Technology is one of the instruments widely used by populations to determine their development and impose conditions on other populations or cultures. The current technological invasion from the First World into the Third World moves authorities, technicians and even the population at large—who lack a clear vision and common sense—to accept a technology that can be more harmful than helpful. Except for the few cases in which the great First World technological cauldron brews up mechanical devices and contrivances—that the author calls “Martian boxes”—, the only option for developing countries is to commit themselves to a true and honest selection strategy on the one hand, and to developing their own local technological policy on the other hand, trusting in the knowledge and cultural potential of their own society.

1. Technology

The constant development of humankind throughout history is indissolubly linked with the evolution of human knowledge and with the practical use of wisdom resumed in devices and gadgets. This is known as “technology.”

Technology has been one of the most powerful instruments through which people conditioned their neighbors or rivals. The Achaeans conquered the Sumerians by using the arrow, the Hittites with the war chariot, the Dorians with iron.

On occasions, simple technological facts, such as the transition from the short bow to the long one, the support pedestal for the arquebuse in the 15th century and its substitution by the musket a hundred years later, or the addition of the stirrup to the saddles of German people who in the Middle Ages checked the advance of the Saracens, were small modifications that changed the course of history. There are hundreds of such examples, perhaps even thousands.
The science boom began during the Renaissance in the 15th century, and scientific development became sustainable. Human ingenuity connected new knowledge with practical applications and modern technology was born. In the last century, technology was consolidated during the Industrial Revolution.

This technological process was so powerful that it has become one of the most important factors in the situation we have reached today at the threshold of the 21st century. Fair or unfair, reality shows that there are now two parallel but highly differentiated worlds.

**A developed world** ("First World", "the North", "industrialized countries") and a **developing world** ("Third World", "the South", "countries in an industrialization process"). A rich world and a poor one. Two universes with different standards in every field: from nutrition to disease, from housing to education, from recreation to information; global and per capita income clearly differentiated for each world; different needs; and different political and strategic requirements.

The developed world is so capable and powerful that it continuously imposes conditions on the other world. Sometimes directly, and by force. Sometimes, through indirect and subtle mechanisms, such as cultural penetration, marketing or propaganda.

The governments of developing countries are usually lacking in well-structured technological policies that have taken into account their local capacities, their cultural characteristics and their economic and human resources.

Third World countries are nearly always in a really vulnerable situation as they tackle their current implementation needs, with a (usually) meager economic capacity, and with the difficulty of having to choose between a local product with less than perfect precision or polish and a more advanced, innovative and attractive foreign product.

This conflict sometimes leads to erroneous selections. Unsuitable purchases are made: purchases that cannot be paid; things that will not work properly.

This is so important that in the 1970s the term **technological selection** was coined, and made to rank higher than many other variables that play their part in a country's development.

A technology that is not understood, and that does not envisage the complex framework of interactions between cultural, economic, social, political and idiosyncratic factors, has no possibility of succeeding in developing countries in general, let alone in the least developed ones.

In rural Africa, in the 1980s, more than 70% of hand pumps with First World technology, provided through donations, international technical cooperation agencies,
NGOs, etc, were used until the first breakdown occurred. From then on, the local people in charge were not able to repair the faulty parts, not because they lacked the intrinsic capacity to solve the problems, but simply because they had no interest in doing so, or experienced some kind of cultural rejection.

However, there is one situation -- and one only -- where First World technology can be incorporated into the Third World without conflicts or drawbacks. This is when we are presented with a “Martian box”.

2. The Martian box

The concept of “Martian box” was developed by the author while working in Africa in the field of appropriate technology. It is based on the following sketch:

A Martian spacecraft arrives on Earth and a small being gets off, carrying a box. He meets a human and offers his box in exchange for some inexpensive souvenir that he will take back to his planet.

The box is simple, and perfectly sealed. It has an entry and an exit orifice and a switch.

The Martian briefly explains how to make it work. It simply has to be switched on, or something should be put in through the entry orifice, and you wait for the product to come out at the other end. The product obtained can be: energy, food, time-keeping, a way of doing complex calculations, producing drinking water, moving remote objects, producing entertainment, etc.

The receiver of the box (the user) has no idea what it is all about, or what the box has inside it. He cannot understand what kind of mechanism the box has. However, the significant aspect is that this user will not only be uninterested in understanding the gadget, but also he will feel that he does not need to be concerned. This lack of concern is because when the Martian gave the instructions, he indicated that as well as being easy to operate, the box required no maintenance and that it had a long-lasting source of energy.

We have thus been presented with something totally alien to us. Something that does not belong to our environment, our knowledge or our world. But because of the features of the box, namely:

- low-cost
- economic operation
- easy to handle
- virtually no maintenance
- reliable
• long service life
• meets a need that other products or technologies do not provide.

it introduces an interesting phenomenon: regardless of how alien that technology is (it could actually be from Mars!), it will immediately be accepted in any part of the world, by any user, and in most situations.

There are many examples of Martian boxes: quartz watches and clocks, television, ballpoint pens, telephone, transistor radios, hi-fi sound systems, microwave ovens, sewing machines, TV remote control, Nintendo-type electronic games for children, etc.

In the most remote and impoverished areas of Africa, Asia or Latin America with illiterate inhabitants, and where people would not use a motorized plough because it is strange and complicated to operate and repair (i.e., culturally unacceptable), there is, however, widespread use of portable electronic calculators (another typical example of a Martian box).

**Only First World technologies with characteristics similar to Martian boxes will find good acceptance in developing countries.** Unfortunately, these are uncommon; and where instruments or equipment of that type are non-existent, it will be necessary to work under the appropriate technology concept.

### 3. Appropriate technology

Conventional advanced technologies from developed countries can be very attractive but their use in poor societies can cause more problems than solutions.

The reason for this is the cultural component of the technology. This concept can be understood with an example.

In a certain country, the technological innovation of the computer is introduced. In a family, the following phenomenon will occur: a child will use the machine; he/she will handle it confidently; it will be an important part of his/her life. The child may even modify it or repair it. The child’s grandfather will most probably say: “I’m not interested in computers. They may be very important and they may well do useful things. But I don’t understand them. I have never used them and I never will!” The child has understood the machine and accepted it. The grandfather has not.

If a technology offered to two people from the same world, the same country, and even the same family, who differ culturally only in the periods when they were young, can receive such a different acceptance; what can be expected of that technology reaching people with cultures a thousand times removed from one another?
How can the latest technological prodigy be accepted by an individual whose education, nutrition, information, lifestyle, environment, income, social relations, interests, needs, etc., are totally different to those of the place where the technology originated?

This explains the term “logical component” of technology, whose strongest parameter is the cultural one.

We thus propose the need for an understanding of technology, not from the simple engineering perspective but from a cultural position centered on the local social context, since it is the social context that will determine the success of a technology.

Much has been written about that “social context”, and much more will be written about it, since it does not recognize a simple formula that one can refer to solve the technological selection problem. This social context is a complex interweaving of relationships in the numerous fields that make the individual a unit and a gregarious part of a society.

In the first place, if a technology is to be socially acceptable, it should be basically (although not exclusively), a native creation of the users’ own country. (We will come back to this point).

Ideally, the development of a technology should be conditioned not only by the technical and scientific progress achieved per se, but also by the cultural and ideological values of the society that produces the technology. Culture, through its social changes, should orient technological changes and not vice versa.

A truth that is sometimes not grasped is that all countries have an enormous native technological potential, which is not concentrated in one or two organizations, or in one or two universities, but in the social mass: in the workshops, the factories, and the fields.

It is wrong to think that research centers of a high scientific level in a developed country are the only basis of the “technological flow” of that country. In the United States, the first technology that started in the 19th century and that was the basis of today’s Great Technology, did not come from universities but from peasants and their rural workshops; from businessmen and their small town factories.

Only five months after the end of World War II, when one third of its male population had disappeared in the fighting, Germany reopened its Volkswagen factory and resumed production of its “Beetle”. The know-how was not in one or two engineers who had managed to escape, nor in some plans stashed away in safe-deposit boxes, but rather, in the hundreds of workers, machinists and mechanics who had survived the war.
The phenomenon lies in the fact that the people themselves, in their daily struggle to cope with their needs and problems, find the means to solve their problems. No one knows and understands the scope of a problem as well as the person who has to solve it. In addition, local people know how to give priority to solutions that will save efforts and money.

In reference to the last paragraph, there is the well-known anecdote of the white man who goes into the jungle and offers his rifle (precise and deadly for hunting) in exchange for one of the Indian’s possessions. The Indian looks at it doubtfully, and finally ends up rejecting the magnificent offer. His reply is not only an ode to common sense but also a clear example of appropriate technology philosophy.

“The rifle kills rapidly and at great distance. My blow-pipe is not so good. But I know it well. My father used it and my grandfather used it too. I only know that this rifle uses fire sticks. But what will happen when the fire sticks are finished? Where will I get more?
Ah … but my darts are made out of thorns from the bushes that grow all around us here. I will have darts all my life and so will my children and my children’s children.”.

Governments, technicians, mediators, agents who want to solve technological problems with honesty and who are not influenced by the mercantilist needs of the sellers of complex technology, must understand that their minds cannot be dazzled exclusively with the shining devices coming from the First World. It is inappropriate, risky and negative for the true interests of the country and its people.

The lesson is that decision-makers must never ignore what happens at home. It is here that they should look first.

4. Policies, technological selection and information

In view of the importance of technology in modern life, it is unacceptable that there are still countries that have no national technological policy.

Drawing up a proper policy is no easy task. Many authorities who are really the true definers of those policies fall naively into temptations that are sometimes a hair’s breadth away from the absurd.
Poor countries with millions of inhabitants living below the poverty line invest vital resources in a nuclear technology that only the richest can afford.
Others have embarked on space races when their farmers and communal factories did not have even the most basic provisions of raw materials, equipment or tools.
How many countries have spent millions on complex equipment without having local human resources to handle those technologies; technologies which have soon faded out leaving behind disillusion, dilapidated efforts and large debts?
Preparing a technological policy is not the task for a minister, a politician or even for one or two well-meaning engineers. It is a task for many people. Strictly speaking, for all the parties involved. The following attributes are essential in this task:

- honesty
- common sense
- awareness of the real situation
- empathy with the social mass rather than with privileged or power-holding classes
- independence from outside pressures and/or interests

When the potential policymakers are willing, on those terms, to lay the foundations for a true technological national policy, they must set out on an arduous road with no short-cuts.

First, it will be necessary to initiate an open dialogue within the country, on what is desired with regard to development. Should we necessarily “purchase” development in the way modern western culture sells it to us?

The word “development" is a curious term recently adopted in human society. According to some schools of philosophy, “development" is a concept linked in the first instance to time; to the measurement of time and how time conditions facts and situations.

For thousands (even hundreds of thousands) of years, primitive man and the traditional societies have thought about time and its action, observing the sun rising at the east, crossing the zenith and setting at the west; the repetition of seasons, the migration and return of birds, disappearance and reappearance of harvests; the advancing and retreating of ice; all of which implied not a linear development, but on the contrary, an ending in order to usher in a new beginning; and the recurring of phenomena. Events developed following a cyclical process, not a linear one.

The idea that we should constantly strive to become better (lineally not cyclically better) has been a religious and moral idea during the history of mankind; not necessarily a concept applicable to ways and standards of living.

Of course it is difficult to say: let’s stay where we are or let’s develop at the pace of our own possibilities. But since no one had the courage to propose something like this, or at least the courage to make an erroneous but collective selection, during the whole of the 20th century, non-industrialized countries have been entering into a development race lost before it was begun; and the situation we have reached speaks for itself. It spells out “failure”. Poverty is alarming, the most preventable diseases such as tuberculosis, cholera and diarrhoeal diseases wreak havoc; violence and crime are the only way out for millions of human beings; hunger predominates.
This leads to the second point: to answer truthfully the questions that a national policymaker should ask himself/herself:

Is it really necessary to embark on a race to achieve the same technique that dazzles us from the powerful and developed world? A technique that when it is achieved will be fatally “old and obsolete” in the place where it originated?
Will social costs be considered?

Australian Aborigines continue to use boomerangs and, as far as we know, they have not thought of renouncing as a society the few (but very valuable for them) articles they use or replacing their ancestral hunting weapons by rifles with laser sights.

Nor have fishermen on the island of Zanzibar thought of replacing their technological expertise on boat-building and making sisal nets, by electronic computerized sonars.

The islanders and coastal people of Lake Titicaca are not attempting to alter their resources or way of living by swapping the productive technology of their famous (and very efficient) reed canoes for modern rubber and neoprene “crocoducks”.

CEPIS itself has made an effort to develop and promote a truly appropriate technology throughout most of its existence. With a clear understanding of the regional situation and setting some distance between itself and the advanced technology of the First World, the Center designed a new technology based on engineering achievements in Latin America and the Caribbean, adding social and cultural factors to design a technological discipline that has become known as “CEPIS Technology.” A true revolution, where a 21st century technology does not have a computer and where motorized and mechanical mechanisms have been replaced by merely hydraulic ones.

Here we come to a third point, with a new question:
Should we then close our eyes to everything produced in the North?

When mentioning the subject of appropriate technology, the following comment was made earlier in the paper:

*If a technology is to be socially acceptable, it should be basically (although not exclusively), a native creation of the users’ own country.*

That assertion and the answer to the previous question in some way excludes high-level technology. The idea that one should look first at home does not mean that once this has been done one cannot then look outside.

And, strictly speaking, that is the way it should be. A real and appropriate technology should not necessarily be isolated, standing alone. In fact, it is almost absurd to think of a total technological independence. No country has the
economic potential to develop all the technologies required for its development (modern and western version of “development”).

A new and important concept is presented here: appropriate technology should not necessarily exclude First World technology; rather it can and, usually, should be complemented with it.

A fourth point follows on naturally from the above. If it is necessary to look into industrialized world technology, then, would it be possible to have a healthy technological independence? Will it be possible to be technologically self-sufficient?

The answer, fortunately, is affirmative.

Yes. There is a way to find a technology that can be understood, that is acceptable, and that is based on the scientific, cultural and social pattern of the country or region; without necessarily being free of a foreign component, from the technology of industrialized countries; but it should be first and foremost a local technology.

The search for, and acquisition of, such technology is carried out by dedicated staff members, from research centers and universities.

These centers far more than trying to develop some technological innovation, should look into the needs, and the local resources, or find out what can be obtained from outside and, finally, see how to fit it all together. That would be much more productive than trying to develop some technological innovation. It has been widely demonstrated and documented that 1) the wheel has been reinvented over and over again by people with a high degree of enthusiasm but a low level of information, and 2) most innovations end in failure.

At the risk of being accused of redundancy, I feel it is important to reaffirm that search should be done on the appropriate technologies designed by non-structured local sectors, workshops, technicians and even by the public at large whose technologies have already passed the difficult test of practical application.

A fifth point is the need to disseminate the technology. The term “dissemination” in technology, especially in water technology, refers to the: need for creating a market. And if the market is already in place, it is then necessary to impact it with proper marketing.

Good marketing is not always due to an intelligent advertising campaign, but rather to the existence of an actual need.

It should be stated however, that over and above the need, there is another cultural and social component that is “the demand.”
A community can have a need. But that need may not be perceived by the people as such. **Unless people are aware of that need, demand will not occur. And it is the demand that will generate mechanisms to open doors to new technologies.** This can be quickly understood in the drinking water context.

To have water at home or nearby is seen first and foremost as a need that, once met, cannot fail to improve living conditions. Individuals, families and the community will require some technology in order to satisfy that demand.

However, in order to prevent waterborne diseases not only should people have water, but the water should be safe and reliable. Therefore, it needs **quality.** But in a remote rural community, the people will certainly not be aware of this, and thus, there will be no demand associated with this new and more important need.

Governments, with their decision-makers, should transform the need into demand, through an awareness-raising process in the society. Education and information through communication campaigns are the means that should be used for this purpose.

Education, and especially information, are two aspects that decision-makers should develop carefully and emphatically.

Most institutes, groups formed to develop appropriate technology, and universities, spend a considerable part of their time on the collection, processing and dissemination of information. This is a much more important task than the simple research and development of systems or technologies.

There are certain technologies developed in states or provinces, in regions or even villages that can take years to travel the few kilometers to a neighboring community.

Here we can identify an essential role that technology centers can and should play: they should become brokers between the producers of technology and potential beneficiaries of that technology.

If technology centers are incorporated into an information network, their duties will no doubt be increased and enhanced; and as part of a group, they will certainly be helping to create and promote demand. The demand and, more directly, the market for appropriate technology, depend on the fact that the public or user (engineer or rural inhabitant) is aware that information is available and knows where to find it.

So we are back to the concept of demand, and the point we are making here is that options can be offered to cope with demand only when that demand has been created.
Interestingly, although it may seem incorrect, many authors and thinkers have pointed out the need for governments and their decision-makers to exert some kind of coercion during this process.

The subject is delicate. The very concept, let alone the use, of “coercion” is somewhat dangerous per se. However, on occasions it can be a short cut to save efforts and above all, time.

When a mother scolds her young child for playing near a pan with boiling oil in the kitchen, and forbids the child to go near the stove again, she is, in fact, exercising coercion. However, no one will say that her action is negative; on the contrary, this is protective coercion.

When a government forces a rural community to support the installation of a drinking water system, it is also exercising positive coercion if the idea is to prevent waterborne diseases in that community. Coercion would become somewhat negative, if it would try to convince a community to install a system that would make use of equipment in which there were vested purchasing (or selling) interests. There is, however, a commitment formula that consists of maintaining a balance between sound coercion performed by the power strata (top-down action) and the participation of civil society (action from the bottom –up or from the inside– out).

This commitment should ideally lead to the selection of what is most adequate to the real technical needs of a region or community, without ignoring the very important cultural characteristics that have already been mentioned so much.

If it is understood that the most important thing is not to be technologically independent, but rather to be technologically competent, then all the pieces of the puzzle will fall into place.

As mentioned at the beginning of this paper, the world is divided and the division will not only persist for a long time, but it will become even sharper.

However, those who have missed the boat of the First World are not at all condemned to a life of less quality. It will simply be necessary to adapt to the situation in which one lives, with its means and resources. Tools will have to be sought, honestly and intelligently, to make living conditions as acceptable and desirable as those existing in developed countries. Appropriate technology is one of those tools.