

STRATEGIC MANAGEMENT OF TECNOLOGY TRANSFER

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ABSTRACT

A traditional model of Technolgoxy Transfer TT is first introduced. The shortcomings of such a model are discussed.

A new model that borrows many key concepts from strategic management is then presented, its function and relationships are explained.

The success of a Model of Technology Transfer depends primarily on the evaluation process which will function as a feedback for improving future TT modeling attempts.

I - INTRODUCTION

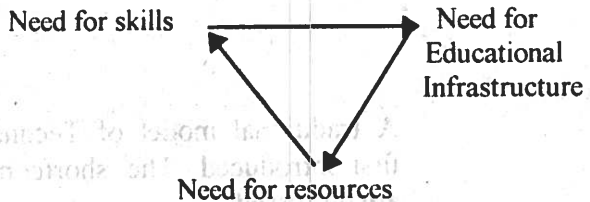
Technology Transfer is in essence managing technology. As Denis Goulet (a Brazilian Politologue) said : « Management of Technology is the one upon which effective utilization of all other technologies must rest. »

The role of Strategic Management is to align the Firm with its environment, thereafter our role in Technology Transfer (TT) is to try to align the Less Developed Country (LDC) with its International Environment by formulating strategies for LDCs and developing capabilities (transferring technologies to support these strategies).

II-CHARACTERISTICS OF A LESS DEVELOPED COUNTRY

Most authors cite the following three factors as the major reasons for Underdevelopment. These factors form a vicious circle.

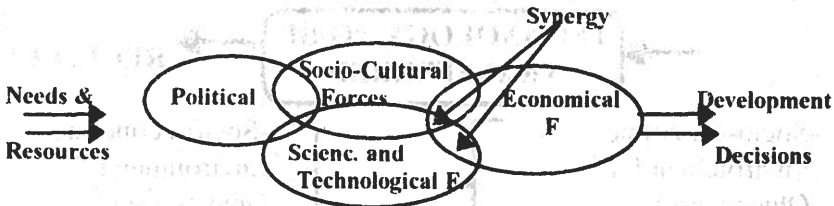
A country is underdeveloped when :



- (1) It lacks technology to produce needed goods.
- (2) It lacks the capital to acquire such technology.
- (3) It lacks the skills necessary for generating capital

Fig. 1

The impact of technology on economical development is determinant. Technology has an obvious relevance to almost every sector of modern society : to agriculture and fishing, to mining and hydrocarbons, to industrial production and distribution. Technology also has obvious roles throughout the social infrastructure : in education, health care, in communication and transportation. It would seem to be a safe premise, to say that technology is relevant to LDCs' development. The fact that technology is the major determinant of Progress (Scumpeter's work testifies this) does not mean that we should deal exclusively with technology, and neglect its environment. The Technology Strategy has to be placed in its natural Environment composed by political, economical and socio-cultural forces.



Economical Development is a function of the synergy among factors and reconciliation of the differences among them.

Fig. 2

If we base our TT solely on political ground, the Sender's country will be sending the Receiver's country military equipment and experts to keep the governments needed in power.

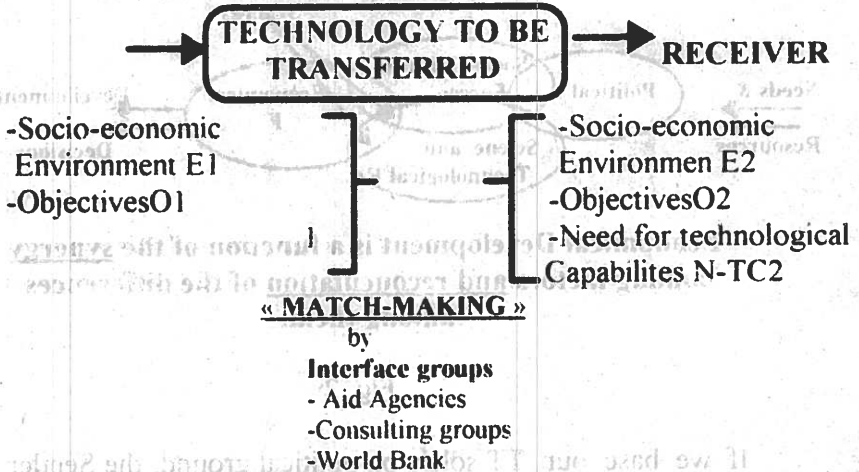
If we base our TT solely on economical grounds, we would miss the spirit of TT, because schools, hospitals, housing will be dismissed, since such investment does not generate any financial gain -and that is what the World Bank is doing. It looks at the project on its « credit worthiness », not on its « investment worthiness ».

III - A MODEL OF TECHNOLOGY TRANSFER

The Committee on Technology Transfer of the National Academy of Engineering (USA) defines technology as :

« The process of collection, documentation and successful dissemination of scientific and technical information to a receiver through a number of mechanism, both formal and informal, passive and active.

The transfer process begins when it has been established that a technological advance has significant relevancy in a directed or different application and that a necessary adaptation can be made. The process occurs naturally between participants who understand what has to be done to permit effective utilization. »



A BASIC MODEL OF TECHNOLOGICAL TRANSFER

Fig 3

Many authors (Seurat, Samli...) have developed models of TT. Despite the helpfulness of these models to visualize the problematic of TT, they do present some shortcomings that will be shown below :

- * It is a unilateral (one way) flow from Sender to Receiver.
- * The model assigns the Sender an active role and the Receiver a passive rôle.

* The « matchmakers » (Technical Staff) even when well intentionned have a « myopia » : being born and raised in Developed Countries, they cannot grasp the realities of the LDCs

* The consequences of this model is that Multi-National Corporations (MNC) and the « matchmakers » will tell the LDCs always what they need.

- Let us take for instance the Receiver (LDC) and see what it expects from TT (Figure below).

- a) Low acquisition cost
- b) Optimal use of local resources
- c) Technological independence

-Now, let us take a look at what the Sender (read MNC) expect from TT

- a) Monetary gains
- b) The exercise of control
- c) A competitive advantage over others

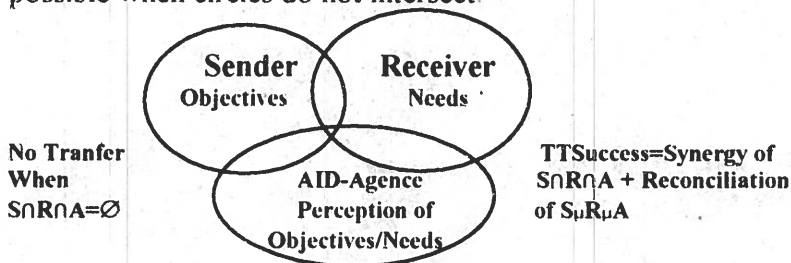
-We have to match the needs of both parts to see whether there are :

- | | | |
|-----------------------------|-------|------------------|
| a- Contradictory needs | ————→ | Desagreement (D) |
| b- Complementarity of needs | ————→ | Agreement (A) |
| c- Reconcilable differences | ————→ | Bargaining (B) |

RECEIVER'S NEEDS	MATCH ?	SENDER'S NEEDS
-Technological Independence	D	-Gain and maintain market presence
-Low Acquisition Cost	B	-Monetary Gain
-Optimal Use of Local Resources	B	-Exploit Local Resources
-Upward Movement from Import to self-sufficiency to export	D	-Exercise of Control (perp. Dependence)
	« B-Chip »	-Gain competitive advantage over other competitors
	A	-Stretch Technological life cycle
Break up Technological Package reliability + Guarantee of Maintenance	D - Sell a complete package A	

Fig 4

Using circles, we can visualize the complementarity of needs (agreement) through the intersection of these circles and the contradictory needs (disagreement) through the remaining surface. Subsequently, the wider the surface of intersection the more considerable the success of T.T. Likewise, TT is not possible when circles do not intersect.



n = intersection

μ = union

ACTORS OF TT

Fig 5

The success of technology transfer is a function of the SYNERGY among these forces and reconciliation of their differences.

V - STRATEGY FORMULATION OF A TECHNOLOGY TRANSFER

For the reasons mentioned earlier, we reject the traditional model of TT and will present a model of technology strategy from the beginning.

The point of departure is given by the NATIONAL NEEDS(ex : food supply). These needs are met through RESOURCES (land, water, equipment) and CONSTRAINTS (soil, weather, infrastructures) which determine the OBJECTIVES (ex : auto-sufficiency). These objectives can be reached by a Range of Technological Options = TECHNOLOGICAL STRATEGY FORMULATION (TSF)

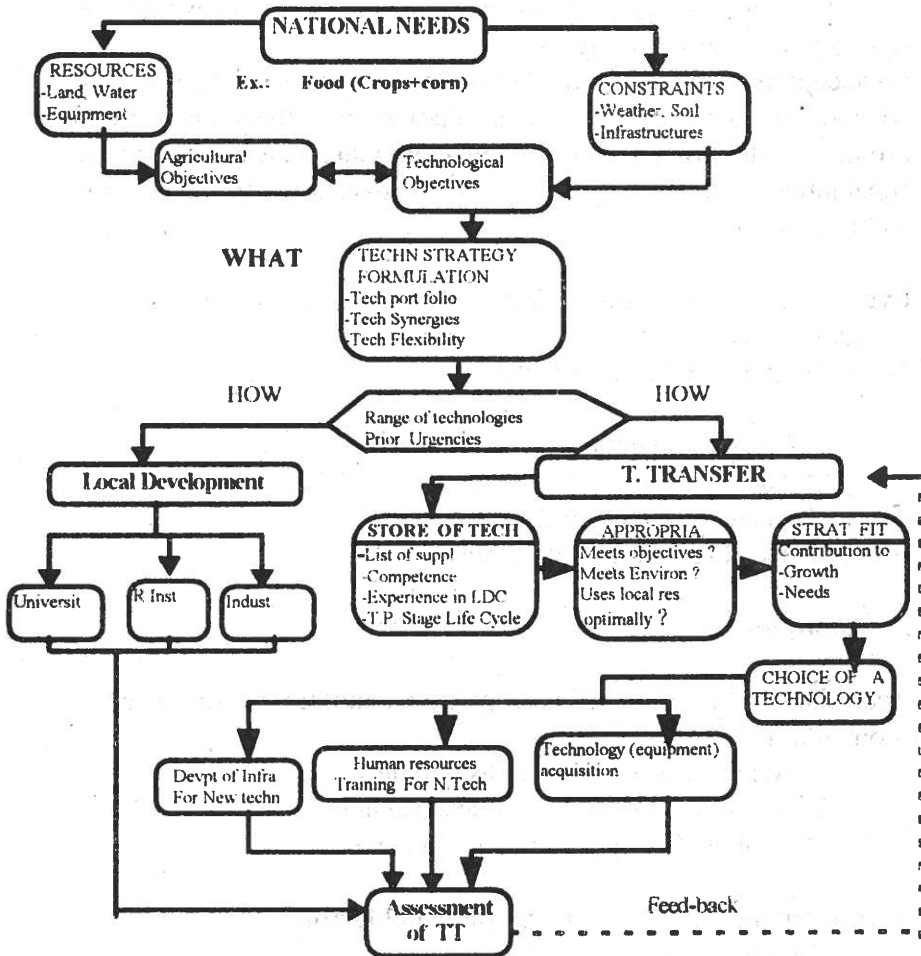
The mean components of TSF are :

- 1) Technology Portfolio : for the agricultural sector for example the portfolio will be between high wheel tractors, row crop tractors, tricycles and crawlers. In Algeria for instance 60% of land owners are small farmers with 5 to 10 acres living mostly on hill land ; they need this equipment in the planting season, to transport crops to the market, to collect hay from the fields and use it with many implements such as plows, fertilizer equipment, harvest equipment ... we will select a 10 Cv row crop tractors. For threshmachines we will select a big one which will be used by the whole Cooperative of farmers etc...
- 2) Technology Synergy : is there a coherence between the technologies chosen for agriculture and other sectors ? For example the same Diesel Engine is used on CIRT A tractors and Sonacome trucks.
- 3) Technology Flexibility : We want a technology that will allow us to gain from the benefits of « Economies of Scale » and at the same time permit us to be flexible in our production and even in changing our products. For example can we use the same productionline to assemble Tractors and Busses ? !!!

The reason why many LDCs try to break the Technology Package into Core Technology and Peripheral Technologies is to allow the MNCs to deliver the Core Technology and develop locally Peripheral Technology. Until now the MNCs have resisted ferocely such Break-up.

Finally the choice is left to the Policy Makers (Decision Makers) to decide whether to develop the Technology locally through Universities, Research & Development Institutes and Industries OR to proceed through External Technology Transfer.

In both ways the National Technology Strategy is manifested by stated goals or objectives and commitment of resources. Implementation in the public sector is accomplished by legislation, resource allocation, and supportive programs and projects. In LDCs T Strategy should be made explicit, formal and visible in the government attitude toward the scientific community -to show direction and reduce resistance and inertia. The tendency of governments to be sporadic in their treatment of science can lead to unpredictability, subsequent confusion, and destruction of morale and motivation of the scientific community, and even to a « Brain Drain ». This case, is happening now in Algeria.



Formulation of a Strategy for Technology Transfer (the model).

Fig 6

V - DECISION FOR EXTERNAL TECHNOLOGY TRANSFER

Since the subject of this paper is on TT, let us explain the right box (T. Transfer in fig.6).

In accepting a Transfer of Technology a receiving nation must consider its technical options, the adaptation of the technology to provide the opportunity to develop independent production capabilities, and the ability of local organization to manage the technology

Every decision to Transfer Technology should be preceded by a 3 step analysis :

1-/ Store of Technologies Available

- * List of suppliers
- * Their competences
- * Their experience in LDCSS
- * The Technology Life Cycle

2-/ Appropriateness

According to Granger, the appropriate technology for the receiver is one that is :

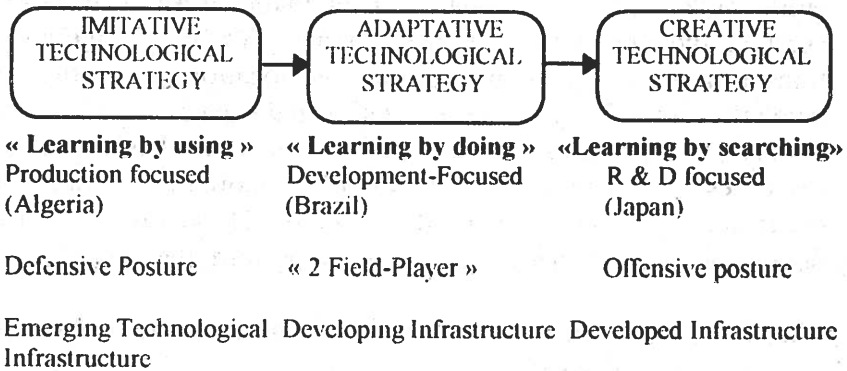
- * Adequate to the objectives pursued
- * Uses optimally the resources available
- * Exploits the opportunities available

Appropriateness depends on the following factors :

- * Scale of use
- * Raw materials available
- * Physical environment
- * Manager skills
- * Capital cost
- * Cultural affinities

Appropriate technology does not mean intermediate technology or second-class technology. It is the best technology for the situation. For example, Algeria bought in 1974 the « State of the Art » technology in gas liquification, because liquifying gas

at a temperature of -160° , will allow to reduce its volume 600 times allowing an efficient shipment to the USA and Europe. Appropriate technology is most of the time a custom-tailored technology. It is sometimes more expensive than standard technology.



APPROPRIATE STRATEGY FOR TT DEPENDING ON THE COUNTRY'S DEVELOPMENT

Fig 7

3-/ Strategic Fit

A pre-control should be undertaken at this stage to see :

How the new technology fits in the local environment :

- *Market and feasibility studies
- *Existing human resources and training requirements
- *Management of the new technology

What are its prospects ? Such as :

- *Contribution to Needs
- *Contribution to Growth
- *Its Success Potential with regard to cultural, technical and economical aspects

VI - STRATEGIC MANAGEMENT OF -TECHNOLOGY TRANSFER GROUP -

In very few cases does the transfer of technology happen between Mutli National Corporations (MNC) and the LDC receiving company. In most cases there is a group of people set up either by the receiving country or International Aid Agencies to conduct the operation of transfer. Indeed TT is not merely a transportation of equipment from one location to another, it involves rather selection, discrimination and capacity to adapt and modify the original technology as well as preparing human resources to operate it. Hence we need more than a donor, an organ and a patient -We need Surgeons. These guys select the donor, the organ, prepare the patient and perform the operation.

The TT Group tries to adapt the technical capabilities originated in E1 to E2. Their role is to:

- Assess the environment factors relevant to E1 and E2.
- Help formulate the objectives of TT
- Help choose the appropriate technology
- Define the steps of the operation.

STRATEGIC MANAGEMENT'S GROUP OF TECHNOLOGY

T.T.STEPS PART. IN DECISION MK	Preliminary Stage	Project Development Stage	Transfer. Implementation Stage
D.C Nationals			
AID Agencies & Consult. Group			
MNC Repr			

Fig 8

This group is ideally composed of people familiar with both environments and should operate as follows :

*During the preliminary study, Nationals from LDCs familiar with the sender's environment and having skills relevant to TT can form the Core of the Group.

*At the next step International Consultants are added to the core group to bring their expertise. Their participation is regarded by the World Bank as an endorsement of the project and a seal of approval for funding.

*In the third step, MNCs' Representatives are included in the group to assist the implementation of the transfer operation

The National Core Group is present at all stages and should collect all information relevant to TT progress and accumulate experience

VII - ASSESSING THE SUCCESS OF TECHNOLOGY TRANSFER

According to Samli, TT is successful if it fulfils three criteria

- 1- The degree to which the newly imported technology stimulates constant innovation
- 2- Whether or not the newly acquired technology is working
- 3- Whether or not it fulfils the original objectives

Similarly Seurat identifies four areas where success of TT can be assessed :

- 1- Percentage of national manpower : the success of TT is judged by the quality and quantity of replacement by Nationals as foreign Experts leave the country.
- 2- TT can be said successful if the plant is run by Nationals while keeping break-downs and waste materials at a pre-established level.
- 3- Individual initiative : TT is successful only if Nationals exert individual effort and initiative
- 4- Coping with complexity : the way Nationals manage the new technology

CONCLUSION

There is a need for a general model of TT, and the development of such a model is possible. The model presented in this paper consists of key concepts such as :

- National needs.
- Resources and constraints encountered
- Objectives of TT
- Strategy for TT
- Capabilities needed to support the strategy.
- Implementation and assessment

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