

Community Development Strand

Unit 3: Technology

Module 3.1 Introduction to Technology



Student Support Material

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Unit outline

Unit	#	Modules
Unit 3 Technology 3 Credit Points	3.1	Introduction to Technology (Core)
	3.2	Practical Applications (Core)

Icons



Read or research



Write or summarise



Activity or discussion

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Module 3.1: Introduction to Technology

Rationale

People have always devised and used technology to suit their environment with the basic purpose of **making their lives' easier**.

In Papua New Guinea, people have used technology to exploit and manage natural resources for tens of thousands of years. Today parts of this indigenous or 'traditional technology' are still practiced in rural communities. More often traditional technology is blended with modern technology to create what is often termed **appropriate technology**.

This module will introduce you to the fundamentals and principles of technology with a specific focus on traditional and appropriate technology in the context of community development.

Objectives

By the end of this module you will be able to:

- Describe different types of technologies
- Describe and illustrate examples of traditional and appropriate technology
- Explain the development of technology and evaluate the place of village / traditional technologies in the 21st Century

Suggested topics

1. What is technology?
2. History of technology
3. Appropriate technology

References

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Topic 1- What is Technology?

Objectives

Through this topic you will be able to:

- Explain the nature of technology
- Provide examples of different types of technology

Resources

- Photographs, drawings and artifacts of different technology
- Copies of local newspapers
- Reference books

What is technology?

Technology is the name given to any system where tools, or machines and materials are used to **make-work easier** and often create a different environment. By this definition, it can be seen that technology is constantly changing.

Technology may be described as:

- Traditional or indigenous
- Low or high
- Intermediate and
- Appropriate

Refer to the Glossary to find definitions of these terms.



3.1 Activity 1

Make a list of all the different types of technology you can think of. Sort your list into the different categories as suggested above. With a peer, look carefully at the photographs of technology on the following page. Identify what the technology is and what category it belongs to. For example, traditional, low or high, intermediate or appropriate.



Different technologies: High, appropriate and traditional.

3.1 Activity 2

Study the list of technologies below. List some other examples you can think of.

Low technology	Intermediate technology	High technology
Bush knife	Hand-pushed lawn mower	Ride-on diesel mower
Candle	Pump kerosene lamp	Electric light
Basic Bicycle	Ten-speed mountain bike	Motor bike

Technology consists of hardware and software

Hardware is the physical appearance of technology. The tools, implements, machines, devices and equipment.

Software is the non-material nature of technology. The knowledge, experience, design ideas and management experience that the hardware.

When technology is transferred from one place to another, e.g., from America to Papua New Guinea, it is mainly the hardware that is transferred.

3.1 Activity 3

Think of examples of technology transfer that have occurred here in Papua New Guinea.

Try to identify problems associated with the transfer of only the hardware of a particular technology.

The importance of technology in daily lives

Over 50 per cent of the increasing amount of imports and aid into Papua New Guinea consists of technology. The increasing transfer of western technology has at least two major overall effects:

1. Hardware and software maybe incomplete
2. Traditional technologies tend to be replaced

If this is true, can you provide two examples to illustrate each effect and think of at least one consequence for each effect?

Often introduced technology is taken and adapted and becomes complimentary to indigenous technology. For example, traditional agricultural systems can be improved with modern seeds and propagation techniques such as intercropping, agro-forestry, small-scale irrigation, organic recycling.

Think of one other introduced technology that has supported and improved a local or indigenous technology.



Figure 1: House building, East Sepik



Figure 2 Kaukau mounds, Enga Province

Traditional technologies

The people of Papua New Guinea have invented, developed, adapted and applied technologies creatively to maintain their lives in very specific conditions. For example, in the New Guinea Islands, the marine technology of canoes, navigation and fishing techniques and the sophisticated agriculture practices evolved to cope with growing plants on coranice.

Indigenous or traditional technology is well understood by local people and is the basis of self-reliant development and the introduction of new technology.

Most successful technological innovations are incremental - a step-by-step building upon existing technology. In other words, it is **appropriate technology**.

3.1 Activity 4

Look carefully at the two photographs of house building and of growing kaukau.

Describe the technological skills needed to be able to do these tasks and try to explain why the technology developed in this way.

Topic 2: History of Technology

Objectives

By the end of this topic you will be able to:

- Describe the nature and importance of traditional technologies
- Explore the ways in which traditional technology adapts and blends with modern technology

Traditional technologies

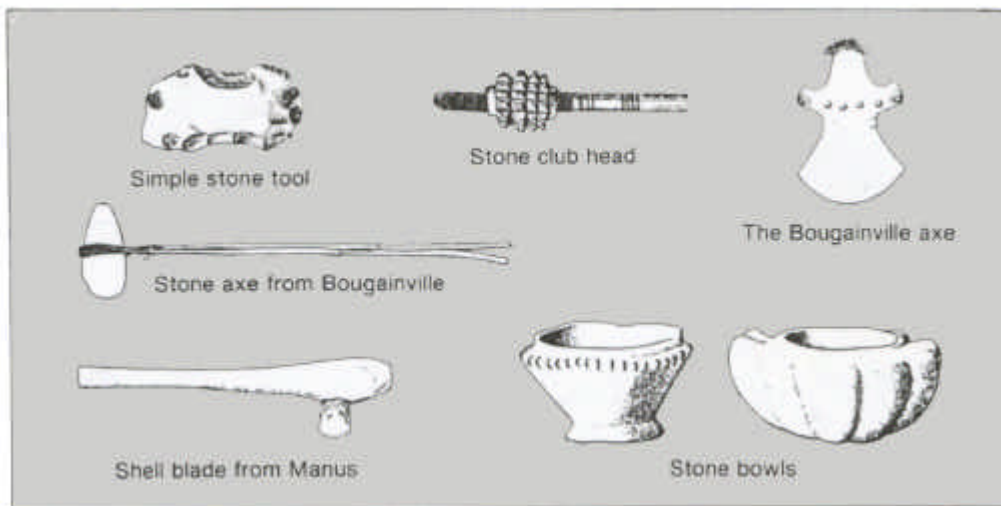


Figure 3: Ancient traditional technologies. Source: PNG's origins, NDOE, 1988

During the past 30 000 – 50 000 years the people of Papua New Guinea have created countless technologies both simple and complicated.

These technologies all had certain characteristics in common:

- They were made from local materials
- They had low negative impacts on the environment
- They reflected the ways of village life
- They showed Papua New Guinean's traditional ability to invent technological solutions to solve problems

Since the introduction of new technologies traditional technologies have been losing their importance.

Why do you think this has happened?

Can you think of examples?

History

In Papua New Guinea, thousands of years before the pyramids were built, people had invented tools for draining swamps and practiced a simple form of agriculture.

In the West large scale production and application of technology began with the Industrial Revolution in Europe. Technology was shaped or developed in the western context, in response to western needs. For example, the steam engine was developed to meet western factory needs for greater and more efficient production. In China, the development of gunpowder, paper and writing and the use of cattle and horses reflected the development of that culture.

Technology timeline

The following technological inventions could be considered the most significant in human development.

Printing press	Domestication of horses, pig and cattle
Domestic rice	Development of steel
Sailing ship	Water pump
Steam engine	Refrigeration
Windmill	Quinine
Plough	Internet
Stone axe	Modern cash crops
Motor car	Fishing net
Guns	Glass
Telegraph and telephone	Radio
Electricity	Television
Airplane	Nuclear fusion
Internal combustion engine	Computer
Penicillin and other antibiotics	Satellites
Silicon chip	Plastic

For different cultures, some of these technologies are more important than others. For example, the development of water pumps and ploughs is perhaps more important to rural Indians than genetic engineering and laser technology. Some technologies are universally important to most cultures, e.g., antibiotics and steel.

3.1 Activity 5

1. Individually read through the above list of technologies and add your own if you feel others should be included.

2. Choose five technologies that you think are the most important to Papua New Guinea generally and to your community in particular.
3. In your groups share your five choices and discuss the importance of these technologies to Papua New Guinea and to your community.
4. As a group choose five technologies that you think are the most important for Papua New Guinea. Be ready to support your choice of technologies with good reasons.
5. Share with the whole class.

As a group you may come up with a **criteria list** to help make your decision.

For example:

Criteria	Example	Yes/No
Social benefit		
Economic benefit		
Educational benefit.		
Appropriate to PNG culture and conditions		

Changing technology

Today, modern technology is changing life in both villages and towns. Many technologies improve people's lives, incomes and makes work considerably easier. Consider the three photographs which illustrate this point. Figure 4 -the outboard motor has allowed river people to travel well beyond their local communities. Figure 5 -the coffee mill has provided an income and made work easier for many people particularly in the Highlands. Figure 6 -the mosquito net has saved lives and improved the quality of life for many people in malaria prone areas.

There are many other technologies which have changed the lives of rural people. Many of these technologies are only sustainable only with outside support.

Try to list at least ten technologies which have revolutionised village life. For example: kerosene, iron roofing.



Figure 4 Traditional canoe and outboard



Figure 5: Coffee bean mill



Figure 6: Mosquito net

3.1 Activity 6

Examine the diagram at Figure 7, which looks at the changes in three basic technologies: stone axe to chainsaw, paddle to outboard motor and garden food to processed food. For each there are favourable and unfavourable effects. Complete the diagram and think of two other changing technologies and the effects.

Present your ideas on a chart with cartoon drawings.

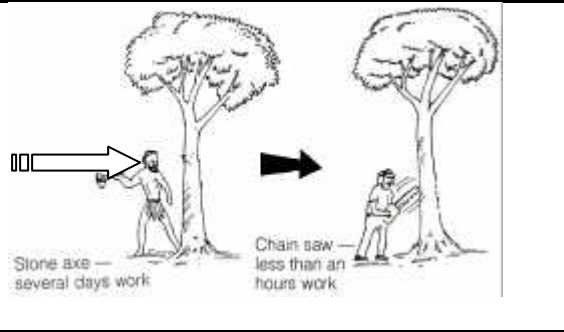
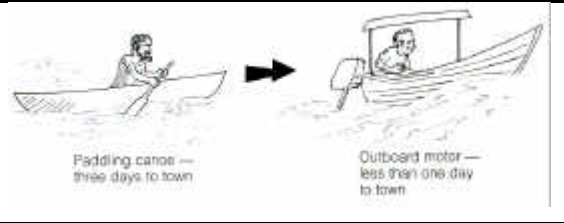
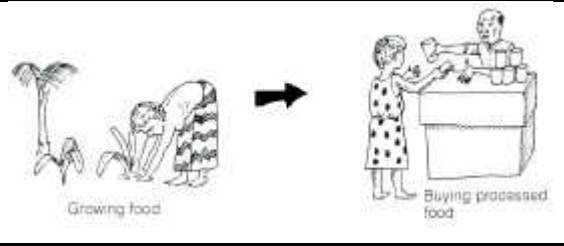




Changing technology	→	Favourable effect	Unfavourable effect
	<p>Gardens cleared quickly, saving time and energy</p>	<p>Reliance on expensive foreign technology</p> <p>Time available for other activities</p>	<p>Can lead to rapid destruction of the environment</p> <p>Loss of traditional food sources and materials</p>
	<p>→</p>		
	<p>→</p>		
	<p>→</p>		
	<p>→</p>		

Figure 7: Changing technology

Think of five examples of traditional technologies that are losing their importance.

Can you think of traditional technologies that are still strong?

	
<p><i>Describe the traditional technologies seen in this photograph</i></p> <p><i>Make a list of the skills needed to build this canoe.</i></p> <p><i>What are the limitations of this technology?</i></p>	<p><i>What are the advantages of using this technology?</i></p> <p><i>Where does this technology come from?</i></p> <p><i>Make a list of the skills needed to build this boat.</i></p> <p><i>What are the advantages of using this technology?</i></p> <p><i>What are the limitations of this technology?</i></p>

Often people see traditional technologies as being too primitive to be useful in a modern country. The growing of cash crops and the entering into the cash economy has seen fewer people staying in villages using traditional skills. As a result, the gradual improvement in local technologies, which was always happening in previous times, has slowed down to almost a trickle.

The blending of traditional and modern technologies is a difficult task. It requires that people know and appreciate both the old and the new. There have been groups in Papua New Guinea who have tried this approach and who have been relatively successful. This approach is a problem solving approach that looks for a solution that matches with the traditions and ways of the people that it is supposed to help.

Topic 3: Appropriate Technology

Objectives

By the end of this topic you will be able to:

- Explain the concept of appropriate technology
- Provide examples of appropriate technology in Papua New Guinea
- Describe and illustrate with examples the importance and application of appropriate technology

What is appropriate technology?

Look at the photograph at Figure 8, which, shows a young boy with spina bifida.

In what ways has this boy's life improved as a result of this technology?

Describe what you think his life was like before this technology was made available.

In what ways is this appropriate technology?



Figure 8 Disabled boy and walking frame

The following economics example may help explain the idea of appropriate technology.

If we define the level of technology in terms of equipment cost per workplace, we can call the indigenous or traditional technology used in Papua New Guinea, symbolically speaking,

K10 technology.

What could be examples of K10 technologies?

The technology used in developed countries such as Australia could be called –

K10, 000 technology.

Do you agree with this description?

List some examples of K10, 000 technologies.

The gap between these two technologies is so enormous that a shift from one to the other is not possible. When many developing countries try to install K 10,000-technology into their economies, the result is that K10-technologies are quickly killed off, destroying traditional workplaces more quickly than modern workplaces can be created. What is required is a technology that ranges between the K10 and K10 000 technologies. Again symbolically, it could be called a K500-technology.

Such an intermediate or appropriate technology would be much more productive than the traditional technology but would also be cheaper than the sophisticated, high capital-intensive technology of modern industry.

Intermediate or appropriate technology

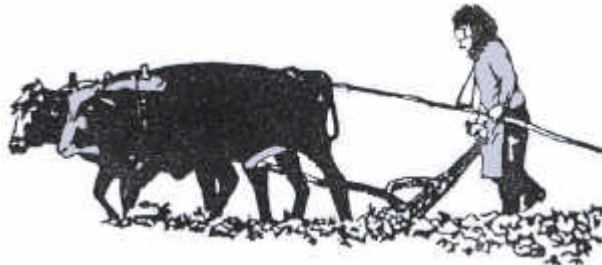
- think of situations where any of these technologies could be appropriate.

Simplest technology

Subsistent farmers clearing bush to establish food gardens. The simplest tools cost little to buy and nothing to operate but the work is hard and slow and produces the least of any technology.



A farmer from Morobe Province tilling the land with a single furrow Plough. The tool makes the work easier, costs little and can be made locally, but a plough pulled by animals is not as productive as mechanised equipment.



A Highlands farm worker learns from another how to operate a modern tractor. The machine is quick and efficient, but is expensive to buy and maintain. It may deprive people of work and be ecologically harmful.



What are appropriate technologies?

Definitions of appropriate technology must acknowledge the importance of sustainability. Like many Pacific Island economies, much of the Papua New Guinea economy relies on aid, and, is sustained by a subsistence economy.

Any introduced technologies must maximise the following characteristics:

Characteristics of appropriate technologies

1. *Technologically sustainable*

- Use local materials and energy
- Build on locally understood technologies
- Use proven techniques, to reduce the possibility of failure
- Provide a product or service of acceptable quality, with high reliability, low maintenance and ease of access

2. *Socially sustainable*

- Involve local people in its development and introduction (ideally responding to a real need)
- Use existing or easily adaptable skills with minimum retraining
- Offer opportunities for further employment and economic activity
- Provide work satisfaction
- Minimise the need for movement of labour away from traditional communities and other occupations
- Can be understood, controlled and maintained by villagers wherever possible, without a high level of Western-style education
- Introduce change gradually, so it does not appear threatening
- Be environmentally harmless
- Avoid disturbance of local customs, traditions and beliefs
- Have beneficial or at least no harmful gender implications
- Does not involve patents, royalties, and consultant fees, import duties, shopping charges or experts

3. *Economically sustainable*

- Require low capital investment per workplace
- Require affordable maintenance
- Provide a competitive product or service
- Provide opportunities for benefits to the people as a whole rather than a privileged group

3.1 Activity 7

The wokabout somil

Use the '**Characteristics for Appropriate Technologies**' to evaluate the wokabout somil in Papua New Guinea. . There is enough information presented in '**Wokabout somil Specifications**' for you to critically evaluate the wokabout somil to see if it is economically, socially and technically sustainable. It is possible that you may find the wokabout somil sustainable on just one or two of these characteristics.

Be prepared to present a full report which gives considered evaluations based on sound reasoning supported by facts.

Possible questions to ask:

- *Is it technologically sustainable? What are the indications?*
- *Is it socially sustainable? What are the indications?*
- *Is it economically sustainable? What are the indications?*



Wokabout somil specifications

Introduction and origin

Portable sawmills have been used in PNG for more than twenty years. The *Wokabout Somil* (walk about sawmill) was the first model widely available. It was developed by an American lay missionary and manufactured in PNG with the assistance of the South Pacific Appropriate Technology Foundation, from 1983. The popularity of this machine saw the import of other more reliable and effective equipment from Australia, New Zealand and the USA.

Wokabout and other types of sawmill became commonplace in PNG. These machines were purchased by:

- Prospective politicians in attempts to win votes
- Elected politicians trying to bring development to their villages
- Missions who wanted to build schools and churches
- NGOs who saw them as a means of bringing about sustainable development

- Donor agencies who saw them as a tool for infrastructure improvement (typically following some natural disaster)
- Entrepreneurs who saw a chance to build permanent housing and generate income

One survey that was conducted estimated that there were up to 1500 portable sawmills in PNG. However only 20% of these were still thought to be in use.

Conservation and development organisations came to realise that portable sawmills presented the opportunity for communities to generate some income without having to destroy their natural forests. Furthermore, such small-scale enterprises could allow people far more control over the pace of development than compared to the option presented by large-scale logging.

Portable sawmills became interwoven with the Integrated Conservation and Development Projects (ICADs) which began to be promoted by the larger NGOs (UNDP, WWF and TNC¹ were all advocating this approach). To indicate that portable sawmill operations were somehow different and more environmentally friendly they became known as eco-forestry projects with the timber produced being called eco-timber, one manufacturer even labelled their machine the Eco-Saw. However, for the people already using the machines or seeking assistance to buy one they remained a Wokabaut

Mobility

Typically, a wokabaut somil can be disassembled into 5-6 parts comprising two end frames, two rails and the carriage (the engine may also be removed on some models). These parts can each be carried by 2-people. Some mills can be carried over quite rugged terrain, it all depends on how keen the workers are!

There are some bigger mills which use the same sort of principle but on a larger scale, these ones you would call transportable and require



4

Figure 9: A wokabaut somil, Ambunti, Sepik River

Cost

About K35-40, 000. It may be possible to check with Farmset who supply the Lucas Mill or Narapela Wei the suppliers of the Lewisaw

Used on what sort of terrain

The PNG Logging Code of Practice restricts industrial scale operations from working in areas of steep (>30 degrees). Mills have been seen working on small terraces on such slopes, however this is perhaps not to be encouraged. So long as the ground under the mill is relatively even and firm, such mills are able to operate. Limitations tend to be set by the ease of winching logs into the mill and carrying the sawn timber out (it would be nice to say that environmental considerations affected practice, however this it is doubtful whether this is case).

¹ United Nations Development Program, World Wide Fund for Nature, The Nature Conservancy.

Weight

The heaviest single component (the carriage and engine is probably about 150-200kg, total weight may be 500kg).

Made in PNG

The original Wokabaout somil was made in Lae. The better machines are made in Australia or NZ. Lucas Mill and Lewisaw, these ones are well supported here.

Portable sawmills as a sustainable activity

Portable sawmills have been promoted as a means for sustainable development because it is assumed that the:

- Impact on the forest can be minimal since they only process a few trees a week and logs can be milled at the tree stump without the need for heavy extraction machinery (e.g. tractor or bulldozer)
- Equipment can be operated after a few days training and therefore provides an appropriate basis for a rural enterprise

These were typical of the initial perceptions of organisations promoting eco-forestry. However, practices which might have achieved sustainable forest management seldom occurred as a result of the sawmill operators own planning. Decisions about harvesting were frequently based on the accessibility and value of individual trees. This could easily result in localised clearances or a decrease in species diversity. Where good management did take place this was likely to have been due the hard work and persistence by the NGOs. Frequently communities that started sawmill projects with assistance from an NGO would return at some point to request for a tractor to help them produce more or reach less accessible areas. All were aware how easy this made the work for the logging companies.

Well managed portable sawmill operations can provide benefits from timber resources whilst largely maintaining the natural forest systems, however the reason these mills have not resulted in major environmental degradation probably has more to do with the fact few operate long enough to cause much damage.

Timber produced using portable sawmills is invariably sold on local markets within PNG. There is a strong demand for sawn timber but this tends to be centred in the urban areas. Saw milling generally takes place some distance from these centres. This inevitably presents difficulties in arranging for deliveries of both timber going out and supplies coming in.

Formal training in portable sawmilling

The Timber and Forestry Training College (TFTC) has offered formal training for portable sawmill enterprises since it was established in 1978. Although the Wokabaout somil was not available until 1983, other machines had already been brought into the country, often by missions.

For a long time before the NGOs discovered eco-forestry the college was the only training provider. Suppliers of equipment never used to get too involved with training, now however they are beginning to sell this service too.

The training provided by the college has emphasised technical skills and safety. For example the college offers a nine-week modular program aimed at small-scale sawmill operators, however only one of the five modules covers business management skills during a single week.

In a paper by Tama (1998), the TFTC gave their interpretation of the causes for the continual failure of so many portable sawmill enterprises as follows:

- Breakdown of engine and other parts
- Inability to make the saw cut as designed
- Lack of funds to sustain the operation
- Problems with sawn timber quality and marketing
- Loss of incentive and motivation to keep cutting
- A lack of expertise in saw milling practice

From this evaluation, it is easy to see why the training given by TFTC has such a technical bias. However since the track record of small scale sawmill enterprises is so poor, then either the training given has not been effective or there are other reasons for the continual failure of projects. Since the technical skills to operate a sawmill are not difficult to acquire even for people not used to such equipment, it would seem that the main problem lies in the business and management aspects of operations, which appear to have been largely neglected by the college.

Source: Tim Dawson, WWF, 1999

Technology for the future of Papua New Guinea

What are the technologies that will help shape the future of this country? Will they be 'high tech' with an emphasis on computers and satellites? Will students in remote places have distant education programmes using satellite communication? Will appropriate and intermediate technologies be the future? As modern technologies such as solar power and micro-hydro become cheaper, more people will have access to them, more lives will be improved and more work made easier.

3.1 Activity 8

Look carefully at the technology you have been asked to evaluate. Use the appropriate technology characteristics and turn them into a checklist to evaluate whether the technology is appropriate for your place. If you conclude that the technology is inappropriate then explain why and come up with an alternative. Prepare a short oral report to the class to explain your



find! Traditional crafts



Western medicine



Micro-hydro power

ROTA-LOO
COMPOSTING TOILETS

Austrian

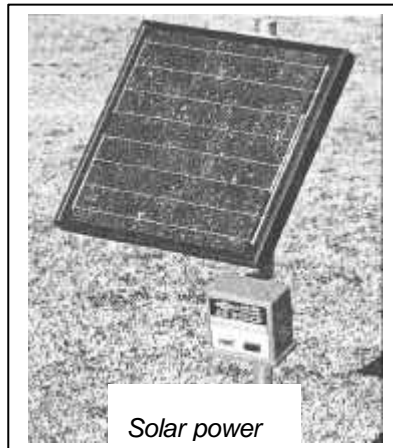
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The right machine for the job

In the beginning before the Europeans arrived, before the missionaries knelt to say their first prayer before Queen Emma planted her first coconut, women worked in the gardens with wooden and stone tools. The men would help sometimes but usually only cleared the garden area, supervised and helped spend the profits from the sale of produce. The work was hard and broke their backs. However, everybody grew enough to eat.

Then came the first expert – a foreign fellow who talked of modernisation, a world where work would be easy and money plentiful. His organisation donated a tractor to work the fields. It roared and worked impressively and the men were so interested that they decided to take over the preparation of the land.

Unfortunately after a month the tractor broke down. A local mechanic looked at the tractor and told the people that there were no parts available but that some could be ordered from Australia. Meanwhile the women had gone back to preparing the land and the men to supervising. The tractor was pushed under a tree where over the years children even girls played on it.

The second expert came ten years later.

He told the villagers how Western technology particularly tractors were no good for Papua New Guinea conditions. How it put them into debt. He promised to bring them a simple machine made from local materials that they could use to plant and harvest, kaukau and peanuts. He explained that it would save hours of backbreaking work and give the people time to do other things. When the machine arrived it looked very impressive but it worked by someone riding a bicycle. In the village, only women plant and harvest peanuts and kaukau and only men ride bicycles. The bicycle planter-harvester was not as interesting as the tractor so it was left beside the tractor under the tree.

Some years later another expert arrived at the village and, ...

Write a story explaining the approach taken by this person and the solution.



Some years later another expert arrived at the village and stayed for two weeks not just a morning. Instead of describing her wonderful machine she simply asked: "What do you need to make your work easier in the garden?" She asked the women as well as the men and sat with the village people talking with them about their life and how it could be improved. Eventually the villagers decided that what they wanted most were hoes and steel spades that wouldn't break when they worked in the garden. They discussed how to get them with the outsider. It was decided that the local vocational training college would be asked to make the tools and some village youth would visit and learn how they were made.



Glossary

Appropriate technology	<p>- is the term used for a wide range of technologies characterized by one or more of the following :</p> <ul style="list-style-type: none"> • Low investment cost per workplace • Low investment unit per output • Cheap and adaptable • Local materials and maintenance <p>Flexible and adaptable to a particular culture and environment</p>
High technology	- sophisticated and often-expensive technology used for a specialized tasks. For example, electronics, digital camera, satellite navigation.
Hardware	- a term borrowed from the computer industry, it is the physical structure of technology. The tools, implements, machines, and equipments.
'High tech'	Usually sophisticated and complex. Highlighted by the most modern components and marketing.
Incremental	- a step-by-step building upon existing technology
Intermediate technology	A technology that fits the needs of a group of people and may lie somewhere between high technology and low technology.
'Low tech'	Usually one of the simplest forms of technology which is easy built and or maintained by local people.
Software	- is the non-material dimension of technology. The knowledge, experience, organizational means, design ideas, ...