



Fuelling the Digital Revolution

INTRODUCTION

The word 'digital' first became popular with the introduction of the 'digital watch'. A watch displaying the time with a digital reading was a completely new concept that excited a generation. However, other than highlighting what were then **leading-edge technologies**, there were few benefits. Wearers had to press a button to find out the time, which was inconvenient. It was argued that the watch was so **product-focused** that it put technology before ease of use. However, few realised that these digital representations heralded a new world based upon digitisation. Instead of digits simply being associated with numerical displays, they have now become the basis for representing data, providing instant information and much more. Today we send messages, documents, images, programmes and much more, from millions of data-bases. This enables us to communicate, buy and sell, bank, access information and be entertained through interactivity. The result has been a revolution based upon digitisation.

The ARM Building, Cambridge

The high technology organisations investing heavily in **research and development** (R&D) are creating the products which are transforming our lives. ARM is one organisation that has focused on the creation of ideas and technical methods through research and development. As users of high technology products, we often attribute the technology that makes them work to the brand name that appears on the outside of the product. In most cases, however, the manufacturer of the product will have bought in the creative technology that allows it to function. In fact the chances are that you have used a product powered by ARM technologies within the last hour. It could have been a mobile phone, a handheld personal organiser or a PC as you surfed the web. This case study focuses upon how ARM has developed a global influence despite being a relatively small player in a fast-moving industry. It has achieved this influence through investment in R&D.

ARM

The first ARM powered processor was used on a desktop computer back in 1987. ARM was then no more than a small design team working within the Acorn Group, a company that developed computers for the educational market. ARM was established as a separate company in 1990 with only 13 employees housed in a converted barn near Cambridge. The early aim of the business was to establish a design that would become a standard for the digital world. The area chosen for the business to focus upon was the research and development of silicon chips within the emerging digital marketplace.

ARM is not a manufacturing company. Instead, it creates ideas and technical methods. These can be used by its global partners to form the 'architecture' or 'design and performance' of powered chips in digital products. Its operations involve the design of the chips as well as the software that operates them. The results of ARM's design and development enables the largest chip companies in the world to manufacture their high-performance chips.

The process

Research and Development

Expertise in Design

Innovative Engineering
with Global Partners

Birth of Digital Products

ARM's expertise in design, combined with innovative engineering from global partners has brought a wide array of electronic products to life. These include some of the more obvious applications such as mobile phones, personal computers and Global Positioning Satellite Systems to less obvious applications such as advanced braking systems in cars and on-board diagnostic systems.

ARM was **float**ed on the London Stock Exchange in 1998. However, as a company with a global reach, it is also quoted on the Nasdaq, which was established in 1971 as the world's first electronic stock market and America's leading market for foreign listed companies.

The ARM business model

Technology spreads quickly in the global economy and goods can be made in low cost countries before being shipped to developed markets. Companies make themselves unique by being at the forefront of technology and developing products that others find hard to imitate. The source of this **competitive advantage** is 'knowledge'. Today, more than ever, we live in a knowledge-based economy where the capabilities of businesses determine success. This can relate to the concepts they develop, how **entrepreneurial** they are, how ideas are used and the strengths of partnerships they make.

ARM is built upon developing **intellectual property**. This is the use of scientific research and development, combined with ideas and a deep-rooted understanding of the market, to create unique and highly sophisticated products. As well as its own research, ARM has a partnering business model, with joint research and development programme with universities, companies and other organisations. From these activities it draws its income from two sources:

1. Licensing – authorising others to use the technologies developed, from which a fee is drawn.
2. Fees – based upon each chip manufactured by licensed companies.

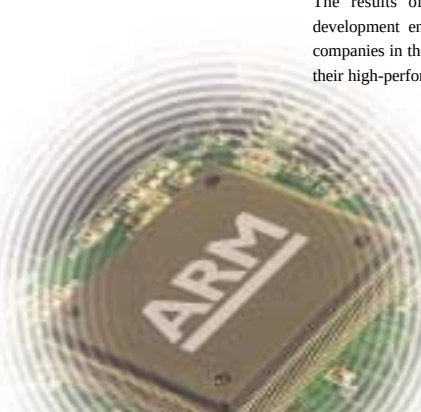
Meeting the challenges of the knowledge-based economy

With ever-increasing emphasis upon knowledge, ARM has become a business built around intellectual property. It has become the world's leading supplier of intellectual property to the silicon chip industry, by creating a unique chip design with high performance and low power consumption.

ARM's technology provides its partners around the world with the opportunity to develop new products based upon its architecture. An ARM powered chip is the driving force behind those products - it is ARM's expertise that has brought products to life.

A key element of the intellectual property is re-usability. For example, all ARM powered chips are based upon the same architecture and platform - making them compatible with an increasing number of products as the range of applications expands. Knowledge has thus become an **external economy of scale**. As the industry has grown, the body of knowledge developed by ARM has increased. This means that the software written in the early 90s can also be used in chips today.

www.arm.com



Creating a culture of participation

In recent years there have been two clear changes in the business world. These are:

1. the emergence of **dot.coms**
2. large organisations having been broken down into smaller separately managed units.

Smaller units are able to place more value upon people and encourage them to take ownership of their ideas and responsibility for the issues that face them. With only 500 employees ARM has created a participative working environment, encouraged by a range of incentives such as stock options. Ambitious goals are met by ambitious people. The challenge for ARM is to stay at the forefront of this rapidly evolving digital world, so its architecture continues to be used across an increasing range of applications.

Partnerships

Partnership is part of the culture of ARM. Within the process of research and development, ARM is involved in joint programmes with a range of different organisations, including universities. At a **micro** level, individuals within the organisation have the power to champion a cause and collaborate with others to initiate change.

As ideas and concepts are extended within an organisation, partnerships then develop at a **macro** level. This partnership model involves working with customers such as Intel, IBM, Sony, Sharp and Toshiba. Partnerships help to create a global community that includes many independent ideas and product developments. Collaboration within this community has encouraged the market to grow at a faster rate than a company could stimulate on its own.

ARM also works with its own suppliers such as Development Tool partners who help to extend the capabilities of

ARM's technologies. By helping ARM to improve its intellectual property, these partners are creating a virtuous circle which is also enabling them to expand their own businesses.

Given the highly-focused and research-based strength of ARM, there are many different partners. Each partner has a valued contribution to make to specific customer needs and applications, enabling designs that result in customers developing highly focused consumer products. One definition of a partnership is that it involves "the sharing of risks and profits in a business venture". Not only do they provide benefits for those involved, they also provide a route for new ideas to get to the market quickly and efficiently. Working with partners also means that the business has total customer focus. The final users of chips based upon products from organisations such as Yamaha are also the customers of ARM, albeit a stage further down the supply chain.

Summary

Branding and the reassurance that certain names provide has become important within an increasingly complicated marketplace. It is easy to think that it is just the very large companies that are transforming products or services. However, one stage behind many of these companies is the intellectual property developed by companies that have invested heavily in research. In this business environment where so much is **outsourced**, smaller organisations such as ARM can have an enormous influence upon the everyday lives of people across the globe.

ARM has become a world leader. It supplies innovative architecture for advanced system chip designs and has created a participative culture that enables it to work with its partners to provide solutions and global support for a new age. Modern life includes 'chips with everything' from using the Internet, booking seats on an airline,

using your credit card, digitising notes, using your personal computer, shopping, using your mobile phone or simply being entertained within your own home. Behind all of this technology is ARM, an organisation that is using its research and development to extend the possibilities for tomorrow.

GLOSSARY OF KEYWORDS

Competitive advantage:

The distinctive elements of products and processes that enable an organisation to offer a better product or service than others in its industry.

Dot.coms: Companies trading or communicating through the Internet.

Entrepreneurial: The combination of ability and risk-taking to use ideas as a basis for developing products that satisfy customer needs.

External economies of scale:

Advantages benefiting a whole industry as the industry develops and grows.

Floated: The 'launch' of a business on a stock exchange with the sale of shares and other securities raising capital.

Intellectual property: The development of leading-edge knowledge as a result of scientific research.

Leading-edge technologies:

New technologies incorporated in products that initiate a process of transformation.

Macro: Outside the organisation.

Micro: Within an organisation.

Outsourced: Buying in of goods and/or services from other organisations.

Product-focused: Products that are focused upon innovation rather than usability or the wishes of the consumer.

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QUESTIONS

- 1 Provide two examples of digital products that you have used so far today.
- 2 Describe where ARM obtains its income. How are such income sources different from those of a traditional manufacturing or trading company?
- 3 Explain what is meant by a knowledge-based economy.
- 4 Many organisations have broken into smaller units through a process known as dis-aggregation. What are the benefits of this process?
- 5 Evaluate how ARM could use its experience and strength developed in recent years to further develop its influence in global markets.

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