Innovation Policy for Human Capital Investment in Taiwan's Education*

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Abstract

Investment in the development of human capital in higher education is one of the most effective ways to promote a country's continued economic growth and social equity. For Taiwan, this is especially the case as it faces new challenges such as slowed economic growth, an aging population, human capital flight, shifting economic and industrial priorities, and other issues as addressed in this paper. The broad focus of this study is on innovation policy for human capital development in Taiwan's education. In particular, it investigates key issues related to the promotion and implementation of Science, Technology, Engineering, and Mathematics (STEM) education and Technical and Vocational Education and Training (TVET) for the purposes of cultivating human capital. The study attempts to examine the following research questions: What institutions and programs exist to promote STEM education, TVET, and human capital development in Taiwan? What key challenges do these initiatives try to address? How successful have these initiatives been at promoting human capital development? The findings presented in this study address themes including organizational structures tasked with human capital development; related public policies, plans, and programs, especially for promoting STEM and TVET education; and emerging human capital needs of and skills prioritized by the public authorities, industry, and civil society. The study then discusses the key challenges faced and the local responses to these challenges.

Key words: Human capital theory, STEM education, TVET education, innovation policy

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Introduction

Human capital plays an important role in the economic development of countries around the world [1). Taiwan, for its part, has long placed a heavy emphasis on education, which has been a key aspect of its rapid social and economic progress for well over a century. This focus has persisted through several different historical eras and continues to this day through government agencies' policies and other programs for promoting Science, Technology, Engineering, and Mathematics (STEM) education, Technical and Vocational Education and Training (TVET), and human capital development more broadly. To effectively engage with issues related to human capital development and investment in Taiwan and serve as a foundation for the subsequent sections in this paper, this section provides an overview of the relevant historical context, demographic changes affecting society, and the economic, educational, and public policy landscape related to human capital development in Taiwan.

Dramatic demographic changes have taken place in Taiwan in recent years, many of which have an effect on human capital development. In particular, the declining birth rate has posed a major challenge for the education system at all levels and especially for the many colleges and universities established since the late 1990s and early 2000s. Many schools simply do not have high enough student enrollment to keep their doors open and are facing the prospects of potential closure or the necessity of merging with other institutions. This has led the government and many universities to seek students from overseas to fill their dwindling student populations, compete with local and overseas institutions in world university rankings, and maintain relevance in an increasingly competitive environment for higher education institutions around the world. The number of foreign students in Taiwan has increased substantially in recent years with the help of scholarships offered by Taiwan's Ministry of Education (MOE), Ministry of Foreign Affairs (MOFA), and other institutions as well as other policies designed to attract overseas students.

In addition, the rapid economic growth Taiwan enjoyed since the late 1970s has gradually transformed the island's manufacturing-based economy into an increasingly high-tech and knowledge-based economy. Having previously been concerned mainly with industrial manufacturing, Taiwan, like the other three Asian Tigers, followed Japan's economic leadership during this period in what has been referred to by economists as the "flying geese" model of development. During that time and after, Taiwan gained a reputation for highly efficient investment, a trend that was explored by many scholars in the 1990s [3). For this reason, high expectations are placed on the return of investments of any kind on the island. Legislation related to public spending and investment is, as a result, often highly scrutinized for accountability and expected to produce results quickly. Taiwan, Singapore, South Korea, and Hong Kong invested heavily in human capital over these decades through both public, private, and household spending on various forms of education and training. That said, public spending on education was significantly lower in Taiwan than the other three Asian Tigers, yet it was still successful in terms of economic development [3).

However, this rapid and unprecedented rate of economic growth would not last. The Asian financial crisis of the 1990s coincided with the slowing of the Taiwanese economy, which has since stabilized at a rate consistent with other countries at a similar level of development. The subsequent global financial crisis of 2008 may have reinforced this relative slowdown and encouraged a number of austere business practices that persist to this day. Wages, for example, have stagnated for many years in most of Taiwan's key industries, especially for young professionals in nascent careers.

Low wages in Taiwan are also coinciding with a high demand for labor of almost every kind. Unskilled labor is often filled by migrant workers, but the slow drain of its most talented young graduates to Chinese firms in tech centers such as Shenzhen and enterprises in other foreign countries around the world, coupled with the aforementioned demographic issues, is exacerbating an already severe shortage of young and capable human capital. Overseas companies in mainland China, the United States, and elsewhere tend to offer better pay and benefits to new

graduates than do Taiwanese firms, and many of these businesses covet well educated Taiwanese graduates.

Research Methodology

Official statistics and relevant indicators from both academic and media sources are used to shed light on the public policy and human capital issues affecting Taiwan. Primary government sources include official publications such as Yearbook 2017 in Taiwan, an annual publication released by the Executive Yuan (executive branch of government) that covers a wide variety of demographic issues related to Taiwan's domestic society and relations with other countries [7]. Other publicly available government sources, including policy documents, statistical indicators, and relevant whitepapers, are also used to provide empirical evidence supporting the findings and discussion in the following sections. Given Taiwan's commitment to making government data open and accessible to the public [8] documents released by government agencies and programs related to public policy innovation and human capital development are updated regularly and contain detailed information about organizational structures, funding, and procedures. All of these sources are used to illuminate the extent of the Taiwanese government's involvement in human capital development.

Academic and media sources are then used to evaluate the impact of these public policies aiming to promote STEM education, TVET, and the development of human capital more broadly in Taiwan. Scholars have been involved in this endeavor since Taiwan's rapid economic growth began. Where needed, insights are drawn from studies going back to the late 1990s regarding educational reform policies and investment in human capital development. Media sources which have compiled data and conducted interviews with industry representatives are used to gain insight where otherwise unavailable.

All sources are synthesized in the discussion section, where the key challenges facing human capital development in Taiwan are identified, and local responses to these challenges and policies are evaluated.

Lessons learned from the history of human capital development are highlighted, and policy recommendations are then offered related to domestic policy innovation to address relevant challenges. Although the findings of this study are not comprehensive, they are intended to illuminate the larger picture of human capital development in Taiwan. The most influential organizational structures, policies, plans, and programs have been considered and evaluated based on the above sources, and challenges, responses, and recommendations that are identified are based on these documents.

Research Findings

Taiwan has placed great emphasis on human capital development through various means, including STEM and TVET education. Its economic development over the years is evidence that Taiwan has been remarkably successful in this regard, suggesting that there are important lessons to be learned from the Taiwanese experience. Even so, given the wide range of relevant policy options, optimizing human capital investment based on the context of a society and the resources available to it is no simple task. This study aims to shed light on the major aspects of its investment in and development of human capital. Specifically, the findings presented in the following subsections.

Organizational Structures

There are many different institutions in Taiwan involved in human capital development through STEM education, TVET, and other means. These include government agencies, non-governmental institutions, and private investment. Given the relatively high level of centralization in Taiwan, public agencies at various levels, including the five Yuan (branches of government), ministries, councils, public universities, and other relevant institutions, take the leading role in these issues. As for non-governmental institutions involved in promoting human capital development in Taiwan, several that merit discussion include Taiwan's

many different private universities and higher education institutions, the Industrial Technology Research Institute, Epoch Foundation, and Fulbright Taiwan. In addition to government agencies and non-governmental institutions, private investment also plays an important role in facilitating capital development through programs either managed or financed by businesses in various industries. The most noteworthy public agencies, non-governmental institutions, and private actors and their respective roles in human capital investment in Taiwan are discussed in greater detail in the following subsections.

Public Structures

Taiwan has a democratic but relatively centralized political structure, and public agencies are the most influential actors involved in promoting human capital development. The most prominent governmental actors include the Executive Yuan, Ministry of Education, Ministry of Science and Technology, Ministry of the Interior, Ministry of Labor, Ministry of Economic Affairs, and National Development Council. These agencies, either independently or in collaboration with relevant partners, are each responsible for managing programs related to different aspects of human capital development in line with their institutional aims.

Private Investment

In addition to public agencies and non-public institutions, private investment is an important aspect of overall human capital development in Taiwan. Through the promotion of STEM education, TVET, and education more broadly, private investment by individuals and households as well as investment in various programs by local and foreign companies and others in the business community all contribute to the creation and strengthening of human capital in Taiwan.

Household and Individual Investment

Private investment in human capital is the means by which parents invest in their children's future, firms invest in their own workforces, and individuals invest in their own marketability and competitiveness. Taiwan is particularly unique, in that household spending on education is one of the world's highest. Taiwanese parents spend more on their children's education than all but four of the world's nations according to a report by HSBC. The report, titled *The Value of Education*, claims that an average of US$56,424 is spent on every Taiwanese child, a figure behind only Hong Kong, the United Arab Emirates, Singapore, and the United States [25]. The high amount of spending can be attributed to several factors, including private primary and secondary school tuition and fees, after-school programs called *buxiban*(補習班), and college expenses such as tuition, fees, books, and accommodation.

Domestic and Foreign Enterprises

In the past, Taiwanese businesses have not spent a great deal on staff and employee training, but that has been changing gradually over the past few decades. Taiwanese businesses are spending more money on training and coaching employees, but many outsource such activities to specialty training and certification firms [26]. Several foreign companies have also made major contributions to human capital development in Taiwan. A prime example of this is Google, for which Taiwan is its "largest R&D center in Asia" [27].The company has contributed large amounts of financial resources to relevant programs over the years, including committing in 2018 to "train 50,000 Taiwanese businesses and students in digital marketing over the next year through a combination of online and offline initiatives" and "holding a train-the-trainers program for teachers in locations across Taiwan … to educate a new generation of Taiwanese students in AI" and machine learning [28]. Other prominent foreign businesses that have invested in human capital development in Taiwan include Microsoft, which has launched an AI R&D center, and Amazon, through its investment in a "joint innovative center" [27].

Public Policies, Plans, and Programs

In recent years, many public policies, plans, and programs with the aim of encouraging human capital development in the Taiwan have been proposed and implemented. These are managed by various government agencies and institutions, as highlighted above, and they have varying timeframes with some having been completed and others ongoing. Although the overall agenda of the Taiwanese government is set by the current administration, many individual programs and policies that remain in effect were put in place by previous administrations. For the purpose of coherent discussion, this paper sorts them into four categories: policies, plans, and programs for promoting the STEM fields in Taiwanese businesses and education; those facilitating the development of TVET; those concerned with developing entrepreneurial skills and opportunities; those that support human capital development in general.

STEM Programs in Taiwanese HEIs

According to the statistical yearbook released each year, 1,309,670 individuals were enrolled in higher education programs in Taiwan in 2016–2017, 545,601of them in STEM-related fields [7].Problematically, STEM programs in Taiwanese HEIs struggle to gain international recognition, and the Taiwanese government has initiated the Aim for the Top University Project (邁向頂尖大學計畫)with the intended result of elevating at least one institution into the top 100 universities in the world. Many of the universities targeted by this program, which involves 5-year plans for institutions receiving funding, have created offices specifically related to using that funding to improve their institutions [29]. Another plan, the Multi-Star Project (繁星推薦) gives students the opportunity to apply for admission to STEM university programs through means other than examination. It has been seen as a successful program in spite of initial backlash, and ‘Star’ students, as they are sometimes called, tend to reach high levels of achievement [30]. However, alarmingly low

birthrates in Taiwan have become an existential threat to many higher education institutions, a problem which is discussed further below.

TVET Programs in Secondary and Higher Education

As mentioned previously, the promotion of TVET in Taiwan is largely managed by MOE through the implementation of relevant programs in middle schools, high schools, and junior colleges. Students seeking a vocational education have a number of pathways available to them, and specific opportunities may depend on what educational resources are available in their community. One option is comprehensive junior-senior high school, which combines middle school and high school and contains both vocational and academic tracks. Students attending these schools have the choice of either one of the two tracks or pursuing a combination track mixing academics and vocational training. Typically, though, students opt for only one of the two tracks. Upon graduation from middle school, students in the vocational track are presented with the option of going on to 3-year vocational secondary school, where they choose a specialty such as engineering, business, or fine arts, or advancing immediately to a junior college offering a 5-year program, after which they will have obtained the equivalent of an associate's degree. The other option, a 3-year vocational secondary school, also enables students to go on to junior college where they can enter a 2-year program resulting in the same associate-level degree.

It should be noted that none of the above options "lock" a student into a particular track for the entirety of their education. After completion of the junior college track, for example, students can go on to a 2-year technical institute, or even decide to transfer to a 4-year university. Although attention has been focused more on expanding access to 4-year programs in recent decades, especially in STEM fields, some attention has begun to shift back toward TVET education in Taiwan, as can be seen by projects such as the Forward-Looking Infrastructure Development Program [6].

Discussion

Taiwanese efforts to develop the human capital resources necessary for sustainable and equitable growth have had mixed results. There are a number of factors at play that work in Taiwan's favor, but equally influential are the forces which confound the efforts of policy makers and business leaders on the island. Taiwan enjoys many advantages through its close economic ties to large markets like China and the United States and the economic development it achieved in the 1970s and 1980s. However, the limits of these advantages without significant changes in the way human capital is developed have become apparent since the slowing of economic growth beginning in the 1990s. Among the chief concerns of Taiwan at this point is how to capitalize on its existing advantages and facilitate the growth of talent in other areas so as to compete in an ever-globalizing world [56]. The following subsections first discuss the key challenges faced by Taiwan in terms of human capital development, which include economic changes, demographic changes, human capital flight, and limits on international participation. This is followed by further discussion of the local responses to these challenges, which have included fostering interest in STEM, improving TVET programs, facilitating twenty-first-century skills in education, and attracting and retaining highly qualified domestic and foreign talent.

In terms of human capital needs and strategies, Taiwan is in a unique situation globally because of a host of factors that are both international and domestic. Many of these challenges have manifested themselves since the 1990s after a general slow-down of economic growth in Asia and massive technological advancements during that time. Major challenges facing Taiwan's human capital development include economic changes, shifts in population demographics, an acute loss of talent abroad (especially to China), and a limited capacity for participation in the international community.

Conclusion

The cultivation of quality human capital is a top priority for Taiwan. Ever since the economic miracles of the 1970s and 1980s, a strong, well-trained workforce has been an essential part of continued success. Specifically, STEM education and TVET continue to be prioritized by policymakers, enterprises, and individuals as a means to ensure that Taiwanese human capital resources can contribute to the realization of continued economic growth. Public agencies, non-governmental institutions, and private interests all contribute to this endeavor in important ways in order to meet the difficult challenges facing Taiwanese society today. However, an aging, highly educated population facing slowed economic growth in a globally changing industrial and technological landscape must work harder than ever to maintain a healthy economy that guarantees equitable opportunities for its population.

If Taiwan is to succeed, significant effort is needed to give Taiwanese scientists, engineers, machinists, and professionals of all kinds the tools they need to bring Taiwan's society into the 21st century. Specifically, Taiwanese businesses, institutions, and government need to work together to make the island more attractive to the talented young professionals produced by its universities and colleges. In terms of TVET, Taiwanese society cannot overlook the importance of innovative and accessible vocational and technical training. Taiwan's highly educated population will be squandered if it runs short of qualified trades people. The education system in Taiwan also needs to continue to shift away from a traditional rote learning style and towards a methodology that promotes critical thinking and skills that are relevant now, and that will be relevant in the future. Overemphasis on testing in school will continue to undermine those efforts until major changes are made. Beyond that, Taiwanese businesses and policymakers need to devise new ways to attract more top minds from abroad, and to retain them, and their native talent, for longer.

Taiwan has made immense progress in terms of human capital investment and development and it has served as a model for others in the region, and indeed, the world. In other words, Taiwan is faced with new demographic, economic, educational, and policy-related challenges that continue stand in the way of progress and growth. Many initiatives have aimed to address these, but more must be done if Taiwan is to optimize its development of human capital and continue to compete globally with the world's most advanced economies.

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