

THE MANAGEMENT OF TECHNOLOGY TRANSFER

Plenary Paper¹

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Technology today is one of the most powerful forces in our environment and at times it is by far the most important for many firms, institutions, nations and society at large. And its power is still growing.

James R. Bright (1972)

Knowledge, during the last few decades, has become the central capital, the cost centre and the crucial resource of the economy.

Peter F. Drucker (1969)

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ABSTRACT

The future world economic development as well as the improvement of other aspects of the quality of life depends to a very large extent on technological development, which again depends essentially on the successful application of the process of technological innovation. This process with its various stages of research, development, engineering, and marketing cannot function without effective communication for the purpose of technology transfer, i.e., transferring knowledge between the stages.

It is important not only to understand the process of technological innovation and to realize that technology transfer is an essential part of it, but also to understand that technology transfer is the transferring of knowledge rather than of goods and services, and is dependent on successful communication. Further, technology transfer should be managed as part of the package of managing technological innovation, which should be purposeful and continuous rather than a response to haphazard demands.

One of the aims of the National Timber Research Institute is to promote the more efficient use of the South African wood resource as a reliable and economical structural material. Research results in this field have been successfully transferred to the South African forest products industry where 90 low cost stress-grading machines are now in use, and where stress-graded timber is selectively used in glulam products and 20% of all roof trusses.

The low cost grading machine, the grading system, the design data, the roof truss design method and computer program, as well as the glulam manufacturing systems, were developed by the National Timber Research Institute and transferred to industry by way of research steering committees, symposia, publications, industry-sponsored development contracts, and direct assistance in factories.

Keywords: Economic development, technological innovation and transfer, research, management.

INTRODUCTION

In the above two quotations lie locked the power, the opportunities, and an immense challenge for future economic development and improvement of other aspects of the quality of life. The power of developing new technology, the opportunities to exploit the knowledge people have of technology, and the challenge

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to people to plan and manage the exploitation of this power is the subject of this paper. The aim is to describe one model of technological innovation, i.e., the system of developing and applying technology through people and to show that technology transfer by people and purposeful management by people is a prerequisite for the success of the system. Certainly a better understanding of the system of technological innovation will assist with improved technology transfer and application of research results.

All research people are a part of this system, as are most technical educators and a large number of engineers and managers in industry. Technology transfer provides the flow link of knowledge that is a prerequisite for the operation of the technological innovation system, and management provides the driving force to achieve maximum success.

This new perception of technology and its transfer or application puts the opportunities to be exploited in a new perspective, calling for new priorities to be set and to be followed, so leading to the achievement of wider horizons than we ever dreamt of in the past.

To achieve our aim we have to get a clear picture of the historical role that technology played in the development of the world economy, and also of its importance to the future. A close look at technological innovation is required to enable us to understand the process of development, transfer, and economic application of technology. It is essential to understand that technology transfer is the communication process that links the people who operate the various facets of technology development, transfer, and application; and planning and management are as important to the success of technology transfer as they are to any other business venture. Finally, the system depends on people. In fact, apart from funds, people are the main resource in technological innovation. The ideas that form the basis of all research, development, or innovation originate in the minds of people. The initiative, drive, and determination required to develop ideas into successful economic application can only come from people who are motivated to achieve a particular goal (Bosman 1977).

THE INFLUENCE OF TECHNOLOGY ON ECONOMIC DEVELOPMENT

The economic expansion during this century is based on technologies that were firmly established before the First World War and that exploited inventions made in the previous fifty years. For example, farming is the main force behind the economic growth in developed countries, and farm productivity in most developed countries has been increasing faster than productivity in the manufacturing industry. Although agricultural technology is continuously improving, most of the important basic developments, such as tractors, fertilizers, and improved seeds and breeds, were initiated at the beginning of this century or in the latter part of the previous century.

Similar arguments hold for the other important forces in the economic expansion, i.e., the steel industry, the automobile industry, the electrical industry, and the organic chemical industry. All these industries are based on technology.

There are also many other new industries based on newer technologies, but in terms of economic importance, i.e., by contribution to national product and employment, they are still relatively small. Some are, however, growing fast, such

as plastics, aircraft, and computers; and they can be expected to play a major role in technological and economic development in the future.

So much for history, although the last paragraph has already brought us to a transitional stage between past and future. According to Drucker (1969), in this transitional stage the world is experiencing and will experience, to a growing extent, a major discontinuity—a drastic “shift” to industries based not only on new and different technologies, but on different sciences, different logic, and a different perception. He is convinced that these new industries will demand “knowledge” workers rather than manual workers in contrast to the industries of the past. This indicates not only a demand for technological innovation, with all its facets and at a much higher level than in the past, but also a demand for the transfer of this technology on a much bigger scale to many more workers than ever before.

These new industries have the capability of providing rapid economic growth for a long time to come. The old industries, although they may still grow and prosper relative to their past achievements, are expected to increasingly lose their capacity to contribute to rising national incomes and employment.

TECHNOLOGICAL INNOVATION

Technological innovation is the main force behind technological development. It is the process of applying scientific, engineering, manufacturing, marketing, and managerial functions to develop an idea or an invention in order to achieve industrial and commercial objectives.

Charpie (1970) classifies technological innovations as follows:

- those that bring about productivity gains;
- those that represent new contributions to existing products, processes or industries; and
- those that express themselves in the spectacular creation of completely new industries.

He continues that many studies in industrialized countries show that 30 to 50% of long-term economic growth stems from technological innovations that improve productivity, and approximately the same amount from technological innovations that lead to new products, processes, or completely new industries.

Bright (1971) describes (Fig. 1) eight stages or phases in the process of technological innovation, although there could be as few as three and as many as fifteen. The stages, although not sharply defined, are readily identifiable and facilitate measurement and comparison. The first stage is the scientific suggestion, discovery, or recognition of a need or an opportunity. It appears that the bulk of contemporary and recent innovations do not originate in undirected basic research activity, but spring from the recognition of a need or the recognition of an opportunity. The next stage covers applied research and development, followed by the industrially oriented stages of the manufacture of prototypes, tooling for production, etc. until a commercially successful series of products is accepted and taken up by the market. Generally a linear program is followed, though provision is often made for feedback of information from a later phase to a previous phase. Twiss (1974), in a very lucid analysis (Fig. 2), shows how information

