Available online at www.sciencedirect.com
SCIENCE DIRECT®
Technological Forecasting & Social Change 73 (2006) 559–574
Technological Forecasting and Social Change

The R&D system for industrial development in Taiwan

Tain-Sue Jan*, Yijen Chen

National Chiao Tung University, Department of Management Science, 1001 Ta Hsueh Road, Hsinchu 30050, Taiwan

Received 4 July 2004; received in revised form 20 December 2004; accepted 26 January 2005

Abstract

The research and development (R&D) system for industrial development in Taiwan is made up of three parts: industrial firms, government-supported institutes (GSIs), and academic institutes and universities. The Taiwanese experience showed that the effective interaction of the GSIs and the industrial firms has successfully supported the development of its industry. The Industrial Technology Research Institute (ITRI) played the key role in industrial development during recent decades. This study provides a comprehensive analysis of ITRI and the way in which it fulfills its role through an examination of its major tasks. The implications for developing countries are also discussed.

Keywords: R&D; Industrial development; ITRI; Task analysis

1. Introduction

The research and development (R&D) systems both of developed and developing countries are generally made up of three parts, namely industry, government, and academia [1,2]. In Taiwan, this system is composed of industrial firms, government-supported institutes (GSIs), and academic institutes and universities [3,4]. Most industrial firms in Taiwan are small and medium-sized enterprises[1] (SMEs). In 2002 SMEs represented 97.72% of the total number of firms [5]. Since most SMEs lack their own

* Corresponding author.
E-mail addresses: jts@mail.nctu.edu.tw (T.-S. Jan), yjchen@itri.org.tw (Y. Chen).

[1] According to the May 2000 definition of SMEs in Taiwan, in the case of the manufacturing, construction and mining and quarrying sectors, SMEs are defined as those enterprises with paid-in capital of less than NT$80 million or regular employees not exceeding 200 persons [5].

0040-1625/$ - see front matter © 2005 Elsevier Inc. All rights reserved.
doi:10.1016/j.techfore.2005.01.005

R&D resources, industrial development requires support from government and related R&D agencies. In addition, large enterprises tend to rely on their foreign partners for supporting technology acquisition and thus spend little on independent R&D activities [6]. Therefore, the government partially or wholly supports R&D agencies for purposes of technological development either through in-house development or by introducing technologies from developed countries [7]. The technologies are then transferred to the industrial firms so that the firms can conduct and improve their product development with low R&D risk.

Taiwan has two major institutes for industrial development: one is the Chung-Shan Institute of Science and Technology (CSIST) and the other is the Industrial Technology Research Institute (ITRI). The former is devoted to developing technologies for military sectors, and the latter is for civilian ones. CSIST was set up in 1969 under the direction of the Ministry of Defense. The special task of CSIST is the development of critical weapon systems such as missiles and the IDF fighter [8]. Unlike the development of military technologies in developed countries, most of the key technologies of these weapon systems were developed by CSIST itself and manufactured by military sectors. CSIST has been so dedicated to weapons systems technology development that it has contributed little to civilian industrial development during the last few decades.

Established in 1973, ITRI is a government funded R&D agency. In contrast to CSIST, ITRI is dedicated to technological development for civilian industries. ITRI is the largest non-profit research institute in Taiwan, and it fulfills a crucial role in R&D system development for Taiwanese industry. As an R&D agency, ITRI conducts R&D projects to develop technologies. Then ITRI transfers the technologies to the industrial firms for direct commercialization or for the development of commercial products. ITRI has successfully created the semiconductor industry and assisted the development of the information, optoelectronics, automotive, and machine tool industries [9–12]. Currently, some of these industries have significant positions in the international market. For example, two of the leading semiconductor foundry companies, Taiwan Semiconductor Manufacturing Company (TSMC) and United Microelectronics Company (UMC), are ITRI spin-off firms.

Before 1980, Taiwanese government policy did not encourage universities to engage in joint research ventures with industry [13]. Government R&D agencies such as the Academia Sinica, the most famous academic institute in Taiwan, play a central role as a conductor of basic research. The interactions between academic institutes and industrial firms have been so limited that the academic institutes have made less of a contribution to industrial development in Taiwan.

In summary, although the R&D system for industrial development in Taiwan consists of three parts—industrial firms, GSIs, and academic institutes—the effective interaction of the GSIs and the industrial firms is the most important factor in industrial development, a factor in which ITRI has played a critical role during the recent decades. In this paper, we will describe the background of ITRI, and then we will use the Mintzberg's method of role and task analysis to explore the actual activities of ITRI. Finally, we will also apply this role analysis in order to compare the R&D systems for industrial development in the Newly Industrializing Countries (NICs).

2. Background of ITRI

ITRI is a nonprofit government-sponsored institute with two critical missions for industrial development. One is to upgrade existing industries through technology infusion and the other is to