book has covered a number of major topics on product engineering and the creation of a company to exploit innovation. This includes the generation of ideas, preparation of the necessary documentation, background information on branding, marketing, IPR and finance, product design, experiences of student teams who have undertaken the exercise and assessment. This chapter looks to wrap up by highlighting some of the key points of the text and also some future points for discussion.

14.1 Introduction

The text has documented an innovative process of creating engineering products and companies from ideas generated by the students. The process makes the argument that the engineering and science students are in an ideal position to create products and companies if they can be suitably educated, have experience of business creation and reasonably detailed technical knowledge. Indeed, the numerous examples that we have briefly highlighted – such as the tow-bar product from Buteos – indicate how experience gained in a year placement put the team in an ideal position to create an innovative product, allowing a user to more effectively hitch trailers, caravans, etc. to their vehicle.

The success of the Industrial Project module has been demonstrated by the extent of the success that students have had in taking their ideas, products, business plans and business pitches to national and local funding competitions, with little need to modify the original concept and accompanying paperwork. The student reviews have been very positive and the many students who have now graduated have made the comment that they felt it was the most useful course they had undertaken at university as it gave them a good appreciation of the process of the work environment, whether they joined an SME or a larger organization after graduation.

It is clear from discussion with the students that the part of the course that concerned them most, and caused the most angst, was the material covered in Chapter 2, namely

idea creation. For those readers in an academic position considering the introduction or modification of innovation or product design courses, idea creation will probably be the most risky/adventurous decision for them to make in terms of running the project.

The material in this book covers experience of two modules, one in electrical and electronic engineering and the other in mechanical and aeronautical engineering. In the latter course, the ideas are initially proposed by the staff whereas in the former course, the idea generation is as described in Chapter 2. The students will generally acknowledge (admittedly at the end of the exercise) that having and then running with their own ideas as products turned out to be the most rewarding part of the activity.

There is also an important aspect to point out here from an IP perspective and that is, the ownership of the idea. Queen's University Belfast will probably be like most UK universities in that any idea generated by a member of university staff will be in the ownership of the university. However, ideas generated purely by the students will remain the property of the students and whilst the university commercialization offices may wish to be involved, there is a clear demarcation of IP ownership. This does present some challenges for the academic mentors to ensure that they do not contribute directly to the generation of the idea, but ensures that individual members of staff do not get overly involved in specific projects.

14.2 Thoughts for Mentors

One aspect that we have highlighted in this book is the experience of the student groups. In retrospect, the students feel that this is a vital module to have undertaken although this tends to only be the opinion after module feedback has been undertaken. It has to be said that there is little appreciation of direct and blunt feedback from the mentors, although the mentors at Queen's University Belfast were deliberately chosen for their commercial exploitation experience or because they would not hesitate in giving direct feedback.

The first few weeks are vital, and care needs to be taken by the mentors to ensure that the teams are collaborating effectively or even at all. A few points are made below:

- **Generation of ideas.** It is important to ensure *all* members of the teams start to generate ideas and that none takes a back seat with regard to this aspect, as the best ideas could come from those deemed to be the weaker members of the team.
- **Regular meetings.** It is important to ensure that the groups get off to a good start, so regular meetings to ensure the team are generating individual ideas are sensible. These meetings need to happen more often when the ideas aren't coming!
- **Minutes of meetings.** This is a good suggestion for many reasons. It allows mentors to back any informal assessment that they have made about individual contributions in team meetings with actual detail. This can help in providing detailed backup of any assessment, particularly where a high level of self-assessment will be employed in the marking scheme. Also, it helps the students to both see from where they have developed their ideas, particularly if they need to go back over alternative product ideas, and also be reassured of their work to date.
- **Expert involvement.** There have been many instances over the past four years where the mentors' views have varied on how to commercially exploit, market, or finance various ideas, so it is useful to be able to consult an expert source on any discrepancy. It is probably

more useful to have one-to-one meetings with the experts, as though their presentations are very good, direct advice helps. It is useful for the mentors to be part of these meetings, as it provides a good learning experience for them as well.

It should also be highlighted that time is needed for supervision and this can be problematic when the numbers on the course increase. This has occurred in the past and in these cases, we have split the supervision of the teams, but only after a suitable idea has been identified as it is important to get as much involvement in the creative process as possible.

14.3 Thoughts for Students

Two of the chapters have been dedicated to students' experiences in order to give the recipient perspective but also to reinforce important aspects of the course. Some of the issues were highlighted by the description, but overall, the team contribution is vital. Whether the teams have been the first to select themselves or have had to be made up from the remaining registered course attendees does not seem to have a major bearing on performance.

From the mentor perspective, it is the selection of the 'right' people for the important roles in the teams that is important. The key roles are probably CEO and CTO. The CEO role needs a person who is able to make sure that targets are met but at the same time keep the team together. Interestingly, groups have had several members contesting the CEO role as the individuals have viewed this as 'being in charge' rather than choosing the person with the correct characteristics for the work. However, the mentor usually makes clear the characterization of the person needed, and has had some influence that the correct person is selected. The importance of getting the right person in the role cannot be exaggerated.

Although innovation and company creation are important, the CTO role has a particular relevance in this exercise. Having someone with practical expertise is vital as the concept of creating a working prototype has a major impact for the business and particularly for the presentation. In addition, it is important that the teams are able to make the best of the expertise of academic staff in the relevant engineering schools.

Generally, teams who have worked hard and worked as a team will do well, but those teams who have excelled have usually had an impressive CEO and an exceptional CTO. The teams who have fared poorly have usually had a poorly chosen CEO as generally, team members at the master's level in engineering degrees are reasonably competent in an engineering capacity.

14.4 Future Directions

The modules from which the material described in this book has come have been developed over the years. In the initial versions, we had talks from innovation specialists, SME founders and then input from finance and marketing. After various reviews, it became apparent that additional input was needed from branding and IP issues, and these were added. We envisaged that the current finance talk could be partitioned into separate sections, one on understanding how to compute finances and what aspects to consider and a separate talk on generating the necessary finance information for the presentation and the business report.

From consideration of the existing schedule of talks given in Table 14.1, we feel that we have good coverage but could also look to get someone in to talk to the students on sales,

Table 14.1 Existing talks

Week number	Topic
1	Meeting with course organizers
2	Startup process, warts and all
3	University innovation support
4	Strategies for marketing
5	Branding
6	Intellectual protection
7	Finance

although this is partially covered under the marketing aspect. In addition, we would be keen to see expansion of taught material on finance as the current talk tends to involve a sharp learning curve for the student groups.

14.5 Final Comments

The material in this book is relevant to an academic/teacher who is looking to exploit some of the concepts described or a student/prospective innovator/company founder who has found some of the material interesting and helpful in company creation. We feel that the key contribution has been the experiences of the mentors and, more importantly, the students, in the practicalities of developing ideas and setting up companies. On a personal note, all of the editors would comment on the positive experiences in brainstorming with the groups on new ideas.

The key desire for those involved in the course would be to see the translation of any of the excellent ideas generated by the student groups into commercially viable products and accompanying companies. Several of the groups have demonstrated this potential by convincing external reviewers of the merits of their propositions in the numerous competitions that they have entered.

Glossary

Accrual	This requires that sales and expenses are taken into account and reflected in the profit and loss statement of the accounting period in which they occur, whether or not cash was received or paid out. It is generally taken to be an expense incurred in the accounting period, but which was not actually paid for in that period. For example, if for a business with a 31 December year-end, the electricity bill covering the quarter November to January is not received until February, then the cost of November and December should be accrued as owing in the P&L for the year ended 31 December and shown as an accrued creditor in the balance sheet as at 31 December.
Balance Sheet	The balance sheet is a 'snapshot' in time, on a specified date (usually the last day of an accounting period) of who owns what in the company, and what assets and liabilities exist at that point. The information contained in the balance sheet and the way it is laid out will be specified under generally accepted accounting principles (GAAP).
Breakeven Point	Point in time (or in number of units sold) when forecasted revenue exactly equals estimated total costs; where loss ends and profit begins to accumulate.
Budget	In a financial planning context this means an amount of money that is planned to be spent on a particular activity or resource. Budgets are generally monthly, quarterly or annual.
Capital Employed	This is the value of all resources available to the organization. It may be viewed as the total capital tied up in a firm's fixed and net current assets. Since the balance sheet must balance, it must comprise share capital, retained profits and reserves, long-term loans.
Cash Flow	The movement of cash in and out of a business from day-to-day trading (wages, materials, utilities, etc.) and other non-trading transactions (such as capital expenditure, loan repayments, tax and dividend payments).

Contribution	Sales minus cost of goods sold and variable costs. This sum pays for fixed costs and contributes to net income.
Cost of Goods Sold	The directly attributable costs of products or services sold, usually materials, labourer and direct production costs. Commonly arrived at via the formula: opening stock + stock purchased – closing stock.
Creditor	A third party to whom money is owed. Generally a supplier, a bank or other lender.
Current Asset	An asset such as debtors, stock, work in process or cash that is constantly flowing in and out of an organization in the normal course of its business, as cash is converted into goods and then back into cash. In accounting, any asset expected to last or be in use for less than one year is considered a current asset.
Debtor	An individual or organization owing money to the company. Mainly trade debtors who have purchased goods or services on credit and not yet paid for them.
Depreciation	The apportionment of cost of a capital item over an agreed period, based on life expectancy or obsolescence. The capital item will be an item of equipment, plant, machinery, building, etc. and generally over a certain value that is used for the purpose of the business over an extended period, usually not less than three years. In the example shown, a piece of equipment costing £30,000 having an expected useful life of four years would be depreciated (written off) over four years at a cost of £7500 per year. The P&L will show a depreciation cost of £7500 per year; the balance sheet would show an asset value of £22,500 at the end of year one, and the cash flow statement would show all £30,000 being used to pay for it in year one.
DNA	Strictly this stands for deoxyribonucleic acid but used in many business texts, it refers to the underlying acumen in an area of specialism.
Equity	In this context equity refers to the ownership of a company's shares and thus the ownership interest in the net assets of the company. On a balance sheet total equity represents funds contributed by the shareholders plus retained earnings (or minus accumulated losses).
Fixed Assets	See Depreciation. These are the assets held for use by the business rather than for sale or conversion into cash, e.g. fixtures and fittings, equipment, buildings.
Fixed Cost	Fixed costs are costs that remain fixed in relation to changes in the level of sales or output. These might include costs such as insurance, rent, business rates, administration salaries, etc.
Forecast	A 'forecast' in certain contexts means the same as a budget. It is essentially a prediction for a future period of time of

	performance (costs, revenues or other data). Typically, it is a projection based upon specific assumptions.
Gross Profit (or Gross Margin)	Sales value less cost of goods (or services) sold. It is profit before the deduction of operating costs. Gross profit percentage is the gross profit expressed as a percentage of sales, e.g. if sales are £150 and cost of goods sold is £90 then gross profit is £60 and the gross profit percentage or gross margin is 40%.
Intangible Asset	Brand value and intellectual property, such as knowledge and know-how. They are assets that add value to the business and are a resource used to generate income, but have no physical existence. Notoriously difficult to quantify, not necessarily recognizable in a startup but can become quite significant quite quickly as evidence builds through turnover.
Intellectual Property Assets	Those assets which are seen as essential knowledge within the company.
Intellectual Property Rights	Intellectual assets such as copyright and patents, particularly those that need to be disclosed outside the business and need to be protected.
Liability–Long Term	See Liability–short term. A long-term liability is one that would be expected to be realized or settled beyond one year of the balance sheet date.
Liability–Short Term (Current)	See Creditor. A liability is a general term for what the business owes. A short-term liability is one that would be expected to be realized or settled within one year of the balance sheet date.
Liquidity	Essentially, a measure of the organization’s cash or easily cash-convertible assets. This indicates the ability to meet short-term liabilities. A measure of liquidity, the liquidity ratio, is the ratio of current assets to current liabilities. There is another more onerous test of liquidity known as the quick or acid test ratio, which is essentially the same thing except that stock is excluded from the current assets (on the basis that stock might not be speedily converted into cash without damage to its value).
Management Accounts	Business and accounting information prepared on a regular basis (usually monthly and quarterly but may be weekly) for presentation to management, in order to facilitate business decisions.
Net Profit (Net Margin)	See Gross Profit. Net profit is gross profit minus operating expenses. Net profit percentage or Net Margin is the net profit expressed as a percentage of sales.
PR	Public relations is the practice of managing the spread of information between an individual or an organization and the public.
Prepayment	See Accrual. A prepayment occurs when an operating expense is paid during the accounting period but the period covered extends beyond the accounting period. Example: If for a

	<p>business with a 31 December year-end the insurance premium for a full 12 months is paid in advance on 30 November then 11 months of that payment will relate to the following financial year and will represent a prepaid expense (a prepayment). That expense will be reduced accordingly in the P&L for the year ended 31 December and shown as a prepaid expense (a current asset) in the balance sheet as at 31 December.</p>
Return on Investment	<p>There are a host of different terms and measures and it is often important to have the person or organization asking for this to define what they intend. It is probably sufficient to define this as the money or value gained or lost on an investment relative to the amount of money invested. Example: If you invested £50,000 in a venture today and it was worth £100,000 in a year's time then your return is 100%.</p>
Stock and Work-in-Progress	<p>Goods bought in or manufactured for resale/sale.</p>
Turnover	<p>The monetary value of sales during a particular time period, e.g. monthly, quarterly or annual turnover.</p>
Variable Cost	<p>Those costs that vary directly in relation to sales or output. This would include, for example, the costs of components or raw materials, salary costs directly associated with production, packaging, distribution costs, etc.</p>
WII-FM	<p>What's in it for me?</p>
Working Capital	<p>Working capital is essentially current assets minus current liabilities. Its significance is that it indicates whether a business has enough short-term assets to meet its short-term financial obligations.</p>

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