

Goldfeld, S.M. and Quandt, R.E. 1973. Estimation of simultaneous model and the value of information. *Journal of Econometrics* 3: 353-368.

Goldfeld, S.M. and Quandt, R.E. 1975. Some properties of the simultaneous model with covariance structure. *Econometrica* 43: 343-365.

Green, J. 1980. On the theory of effective demand. *The Economic Journal* 90: 341-355.

Hartley, M.J. and Malinvaud, P. 1977. The second order properties of a maximum likelihood estimator for a model of output in disequilibrium. *Econometrica* 45: 1153-1168.

Maddala, G.S. and Nelson, C.R. 1975. Maximum likelihood methods for models of markets in disequilibrium. *Econometrica* 43: 1013-1030.

Maddala, G.S. 1983. Limited-dependent and qualitative models in econometrics. *Handbook of Econometrics* 2: 315-384.

Mullin, J. 1978. Macroeconomic vs. microeconomic treatment of "disposal". *Journal of Econometrics* 1: 43.

Quandt, R.E. 1982. *Econometric Disposition Models*. *Econometric Reviews* 1: 1-63.

Richard, J.F. 1980. *Output distribution and disequilibrium models*. Working paper, CORE, Université Catholique de Louvain-la-Neuve, Belgium.

Richard, J.F. 1982. *Econometric Reviews* 1: 11-27.

Schmidt, R. 1975. Note on the Statistical Efficiency of the Frontier Production Function. *Review of Economics and Statistics* 58: 320-329.

Shephard, H.R. 1985. The Alternative Stochastic Frontier and Estimation Methods for Quantity Rationing Models. *Monte Carlo Corporation, European Economic Review* 29: 111-124.

Tischler, A. and Tang, 1979. A Switching Regression Method Using Inequality Conditions. *Journal of Econometrics* 17: 259-274.

Watkinson, G. 1984. On the Theory of Effective Demand under Stochastic Rationing. *Journal of Economic Theory* 34: 45-110.

Wolpin, M. 1980. Estimation of values from a normal and a truncated normal distribution. *Technometrics* 22: 109-120.

ECONOMICS OF RESEARCH AND DEVELOPMENT :

" A THESIS PRESENTATION "

BY : OUKIL M.S.

In November 1989, a ph.D thesis was defended before a board of examiners at the University of Strathclyde, in Glasgow, Great Britain. In what follows, the author would like to present a broad summary to the reader in Algéria. The objective is nothing else than the dissemination of knowledge in the field of economics of technological innovation.

Title of the thesis

" The function and system of industrial Research and development in Algéria".

Synopsis :

The thesis explores the effectiveness of research and development (R & D) in the industrial sector of Algéria. It argues that the outcome is not high, and seeks explanation at the level of the firm, which is the point at which any system of R& D has to make serious impact if it is to be efficient. The failure of R&D to greatly boost productivity is documented by data relating to invest-

ment and output in the various industrial branches. This failure could have many (and elusive) causes, including inadequate funding and misallocation of resources. The focus here, however is on the net work that links R & D to industrial practice and the seriousness with which firms handle the issue of R & D and innovation. They are found weak, badly operating and lacking, and - it is suggested - improvement in this regard is a sine qua non of the effective application of science and technology (S&T) to development ends.

Algéria which is the case under study has made substantial efforts in S & T . A few years ago , it had completed the administrative structure by setting a highest central body under the honorary patronage of the president of the Republic. A concrete outcome of those efforts is the build up of a significant capital formation which is used to implement important R & D programmes in different sectors an industries.

But R & D as an economic activity does not seem to be efficiently undertaken. The général impact on industrial productivity is so small that it

is difficult to trace and prove. Ambitious as it is at the macro-level, Algérie's S & T policy has even lagged behind the strategy of intensive industrialisation, which relied on massive import of modern technologies. After more than two decades of development experience, the negative productivity in the industrial sector has sustained the above inefficiency.

The study is an attempt to examine this state of affairs by considering the effectiveness of R & D functions and network at the justified by the fact that it is at the productive unit that the impact of R & D is felt. Indeed, in carrying out their productive activities, firms do face technical difficulties and in the solving of these, that renders R & D crucial in the development process. Thus, the effectiveness of sectoral and national R & D systems and S & T policy could be judged on basis of micro-economic results.

Three groups of factors are identified as the main elements of a coherent R & D system : Organisation and efficient management, linkages and incentives. Closely

related to the study of the system is also the handling of R & D function at the level of the firm. In some firms, such function may be formalised ; in others it may not. In this case, informal R & D or innovative tasks could possibly take place. These-it is stressed in this study-are not of less importance than the formal ones.

The investigation uses data collected from a field work in Algérie. The major part of it consisted of a sample survey covering 98 public and private industrial enterprises including three applied research centres. The outcome from the inquiry is, however, not quite satisfactory. Interviewed firms have not supplied with all necessary information, and the national body in charge of S&T was unwilling to co-operate. Secondary data, on the other hand, are not fully or easily available. This data constraint has, hence imposed recourse to extrapolations and assumptions.

The main objective of the study is to clarify and explore the idea of remoteness of R & D activities from industrial practice with reference to a developing economy. In this context, I have proposed that, R & D remoteness could be defined as lack of relationship

of three types : a) between R & D effort and seriousness with which it is undertaken within the firm and with the rest of the production system ; b) between R & D or innovative effort and productivity, as part of the overall industrial performance ; And c) between industrial firms and other entities , which are capable of contributing to solve problems of production on the basis of strong external interactions and linkages. To test the first relationship, two indices were used : innovation frequency and seriousness. The other two relationships are enlightened using comparative and multiplied regression methods.

Structurally, the thesis is presented in six chapters. Chapter I is introductory and covers the background to the issue, the issue itself, the theoretical and empirical context of the study, the scope and limitations of the study and its organisation. Chapter II presents a broad economic background to the study. It historically describes Algeria's economic development and discusses the adopted strategy. Chapter III gets a closer look into the country's industrial and technological development. Chapter IV

sets the conceptual foundation for the study and the hypotheses to be tested.

The empirical part is in two chapters :

Chapter V includes the analysis, computations and results ; And chapter VI presents a summary of the discussion theme and main conclusions and offers some recommendations.

In developing the framework, I

mainly point out the following : that

innovation is not only formal, but also

informal ; that incremental innovations

are not only of no less importance than

the major ones, but also necessary ; and

that lack of innovation institutionalisation, and weakness in R & D network

could explain the slow development of

innovation capabilities in the country

in question.

On this basis, the study strongly

argues for more concern at a micro-

level, in particular, about the coherence

and effectiveness of both R & D functions

and systems : The former referring to

mainly efficient management of R & D

activities and capabilities, and the

latter to the network of interactions or

linkages and incentives, both inside

and outside firms. Such concern, it is

suggested, is a basic and urgent re-

quirement for achieving a sound level

of technological development, and, consequently a prerequisite for technological independence, or rather self-reliance. The phase, so much officially and publicly being referred to in Algeria as "l'après pétrole" - i. e., the phase after the country's oil will run out - is a hot issue. However, if in recent years agriculture has been justly allowed to gradually restore its important place in the national economy, it still remains that the present industrial apparatus should be geared towards greater efficiency, in all its production units and activities including R & D.

The study presents the following four main conclusions: First, that the undertaking of a heavy industrialisation in Algeria has resulted in technological capabilities, though to varying degrees in production, investment, engineering and innovation. However, those of the latter, in particular, are not only much concentrated in the heavy industry sub-sector and low with respect to innovation and exports, but also that relevant effort is not highly interactive with universities and research centres.

Secondly, that what the country's

overall R & D, or technology policy and system suffer from a lack of pragmatism and coherence. In other words, efficiency and linkages are not yet properly accounted for. A consequence is that relevant effort may - prima facie - look impressive, but when scrutinised, it could be found not standing with industrial performance.

Thirdly, that industrial R & D activities, in Algeria, do not yet present real signs of being efficiently integrated within the industrial production system as they are supposed to be. The relatively greater growth of the heavy or capital goods sector is yet due to employees' experience and learning-by-doing, through the continuous confrontation of various internal and external pressures and difficulties, rather than to a cost-effective innovation effort by relevant firms. This could, perhaps, suggest that in an industrialisation effort - from one phase to another, but gradually rather than jump into the front line at once.

Fourth, and last but not least, that at the firm level, the R & D function has taken time to be given its importance in the Algerian industry. This may be expected as, on the one hand, innovation capability does not

usually precede investment and production capabilities, and on the other hand, algerian public enterprises have long been burdened with various social activities and responsibilities. In any case, there is no good reason why firms do not seek and exploit viable ideas, or innovations however small, and which may be even informally made or suggested.

of technological development, and
of widespread a movement in the
technological development of various
self-reliance. The phase of self-
reliance and publicly owned enterprises
is in Algeria an "active phase".
In this phase after the country's
will come out - is a new phase.
However, it is a new phase and
culture has been partly allowed to
gradually restore its position in
the national economy. It still
remains that the present industrial
structure of the country is a
greater efficiency. In all its
economic units and enterprises involving
the state, however, the following
four main conditions: first, that
of monopolization of a heavy industry
in Algeria has been the
technological capabilities, though
a varying degree in production.
management, organization and education
However, those of the latter, in part,
technical, are not only much concentrated
in the heavy industry and energy and
low with respect to innovation and
experts, but also that relevant effort
is not highly motivated with out
creative and research centers.
Secondly, that what the country's