



Contents lists available at ScienceDirect

Technovation

journal homepage: www.elsevier.com/locate/technovation

Technology upgrading of Small-and-Medium-sized Enterprises (SMEs) through a manpower secondment strategy – A mixed-methods study of Singapore's T-Up program

Yuen-Ping Ho^a, Yi Ruan^{b,*}, Chang-Chieh Hang^c, Poh-Kam Wong^a

^a Entrepreneurship Centre, National University of Singapore, Level 5, 21 Heng Mui Keng Terrace, 119263, Singapore

^b Nottingham University Business School China, 199 Taikang E Rd, Yinzhou, Ningbo, Zhejiang 315100, China

^c Division of Engineering & Technology Management, Institute for Engineering Leadership, National University of Singapore, 9 Engineering Drive 1, 117576, Singapore

ARTICLE INFO

Article history:

Received 7 August 2015

Received in revised form

8 July 2016

Accepted 14 July 2016

Keywords:

Technology transfer

Public research institutes

Small-and-Medium-sized Enterprises (SMEs)

Open innovation

ABSTRACT

This paper outlines a scheme that uses manpower from public research institutes to assist the technology upgrading of Small-and-Medium-sized Enterprises (SMEs). The Growing Enterprises through Technology Upgrading (GET-Up) initiative has been successfully implemented in Singapore since 2003. The key program in the initiative is a manpower secondment scheme (i.e. a temporary placement of manpower in a different organization) known as T-Up. We propose that T-Up represents a new approach to technology transfer which additionally maximizes the industrial impact of public sector research. Instead of traditional technology transfer modes which are transactions-based, T-Up utilizes skills and human resource transfer through secondment of public sector researchers. Findings from two surveys conducted in 2005 and 2012 show that the T-Up secondment program had positive impact on the technological capabilities, innovation performance and growth of participating companies. Additionally, case studies highlight that this approach addresses a wide range of challenges faced by local SMEs and is flexible enough to cater to specific needs and requirements.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

One key challenge faced by Newly Industrialized Economies (NIEs) is the evolution of an appropriate strategy to sustain long-term economic growth. Singapore's economic prosperity in the last four decades is attributed to her success in transitioning from a growth strategy reliant on sourcing technology from foreign Multi-National Companies (MNCs) to one that is more balanced with increasing emphasis on indigenous innovation capability (Wong and Singh, 2008). In January 2003, the Singapore government launched a multi-agency initiative named "Growing Enterprises with Technology Upgrade" or in short "GET-Up", to stimulate technology transfer from public to private sector, so as to nurture indigenous innovations in local industry. Concerted effort was from four government agencies, i.e. Agency for Science, Technology And Research (A*STAR), Economic Development Board (EDB), Standards, Productivity & Innovation Board Singapore (SPRING) and International Enterprise (IE) Singapore. The initiative

is a new integrated approach that utilizes skills and human resource transfer, supplemented by a practical technology road-mapping programme, and provision of technical advisors when needed to assist the technology upgrading of small and medium enterprises.

As a provider of information, government disseminates an array of scientific knowledge through government owned laboratories, technical publications, journals and computer based services (Spann et al., 1995). Following the US government in taking a cooperative technology paradigm, many governments made legislative changes so that universities and government laboratories can play a stronger role in developing technology for use in the private sector (Bozeman, 2000). Technology transfer offices were established in most research offices and universities (Siegel and Phan, 2005). The last decade witnessed an increased number of studies pertaining to university-industry technology transfer (see Bozeman (2000) and Teixeira and Mota (2012)). But there is scarce literature about technology transfer between public research institutes and private sector. Although public research institutes and universities share important features, the two differ on various perspectives. For example, public research institutes are closer to industrial technology development and have lesser focus on basic research unlike universities. Moreover, interdisciplinary

* Corresponding author.

E-mail addresses: yuenping@nus.edu.sg (Y.-P. Ho), annie.ruanyi@gmail.com (Y. Ruan), etmhead@nus.edu.sg (C.-C. Hang), pohkam@nus.edu.sg (P.-K. Wong).

research is more prolific in public research institutes than in universities. Thus, technology transfer from research institutes could be less constraining than that from universities, which warrants careful examination and our study addresses this important gap. Second, most of the studies on technology transfer focus on established firms (incumbents or R&D intensive firms). Even the majority of the Open Innovation (OI) literature that examines how firms use both internal and external ideas to advance their technology have focused primarily on MNCs (e.g. [Mortara and Minshall, 2011](#)). It is only recently that OI researchers began to study open innovation activities in SMEs ([Van de Vrande et al., 2009](#); [Lee, et al., 2010](#); [Minshall et al., 2013](#)). Our study on GET-Up has a special focus on how SMEs source technology from public research institutes, which is an important addition to not only the technology transfer literature, but also the open innovation literature.

As GET-Up's primary focus is movement of scientists and engineers, the centrepiece of the scheme is T-Up – a researcher secondment program through which SMEs can access the sizeable pool of high-quality and experienced researchers at the well-established public research institutes. Secondment here refers to the research staff of a public research institute being “loaned” to work on a full-time basis in an SME for up to two years; the secondee's salary will be paid mainly by a government grant and only partially by the SME; on completion, the secondee will return to the public research institute unless he/she is retained by the SME on mutual agreement. In this paper, we present a mixed-methods study of T-Up as an innovative approach to transfer public sector knowledge and intellectual properties to industry, and we also show that it is an effective mode for SMEs to source technologies from external parties ([Chesbrough et al., 2006](#); [Bozeman, 2000](#)). Based on both survey data collected in 2005 and 2012 and qualitative data collected from selected participating SMEs, we present quantitative and qualitative evidence of how T-Up has benefited the participating firms and achieved the policy objectives of upgrading technological capabilities in local enterprises. Insights from the study could help policy makers understand the significance of the Singaporean workforce for indigenous innovation development, more so for SMEs as they lack the necessary absorptive capacity ([Cohen and Levinthal, 1990](#)) in order to benefit from other modes of transfer. The findings should guide policy makers in making investment decisions on programs that encourage talent mobility.

The paper is organized as follows. In the next section, we briefly describe the scope and process of T-Up. In the first part of our mixed methods approach, we assess the impact of T-Up by presenting findings from two survey studies. Then, these findings are reinforced by case studies presenting qualitative evidence obtained through interviews with selected policy-makers and T-Up recipients. Finally, we discuss the findings from several theoretical perspectives and present practical implications for policy-makers and industry practitioners.

2. Background and description of the program

As Singapore transforms itself into a knowledge-based economy, the promotion of R&D has become a key strategy for driving economic growth. To support this growth strategy, there has been concerted effort to promote indigenous technological development in two spheres: the public sector comprising the universities and public research institutes; and the local industry comprising SMEs, larger local enterprises, and MNCs. To create a strong base of science and technology capability, the Singapore government has invested heavily in public sector research. Public research institutes with focus on key industrial clusters were established under the umbrella of the Agency for Science, Technology and

Research (A*STAR). These public research institutes have created substantial intellectual properties, and developed a large number of competent research scientists and engineers.

At the same time, policy-makers recognized that the business paradigm under which the Singaporean companies had operated for many years was undergoing rapid change and these companies had to make major adjustments. Before the early 2000s, Singaporean companies could depend on the MNCs which readily transferred the latest technologies to their key supporting industry partners anywhere in the world. This traditional source of technology transfer started to diminish rapidly in many high-tech sectors as the time-to-market and product life-cycles became shorter and shorter. The global manufacturing outsourcing practice in recent years has also resulted in much reduced in-house manufacturing expertise in many MNCs. Therefore, as the supporting companies of these MNCs, many Singaporean companies that have indigenous technology and manufacturing know-how could become the preferred global partners of MNCs, be it in the global market place or even in the home countries of the MNCs. In other words, innovation and intellectual property creation have become critical success factors for the Singaporean companies to survive and thrive ([Hang, 2007](#)). This is especially important and urgent for firms in the manufacturing sector as they face keen competition from neighboring countries where the cost of labour is lower. In addition to creating strong local companies to support the MNCs, another industry strategy was to help more local SMEs create indigenous technologies and products/services that would enable them to compete in the global markets. If they continued to grow, some of these local companies could eventually establish themselves as MNCs with their roots and bases in Singapore.

However, Singapore's SMEs faced many challenges that limited their ability to develop sophisticated and high-level technological capabilities. While there were generous assistance schemes to ease the financial burden of investing in R&D or technology in-sourcing, a main challenge was the shortage of R&D expertise. Many local SMEs had difficulties hiring degree holders due to their size and lack of reputation, let alone Ph.Ds or experienced researchers. A large proportion of the graduates from the local universities and researchers from the public research institutes chose to join MNCs, government, or the financial sector. Some of them left the country. Another major challenge was that some SMEs depended on the success of their previous subcontractor or OEM business and operated in a maintenance mode due to organizational inertia. The business owners of these SMEs simply did not have the ambition or foresight to upgrade their business. As a result, the R&D capabilities of the local SMEs remained poor – they lacked the absorptive capacity ([Cohen and Levinthal, 1990](#)) to work with other technology providers and were unable to generate indigenous innovation.

To address these issues, Singapore launched a multi-agency initiative called GETUp in 2003. GET-Up is targeted at promising local enterprises in the manufacturing sector which see themselves as “global enterprises in the making”. The suite of programs under GET-Up comprises: (i) TRM, a Technology Roadmapping program; (ii) T-Up, a manpower secondment scheme; and (iii) TA, a scheme to provide expert Technical Advisory services. This paper is focused on the T-Up scheme. The promising Singaporean enterprises in the manufacturing sector are mainly in the Electronics, Engineering, InfoComm and Chemicals clusters. These are also the same industrial clusters in which the Science and Engineering Research Council of A*STAR has built seven public research institutes with over 1500 Research Scientists and Engineers (researchers) and substantial intellectual properties to share. The enterprises targeted for assistance have been shortlisted by Economic Development Board (EDB), Standards, Productivity and Innovation Board (SPRING) and International Enterprise (IE)

Download English Version:

<https://daneshyari.com/en/article/5110365>

Download Persian Version:

<https://daneshyari.com/article/5110365>

[Daneshyari.com](https://daneshyari.com)