

Research and Development

Key Terms:

Invention	
Innovation:	
Research	
Development	

Purpose of R&D

- Solving problems
- Developing new products/materials
- Improving quality
- Reducing costs

R&D Process

- Identification of problem
- Research
- Development of ideas and solutions
- Development of prototypes
- Final design
- Testing
- Manufacture and launch

Benefits of R&D

- Developing unique products (USP)
- Provides competitive advantage
- Provides long term income
- Premium prices
- Identifies new opportunities
- Motivation for staff
- Enhances reputation

Challenges and costs of R&D

- High financial costs, hard to estimate
- Long timescales
- Uncertain outcomes
- Conditions may change during the R&D process
- Reactions of rival companies
- Possibility of failure and the associated impact on reputation

Evaluate the costs and benefits of innovation, research and development for a business and its stakeholders

A large empty rectangular box with a thin black border, intended for the student to write their evaluation of the costs and benefits of innovation, research and development for a business and its stakeholders.

Chapter 30

Research and development

Research and development (R&D) is essential today for businesses to compete in a dynamic marketplace. It involves the identification of new ideas and turning them into products, services and processes. Businesses who invest in R&D are considered to be innovative and always looking to bring new ideas and products to the market.

Innovation

The commercial exploitation of an invention.

Bringing a new idea to the marketplace is known as 'product innovation'. Doing so in the workplace is known as 'process innovation'. Innovation is not cheap and resources have to be committed by the businesses to bring new products to the marketplace. Governments try to encourage innovation within the business community because an innovative culture will help grow the whole economy, creating both employment and wealth.

Research

Research is the inquiry into, and discovery of, new ideas.

Methods used to generate new ideas include:

- Pure research – research just to find out how or why, with no product objective. This type of research is often carried out by universities or research institutes.
- Laboratory research – for example, the testing of new pharmaceutical compounds on animals.
- Evaluation of existing products – are there problems with this product? How can such problems be resolved?
- Brainstorming using discussion groups – thinking outside of the box, novel ideas for solving existing problems.

Development

Development is the process which changes ideas that result from the research process into commercially viable products or processes.

Development is a costly and complicated process, which for some products may take many years. Concorde was originally conceived in 1962, but it did not enter regular service until 1975. Development of pharmaceuticals can take years as they progress through different stages of testing until approval is achieved.

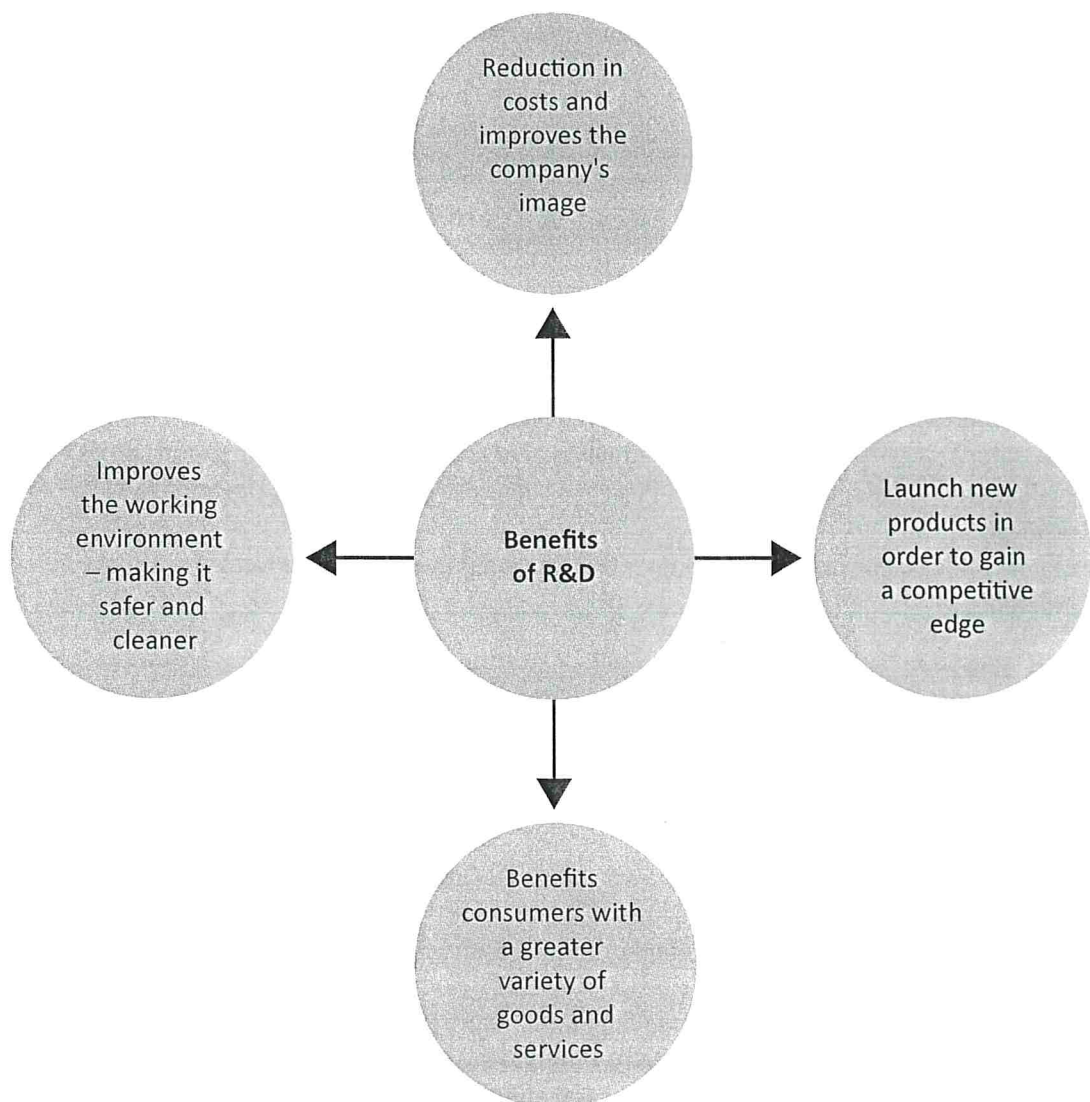
It is important that businesses reduce the development time of new products. Shorter product life cycles are now the norm. Prior to the turn of the century, with a few cosmetic adjustments, a car model could last a decade. Now, for motor manufacturers to stay competitive, a new model launch or major revamp of an existing model three times a decade is the norm. Development can be phenomenally expensive, costing hundreds of millions of pounds for car manufacturers, and even then success is not guaranteed.

The product design and development process

The development of new products have a number of distinct stages which takes the idea through to the launch:

1. Identification of problem
2. Research
3. Development of ideas and solutions to solve the problem
4. Development of prototypes
5. Final design
6. Testing
7. Manufacturing and launch.

Why invest in research and development?



Research and development is needed by businesses because in most markets there is a constant requirement for invention and innovation to keep up with competition and attract customers. New products are required not only for a business to grow, but also to survive. It is often the case, however, that other businesses can wait for others to take the risk of launching new products or technologies and then move into the market

once an idea has been proven. The expression, 'it is the second mouse that gets the cheese', is one that is worth remembering and copycat behaviour is often well rewarded.

Which type of companies rely on research and development?

For pharmaceutical, aircraft and electronics companies R&D is their lifeblood – without new products they will die. This is because their existing products are guaranteed to be redundant within a relatively small number of years as customers demand new and improved versions.

For a second group, which include car manufacturers and the construction industry, R&D has an important role to play: but in these industries there can be an element of waiting to see what the competition are up to. For example, it was only with the launch of the first successful SUV (Sports Utility Vehicle) that design departments in major motor companies throughout the world suddenly became covered in drawings of the Qashqai, Duster, Evoque and the like.

For a third group R&D can take a back seat – instead marketing comes to the fore. This group of industries includes retailers, who often just borrow ideas from each other.

UK businesses and R&D

In the past Britain had been a world leader in research. One study showed that of all the inventions and resulting products of the last 60 years that had a major effect on people's lifestyles, over 50% were originally conceived by British businesses, British inventors or British research scientists.

However, research and development has to be budgeted for as it is a **highly expensive business activity**. Companies must reinvest profits into R&D to grow. For many years Britain has had a poor investment record in this area, with many companies looking for short-term gains and profits. Such companies turned away from organic growth (growing from within) to easier external growth (takeovers and mergers). More recently there has been some reversal of this trend. Businesses have started to link with universities, providing funding and research fellowships, so that the latest science and technology can be used in R&D. Money is now more often used for pure research and many universities now have science parks attached to their campus, where small companies develop ideas that are based on university research work.

Product life cycles and R&D

Effective research and streamlined development shortens life cycles and is also used in a response to shorter life cycles. The example of cars used above demonstrates how R&D allows businesses to stay competitive, but also forces continually higher spending on R&D.

One effect of this shortening of product life cycles is that small businesses find it hard to survive because of the resulting R&D costs. In the UK, Lotus, Rolls Royce and Aston Martin have all become parts of larger motor groups as a direct result of being unable to afford the increased costs of R&D spending, which were necessary if they were to stay competitive.

Market research and R&D

Market research can be the foundation of targeted R&D. If latent (unfulfilled) demand is discovered, then products need to be developed to meet this demand. This product development to satisfy market demand is part of being market-orientated.

Also, market research is used to help develop existing products. Market research is continuously being carried out, with the objective of discovering consumer attitudes to products. Product revamps and redesigns often occur as a direct response to market research findings.

NB – A common error learners make is to confuse research and development with market research. They are very different things, even though market research may lead on to R&D taking place. Learn the definitions thoroughly and you will not make this mistake.

Discussion themes

'Businesses that do not invest in R&D are doomed to failure.' To what extent do you agree with this statement?

Why is R&D considered risky by some stakeholders?

Evaluate the costs and benefits of innovation for a business and its stakeholders.

Why did the Canadian business buy this UK-based business?

Cardiff University spin-out technology firm Mesuro acquired by Canadian firm

<http://www.walesonline.co.uk/business/business-news/cardiff-university-spin-out-technology-firm-8530959>

The importance of research and development questions

Define the key terms (see box 1)

Innovation	
Invention	
Research and Development (R&D)	

For individual companies, R&D improves:

Where are major breakthroughs more likely to come from?

Why is R&D important for businesses in niche markets?

Why do confectionery manufacturers continually develop their products?

How much do GlaxoSmithKilne spend on research and development each year?

What does the company Wipro do?

Which companies are the most competitive in world markets?

The importance of research and development

Research and development is important for the economy as a whole and for individual companies. Tim Mason explains why

Research and development (R&D) has an impact on a country's competitiveness and is one of the 'drivers' of a country's productivity increases (other drivers being investment, skills, enterprise and a competitive environment). The *UK Productivity and Competitiveness Indicators 2003* (published by the Department of Trade and Industry) show that UK firms are undertaking less R&D than their competitors, and that the gap between

R&D in the UK compared to other major economies has widened.

For individual companies, R&D improves performance as it leads to higher sales growth, more value added per employee, greater productivity and increased market value. Andrew Summers, chief executive of the Design Council says that:

Whatever pressure they may be coming under, companies need to take the long-term view. Let up on product development [in a recession] and you will quickly be left

behind. If everyone else is cutting back, then the companies that continue to innovate will be the ones with a clear competitive advantage when the economic climate starts to improve.

Box 1 provides definitions of R&D and the related activities of innovation and invention.

R&D and innovation

Big companies rarely invent anything; they are more likely to be innovators, and much of the innovation that takes place is incremental. Major breakthroughs are more likely to come from small firms or individuals who exploit their invention to create commercial ventures. Inventions by small American firms in the twentieth century included air conditioning, hydraulic brakes, the integrated circuit, soft contact lenses and the humble zip fastener.

It should be appreciated that R&D is not only concerned with *product* innovation, but also with *process* innovation. In other words, it is not just about developing new products or improving existing products, but about developing new processes for producing existing products and services.

Innovative ideas may not be the result of R&D. For example, Wal-Mart introduced

Box 1 Some definitions

Innovation is the successful exploitation of new ideas. Innovation leads to new products, processes and services, and to novel forms of delivery, leading to higher value added.

Invention, according to the *Oxford English Dictionary*, is the act of 'coming upon or finding: discovery'.

Research and development (R&D) can be defined as the investment in, and the application of, technology, and the investment in people and laboratories to develop new, or improve existing, technologies.

'cross-docking', where goods are shifted straight from suppliers' trucks to trucks heading for the company's stores without ever hitting the ground at the distribution centre. This innovation is vital to the company's ability to offer lower prices, the source of its success. However, Amazon, which was one of the first online retailers, regard its patent for one-click internet purchasing as very valuable and an example of an innovation that was developed by their R&D department.

R&D and competition

R&D is important for businesses in niche markets. They need to innovate continually and incrementally as product life cycles become shorter and 'blockbuster', new products become harder to find. Gillette, for example, prides itself on its innovation — 'Innovation is Gillette' its website proclaims. The successor to its popular, three-bladed Mach3 range of razors is the world's first vibrating 'wet shave' blade. Like many companies, Gillette grows through sustaining innovations; developments that do no more than improve on existing products for existing markets. Innovations are more rapidly copied by competitors, pushing down margins and transforming today's consumer sensation into tomorrow's commonplace commodity.

Confectionery manufacturers also have to develop their products continually. This is a highly competitive market and it is important to find new products to gain a competitive advantage. Mars, for example, developed an ice cream version of its classic chocolate bar, which resulted in other companies copying the idea. Mars has recently brought out a new version of the Mars bar.

In electronics, things do not stand still. Apple developed the iPod which quickly became a fashion icon, but it now faces competition from similar products from Sony and Samsung, among others.

One area where Britain does do well is pharmaceuticals. The UK is only second behind the USA for R&D expenditure in pharmaceuticals. Britain's biggest company in this area is GlaxoSmithKline (GSK) which spends £2.7 billion a year. It has various drugs in development which it hopes will do well in the near future. These include a daily pill to treat cancer, which has had good early results in treating breast cancer; drugs for heart disease and asthma; better painkillers and anti-depressants and new diabetes treatments. GSK needs to produce a succession of new and innovative drugs because once its patent runs out, it faces competition from other firms, particularly in less-developed economies. A patent only protects an innovation for 15 years.

According to a recent article on innovation in the *Economist* (24 April 2004), the companies that are most successful in the pursuit of innovation are those that have learnt to let it permeate every aspect of their activities each and every day. These companies inspire their people to pursue innovation with a real passion, create unique products and services through a highly effective blend of formal and informal processes, and connect closely with their customers and markets.

Outsourcing R&D

Like many other aspects of business, there is a trend to outsource R&D. For example, Wipro employs 6,500 people in Bangalore, India, doing R&D for others, including nine out of ten of the world's top telecommunications equipment manufacturers. Cisco Systems, which makes routers for the internet, effectively did the same thing in the 1990s by buying a succession of successful start-up businesses funded by venture capital. It was able to bring together the marketing expertise of a large corporation with the innovative flair of small companies.

This begs the question: how much should a business spend on R&D? New products, ideas and processes are obviously important, but it is questionable how much radical innovation comes from large companies. Most of what they do consists of small improvements or changes to exist-

Box 2 Dualit

Dualit is an example of a company which does well with innovative products. About 90% of toasters sold in Britain are made in China, although toast is not on most Chinese breakfast tables. Dualit spent £100,000 developing a new heat element, a flat panel instead of the easily broken wires in most toasters. The panels provide an even spread of heat and are 'virtually impossible' to damage. The company also spent £120,000 on a Vario toaster which heats rolls and toasted sandwiches as well as ordinary toast. Dualit's managing director commented that 'if you do not come up with novel products and new business ideas, you will not be in business much longer'. Dualit had sales of £12 million in 2001, with sales growth of 10% a year.

ing products. In many cases, significant new products are simply copied and firms make little money out of them. AT&T, the giant American telecommunications company, invented the transistor in its Bell Laboratories and, like Xerox, which invented the computer mouse, never made a penny out of it.

Conclusion

R&D cannot be ignored either for the individual business or for the economy as a whole. The evidence is clear that those countries which spend more on R&D are those which are the most competitive in world markets. Successive UK governments have tried to encourage British firms to spend more on R&D but with limited success. Dyson provides a well-known example of an innovative firm and Dualit (see Box 2) provides another. However, Britain needs to spend more on R&D outside the defence, pharmaceutical and health industries. We are particularly weak in electronics and IT, and in the broad engineering sector.

Tim Mason is Head of Economics and Business Studies at King Edward's School, Birmingham.