

New technology development in the primary sector

Introduction

Anglo American is a UK **public limited company** that operates on a global scale, with mines in Africa, Europe, South America, Canada, Australia and Asia. It is one of the world's leading mining companies in the **primary sector** involved in the exploration, extraction and processing of metals and minerals. The commodities it mines include platinum, diamonds, copper, nickel, zinc, phosphates, iron ore, manganese and coal. Anglo American is the world's leader in extracting platinum and diamonds and is also a leading producer of coal.

Exploration and **technology** development are key **competencies** for Anglo American. The company is continually looking to discover new mineral sources around the world and to develop new technologies which will give the business **competitive advantage**.

Anglo American plays an important part in the world economy. Nearly 76% of its employees live in Africa and it is also a major employer in Europe. For example, its Tarmac aggregates and construction products business employs nearly 7,000 people in the UK. Anglo American is dependent on being able to access a constant supply of mineral deposits. These deposits need to be economically and efficiently extracted and this requires the business constantly to develop new products and processes.

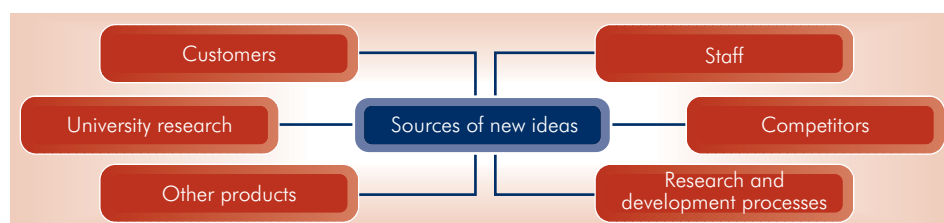
In a fast-changing world new technology development is crucial if organisations want to maintain their **market position**. **Research and development** into new products and processes helps organisations to become more efficient. It can lead to cost-cutting and the speeding up of production times. It also helps to meet the needs of customers more closely.

This case study focuses on new product and process development. It illustrates how the Anglo American Group's strong capabilities through its Anglo Research and Anglo Technical Division make new technology development possible.

New technology development

New products, processes and services are created through **innovation**. Anglo American focuses its research on improving the performance of its existing processes, developing new competitive processes and supporting the wider organisation through specialist mineralogy and analytical services. This enables its customers to benefit from shared **best practice**, as well as from the development of **emerging technologies**. These are new, often specialised technologies that may be used in mainstream business applications to improve safety, reduce energy, increase water usage efficiency, lower overall production cost, enhance product qualities or increase a company's ability to recover value from its activities.

As organisations develop, they are constantly looking for new ways of doing things and of meeting customer needs in a better way. There are many different sources of ideas for new products and processes.



CURRICULUM TOPICS

- Research & Development
- Innovation
- Technology transfer
- Product testing

GLOSSARY

Public limited company: a company whose shares are traded on the London Stock Exchange. They are denoted by the initials plc.

Primary sector: organisations engaged in the extraction of natural resources.

Technology: the application of science and ideas to the development of new products and services.

Competencies: areas of activity in which a firm or individual is particularly strong, e.g. research and development, product innovation.

Competitive advantage: a strategic element that enables an organisation to compete more effectively than its rivals.

Market position: consumer perception of where a brand or company name exists relative to other brands and names.

Research and development: processes that involve investigating new ideas for products which are taken forward to be test marketed.

Innovation: using research and development to create new products, processes and services.

Best practice: the development of performance standards. These are based upon the most efficient practices within an organisation.

Emerging technologies: new technologies that are currently being developed.



GLOSSARY

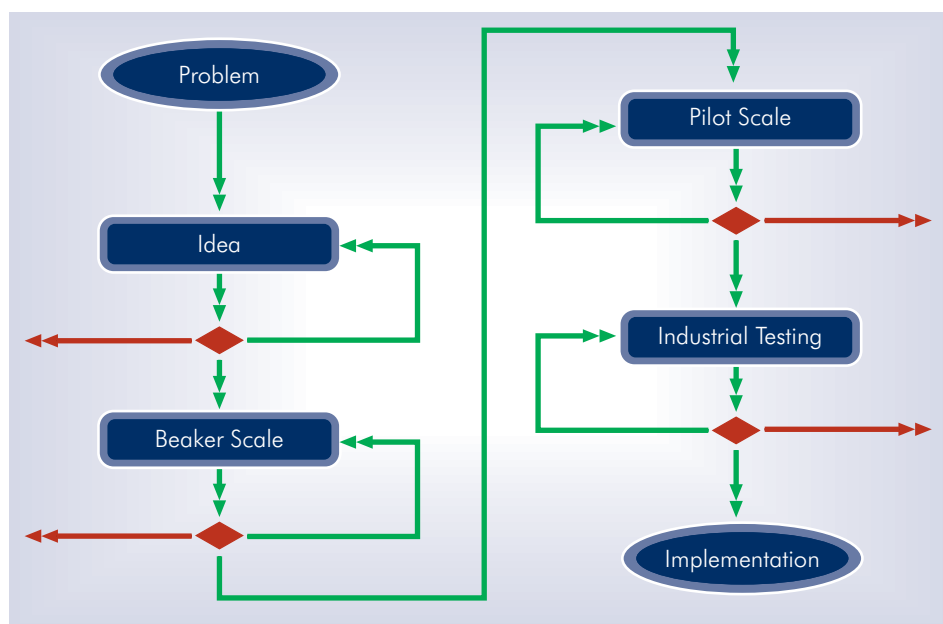
Technology transfer: the process of transferring research into the commercial environment.



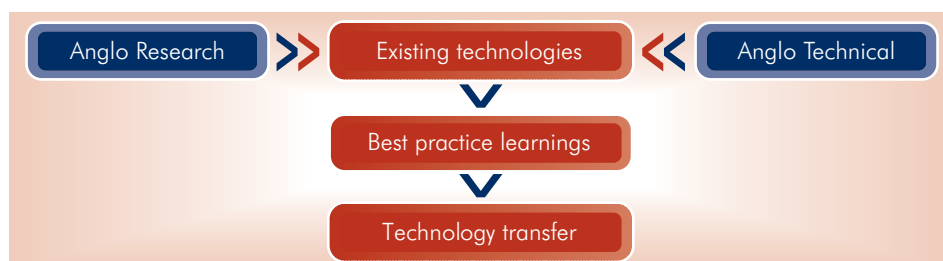
Before a new product or process is launched, it has to go through a series of phases of development. These phases may take place over a number of years:

- The development starts with a well-defined problem that the business needs to solve.
- Once a new idea to address the problem has been identified, the next stage is to produce a structured development plan.
- The development plan will identify what business need the new product will fill.
- The plan will also identify many of the features and benefits the innovation will deliver.
- It also involves estimating the costs of testing an idea, which sometimes means that alternative solutions have to be evaluated and compared for cost-effectiveness.

Anglo American uses a 'roadmap' to show the stages from problem to implementation. This helps to assess at regular intervals whether the idea helps to solve the problem. The red arrows on the diagram indicate specific milestones when the technology under development is reviewed. At these points, a decision is made whether to progress to the next stage or not. If, for example, the technology does not meet expectation or is too expensive, then the plan may have to change or stop altogether.



Undertaking research requires considerable expertise. Anglo American has its own research division called Anglo Research. Anglo Research aims to spread and apply best practice in existing technologies across the Group and to identify emerging technologies. It engages in **technology transfer** across the whole organisation to make sure all parts of Anglo American use the best technologies in the best way. Anglo Research pioneers new technologies in order to improve the performance of Anglo American as a whole.



Anglo Technical, a sister organisation of Anglo Research specialising in various engineering fields, also develops new products and processes. One important field involves geoscientists, electronic engineers and various specialist consultants working together. They aim to enable Anglo American to develop innovative methods of exploration, such as in the use of magnetic sensors. These sensors help to minimise the impact of Anglo American's activities on the environment. For example, by conducting initial exploration from the air, testing on the ground is reduced. At the same time, the work of these teams ensures that Anglo American can mine and develop the supply of raw materials that it needs.

Research and development

Research is the first stage in new technology development. Research starts with a problem and gathers, records and tests data to find a solution. Development involves working out the details of the solution, such as what materials for construction are needed or if the new process will integrate with existing systems. Anglo Research uses its expertise to develop ideas and identify solutions to technical problems and issues. For example, some new mineral and metal deposits are difficult to mine economically in traditional ways and need a new approach. Once Anglo Research has provided the results from the research to guide the new process development, Anglo Technical provides the specialised engineering and technical skills necessary to carry out the development of the process.

Anglo Research and Anglo Technical have five broad roles that support the best application of existing technology and the development of new technologies:

1. Providing support in safety and sustainable development, for example, developing a collision avoidance tool. This warns drivers about vehicles which are outside their field of vision.
2. Reviewing the activities of the organisation to ensure that appropriate technologies are used in existing and new operations, such as in improving energy efficiency in the mechanical processing of **ore**.
3. Collaborating across the Group to implement new technologies that improve efficiency. Anglo American experts from countries across the globe come together to share latest developments in extracting metal from ore.
4. Identifying best practice and transferring this across the organisation through the setting up of common standards across the company.
5. Supporting technical human resources across the business. Talented people at Anglo American have the opportunity of a career across the whole Group and are not limited by geography or the organisational structure.

In extracting minerals there are many challenges. Much of the world's surface has already been explored. This means that it has become more difficult to find mineral and metal deposits. Anglo American employs more sophisticated techniques to find hidden minerals. For example, it uses aircraft, helicopters and satellites to map geological structures and identify subtle patterns in surface rock, the earth's magnetic field and variations in the gravity field. Anglo American can then use this information for targeting sites that might have the potential for mineral deposits. Anglo American undertakes two types of exploration:

- Brownfield exploration takes place around or near to existing mines. It involves the discovery of resources close to existing operations.
- Greenfield exploration focuses on identifying new or previously undiscovered mineral deposits. Around 60-70% of reserves come from Anglo American's Greenfield activities.

From testing to launch

New processes need to be developed and tested before being implemented at full scale.

Computer modelling may be used for testing a new idea with little cost before production starts. As part of the new product development, it may be necessary to create samples, **prototypes** or working models for testing. At Anglo American, a new process idea is first tested at 'beaker scale'. This means very small scale, almost like in a laboratory. Then a small pilot plant is set up. The product or process implementation is the final stage. By developing new technologies and transferring them to all areas of the Group, Anglo American is able to share ideas to maintain its global strength. **Sustainable development** is particularly important to Anglo American. A focus on sustainable development means the company sources minerals for present needs without harming the ability of future generations to access similar resources.

Anglo American's research and development capability is vital to the business. Its ability to develop new products and processes keeps the Group at the forefront of technological developments. For example, in the field of metal extraction from ore the Group has developed a new process to handle lateritic nickel ores. This type of ore occurs on the surface of the earth and has weathered extensively. This means that it requires a lot of effort to extract the metal, involving a great quantity of chemicals and/or energy. It contains the richest sources of nickel but existing commercial processes to extract it are expensive and do not generate a healthy **return on investment**. The new process being developed by Anglo Research aims to minimise use of these chemicals and reduce the energy needed for the process. It has been designed to help Anglo American to use the difficult nickel ores that contain the bulk of the world's available nickel metal more economically.



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GLOSSARY

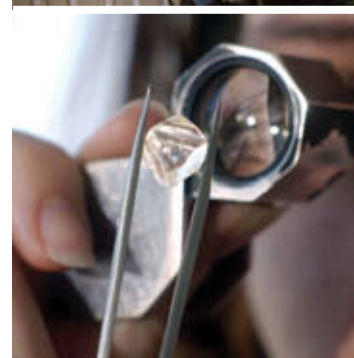
Ore: a type of rock that contains minerals such as gemstones and metals that can be extracted through mining and refined for use.

Computer modelling: using a computer to develop a model of a process or product. Mathematical modelling can also be used for testing a new product or process.

Prototype: a working model of a process or product.

Sustainable development: development which meets present needs without compromising the ability of future generations to achieve their own needs and aspirations.

Return on investment: the return on the funds invested in the business.



GLOSSARY

Corporate social responsibility: the responsibility of an organisation to a range of stakeholders. These include the community and society at large.

Stage	Development of a nickel extraction process
1. Idea generation	Stems from a need for more economical extraction processes for treating nickel laterite ores.
2. Project plan	Identifies the features and benefits required of the process and considers the likely costs involved with its development.
3. Research	Anglo Research uses its expertise to identify how emerging technologies could be used or combined to solve this problem.
4. Process development	Engineering companies and Anglo Technical Division provide the specialist technology skills to support the financial evaluation and engineering design of a full scale plant.
5. Pilot testing	Testing is carried out for functionality, safety and efficiency. A small process plant is designed and built and is run for several months to improve understanding of the new process.
6. Implementation	The process is tested at almost industrial scale and a suitable location for the plant is chosen, before full scale implementation starts.

Influences on process development

A number of factors affect the research and development process. Cost is perhaps the most influential factor. Research does not come cheaply; introducing new technologies is expensive. Investment may be needed for a long time before introduction. It is important that there is a return on investment from the new products or processes once they are launched in order to justify the expenditure on research and development.

Changing technologies are another influence upon product or process development. They provide Anglo American with a different way of meeting the needs of its customers. Changing technologies also have a long-term influence upon planning. Such developments may lead to new processes and the sharing of technologies through technology transfer across the Group. For example, the design and development of a new electro-hydraulic rig has reduced the time needed to drill mine shafts. New developments in conserving and recycling water have made it possible for Anglo American to mine in arid regions of Africa and Australia.

It is also important that primary sector organisations develop their businesses responsibly. Anglo American's business depends on it extracting raw materials from the earth. Anglo American takes a clear and positive approach to **corporate social responsibility**. Sustainable development is built into all its policies, strategies and business practices. For example, the company has developed a Socio Economic Assessment Toolbox. This set of procedures, advice and rules helps to ensure a responsible approach to operating in communities. Every decision is assessed for its economic, social and environmental impacts. This ensures that natural resources will continue to be available for future generations.

Conclusion

Anglo American is not the only mining company in the world. To compete, it depends on being able to access a constant supply of mineral deposits. These resources must be extracted in a cost effective way. In order to remain competitive it also has to take into account the actions of its competitors. In order to keep its market position, Anglo American constantly seeks to develop new products and processes. These rely on ideas, research, improved or alternative use of existing technologies, as well as the introduction of new technologies. Anglo American has sustained its position as market leader in many markets through its capabilities in research and technological development.

Questions

1. Describe what is meant by the primary sector. Give two examples of businesses in the primary sector.
2. Explain the difference between the processes of research and development.
3. What is the relationship between the need for emerging technologies and the process of technology transfer?
4. Evaluate how product and process developments enable a large company like Anglo American to sustain its market position.

