Human Capital Investment in Science and Technology Education and Quality of Life in Thailand

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Abstract
Investment in education is a vital factor for the development of both individuals and the whole country. In Thailand, people have attempted to increase their human capital in terms of academic knowledge by studying in university as well as entering higher education with the expectation for higher wages and salaries, and a better quality of life. The Thai government has implemented policies to improve equitable quality education and the opportunity to access it. Moreover, the national education plan 2017-2036 is the ultimate goal to be achieved. In the digital economy era, science and technology majors have been important aspects of driving the country. Many students decided to study science and technology. This research uses secondary data from the National Statistical Office of Thailand and other related data sources to investigate the first-year income and the rate of return on studying in science and technology majors. The results showed that, in 2022, new graduates from science and technology fields earned wages and salaries higher than the poverty line and the minimum wage of Thailand. Most of them have a high quality of life. However, the high return comes with high responsibility as well. As analyzed, this research suggests that the government should focus on education improvement for people to enhance their labor productivity and quality of life.

Keywords: Human Capital, Education, Science, Technology, Quality of Life

Introduction

In an era of ever-advancing science and technology, where the demand for skilled professionals in these fields is rising, the investment in science and technology education has become an exceptionally crucial investment in human capital. Governments, educational institutions, and private entities across the globe are aware of the necessity of promoting education that provides individuals with the skills, knowledge, and specialized abilities required in this area. The goal is to change how individuals lead their lives, conduct business, engage in societal development, drive economic growth, and tackle a range of challenges, spanning both the individual and society.

Education in science and technology provides individuals with knowledge and abilities that are in line with current labor market demands, particularly in specialized fields such as information technology and engineering. According to "The Future of Jobs Report 2023" released by the World Economic Forum, surveys assessing job requirements in the coming years reveal that over 85% of organizations intend to integrate new and innovative technologies into their operations. This includes expanding their digital footprint and embracing technologies such as Big Data, Cloud Computing, and Artificial Intelligence (AI). There is an anticipation of significant growth in technology-related employment over the next five years, with expertise in technology rapidly emerging as one of the top three critical skills in demand. It is expected that roles in sectors such as Big Data analytics, climate change and environmental management technologies, and encryption and cybersecurity will be the primary drivers of job expansion (WEF, 2023). Therefore, persons who seek education in these areas are more likely to have attractive career prospects, the possibility for large future income, and employment security.

According to the most recent data from Thailand's Ministry of Higher Education, Science, Research, and Innovation, there were 111,553 graduates from various educational institutions in the fields of science, technology, and engineering in 2020. There were 15,729 graduates in natural sciences, mathematics, and statistics, 10,248 graduates in agriculture, forestry, fisheries, and veterinary, 24,913 graduates in health, 15,537 graduates in information and communication technologies (ICTs), and 45,126 graduates in engineering, manufacturing, and construction. Furthermore, the number of students currently enrolled in science, technology, and engineering programs at all levels of education and in all academic years in higher education institutions totaled 497,855 in 2023.

Education is positively correlated with an individual's workforce efficiency. Those who achieve higher levels of education generally experience greater employment opportunities, and a lower probability of facing unemployment, and tend to earn higher incomes on average. Tuition fees, additional educational expenses, and opportunity costs during the study period are all costs of pursuing education beyond the mandatory and college levels. However, it provides benefits in the form of improved skills and certifications, resulting in higher salaries, more work opportunities, and an overall improvement in their quality of life (OECD, 1998).

The quality of life can be measured in a variety of ways, including health, well-being, and economic stability. Investing in human capital through education is a critical aspect in the creation of a high quality of life in this regard. This research aims to investigate the intriguing relationship between investing in human capital in science and technology education and the quality of life in Thailand.

Objectives

This research aims 1) to investigate human capital investment among undergraduate students in three significant majors of science and technology: information technology, engineering, and medicine. 2) to assess the quality of life that results from the returns on investment in science and technology education at the undergraduate level.

Literature Review

Human Capital

Chomtohsuwan T. (2016) defines human capital as the worth of each individual, similar to financial capital, which can generate monetary returns. Individuals with better human capital are more likely to benefit from higher returns. Human capital is classified into two types: (1) Implicit human capital, which includes unobservable elements of an individual that have been present since birth, such as IQ, abilities, attractiveness, genetics, and predecessors' values. Though it is not expressed in monetary terms, it can provide monetary returns. (2) Explicit human capital is the concrete component of human capital. Each person starts with nothing and can build it up through numerous investments such as physical development, healthcare, basic consumption, knowledge and skill acquisition, and formal education.

Gary S. Becker, an American economist who was awarded the Nobel Prize in Economics in 1992, discusses human capital as a characteristic that cannot be separated from the individual. This includes knowledge, skills, health, or inherent values within a person that affect productivity and economic potential. These aspects are inseparable from the individual, much like the movement of financial assets or physical assets (Becker, G. S., 1993). Similarly, Simon Burgess defines human capital as the skills, characteristics, and knowledge that individuals accumulate. It encompasses a wide range of valuable skills and is not limited to just IQ. It is not possible to clearly specify which type of human capital is the most important. Human capital is the result of investments in education, and this investment is not limited to educational institutions alone. Families also play a significant role in this investment process (Burgess, S., 2016).

Human capital, according to Claudia Goldin (2016), is the skills, abilities, health, and expertise gathered through human work that may be used in production, like physical capital, which includes factories, equipment, machinery, and numerous instruments. Human capital and physical capital are both the result of investment decisions that have considerable direct investment costs. Investing in human capital incurs opportunity costs in terms of individuals' time.

Human capital focuses on the individual, in contrast to social capital, which emphasizes relationships. Human capital is the foundation of economic growth, assessable primarily through educational attainment and direct returns in terms of income and productivity. Additionally, it provides indirect returns in terms of health and civic activities. However, measuring the returns on human capital remains a significant challenge, especially those that are 'non-economic,' impacting quality of life and social cohesion (Helliwell, J. F., 2001).

The analysis of human capital is related to the abilities developed through both formal and informal education, both in educational institutions and at home, training, experiences, and development from labor market mobility (Mincer, J., 1981). Mincer also refers to the concept

of 'capital' put forth by Irving Fisher, a renowned American economist. Fisher posited that capital includes any asset that generates income, and he argued that human capital should be considered a part of this asset. Human capital cannot be traded, it exists in the form of skills and abilities that can be leased, and the process of investing in human capital often involves activities that go beyond trading.

The World Bank has defined the term “human capital” as comprising knowledge, skills, and health that individuals invest in and develop throughout their lives. These elements make them aware of their potential as productive members of society. Investing in people through nutrition, healthcare, quality education, careers, and various skills leads to the development of human capital. This is a crucial factor in achieving equality and fostering improved economic growth. The World Bank collaborates with governments in 90 countries through the Human Capital Project (HCP), using human capital investment as one of its primary approaches to achieve the goal of alleviating extreme poverty by 2030 and promoting shared prosperity globally (World Bank, 2019).

Human Capital Investment

Human capital reflects the concept that humans are valuable resources. Investment in human capital can yield significant economic and social returns. Investing in human capital is a process that involves utilizing various resources such as time, money, and effort to enhance individuals' skills, knowledge, abilities, and other attributes. As a result, it influences the overall productivity and economic capacity of individuals. Individuals can improve their chances of future employment and income generation by investing in education, training, and personal development in a variety of areas. This emphasizes the idea that humans are not merely labor factors but valuable assets that can increase their worth through investments. Education and training are the most important components of human capital (Becker, G. S., 1993). There is research that shows that education at the high school and college levels in the United States significantly increases individual income even after accounting for both direct and indirect educational expenses. Furthermore, there is similar evidence from various countries with diverse cultures and economic systems, indicating that the income of individuals with higher education is often higher on average, and generally, post-expense income is much higher in less developed countries.

Theodore William Schultz, an influential economist in the study of human capital theory, proposed the idea that investing in oneself enables individuals to expand their life choices and is one way to elevate their well-being. He argued that humans are assets of value similar to physical capital or machinery. Developing skills, knowledge, and health in individuals can increase their economic value and contribute to economic growth. Education, training, and geographical mobility for job opportunities are forms of crucial investments in human capital that yield returns in the form of higher income, improved job prospects, and overall economic and social progress. Individuals' varying incomes may reflect differences in health and education as fundamental factors (Schultz, T. W., 1961).

Mincer, J. (1981), a human capital analyst, showed interest in the subject of educational investment within educational institutions. He argued that the expenses associated with education, borne by students or their parents, encompass not only tuition and other learning-related costs but also the foregone earnings that could have been earned had the time spent in education been used for income-generating work instead. This potential income is considered the most valuable cost, accounting for more than half of the total educational costs.

Quality of Life

The World Health Organization (WHO) defines "quality of life" as an individual's view of their place in life concerning their goals, aspirations, standards, and concerns in the context of the culture and value systems in which they live. "Quality of life" is a broad and complicated notion that includes physical health, mental well-being, independence, social interactions, personal views, and the individual's relationship with the particular characteristics of the environment. This definition expresses the viewpoint that "quality of life" entails an evaluative assessment within the context of culture, society, and the environment.

Referring to the quality of life model by Felce and Perry (1995) explains that "quality of life" refers to overall general well-being, which encompasses idealized indicators and assessments related to physical, social, material, and emotional aspects. This comprehensive evaluation of well-being comprises three groups of factors: objective life conditions, personal values and aspirations, and the subjective feeling of well-being.

John Kenneth Galbraith presented an essay titled “Economics and the Quality of Life”, which explored the relationship between economics and the overall well-being or quality of life of individuals and society. He put forth the idea that a broad set of indicators is necessary to assess the quality of life, including access to education, healthcare, a clean environment, and social services. The measurement of quality of life must consider the holistic aspects of these various aspects. Considering economic growth measures such as GDP alone is insufficient for assessing the well-being and happiness of individuals and society as a whole.

Income: An Indicator of Quality of Life

The Organization for Economic Co-operation and Development (OECD) conducted a study on the quality of life of people in its member countries, totaling 447. This research considered well-being across 11 areas, including income, jobs, health, access to services, environment, education, safety, civic engagement, housing, social support network, and life satisfaction (OECD, 2022). Income is a key component in determining quality of life.

According to the salary report for the year 2023 in Thailand, conducted by Adecco, it was found that the spread of COVID-19 during the years 2021-2022 had an impact on the uncertainty in the labor market. This led to a downward shift in the starting salaries of recent graduates, decreasing from $428 to $343, and even touching the minimum wage level of $285. However, in the year 2023, the starting salaries for recent graduates have once again reached $428. Currently, incomes in the technology sector are increasing. In order to earn a higher salary, job applicants or workers must have additional skills, such as language and communication skills, as well as the ability to work collaboratively with others. These complementary skills help enhance their abilities and make employers more willing to offer higher salaries.

Methodology

This research collected secondary data from various sources, as follows: Data on the daily expenses of the Thai population from the Household Socio-Economic Survey (SES) conducted by the National Statistical Office of Thailand. Data on the salary of new graduates in the year 2022 was obtained from universities, government agencies, and private

organizations. Data on tuition fees and various education-related expenses were obtained from both public and private educational institutions. Other data from relevant studies.

This research divides the sample into three groups based on the major of study in science and technology at the undergraduate level. The details are as follows:

- Engineering major (22 years of study, starting work at the age of 23)
- Information technology major (22 years of study, starting work at the age of 23)
- Medicine major (24 years of study, starting work at the age of 25)

The estimated human capital is derived from the various expenses incurred by individuals from the time they are in the womb of their mother until they complete their undergraduate degree. These expenses consist of three main components: basic living expenses, education-related expenses, and the opportunity cost of choosing to pursue education beyond high school and undergraduate levels without gaining income from working.

The rate of return on human capital investment is calculated based on the net return that graduates in each field receive in their first year of employment, in comparison to the human capital cost of those graduates. The net return is the income earned after deducting basic living expenses during the working years. This research estimates the income in the first year of employment, which primarily comes from two main sources: salary and bonuses.

This research assesses the quality of life of those who have completed education in science and technology majors. This research utilizes income from employment as a factor. In this research, the quality of life is segmented into six levels, categorized by the average monthly income level, which is estimated from the average monthly income per person, classified by population group according to the level of income throughout the nation (Quintile by income) for 2021, using data from the Office of the National Economic and Social Development Council.

Table 1: Quality of life level divided by average monthly income

Average monthly income ($)	Quality of life level
≤ 85.93	Poor
> 85.93 – 151.48	Low
> 151.48 – 221.44	Low-medium
> 221.44 – 333.93	Medium
> 333.93 – 768.74	High-medium
> 768.74	Hight

Results

Human Capital Investment

This research calculates the value of “Human Capital” based on the investments covering educational expenses, basic living costs, and opportunity costs. The results indicate that the highest investment is in the field of medicine, totaling $192,034.16, followed by engineering at $103,891.66 and information technology at $102,620.09, as shown in Figure 1. The average human capital investment across all three majors is $132,848.64.

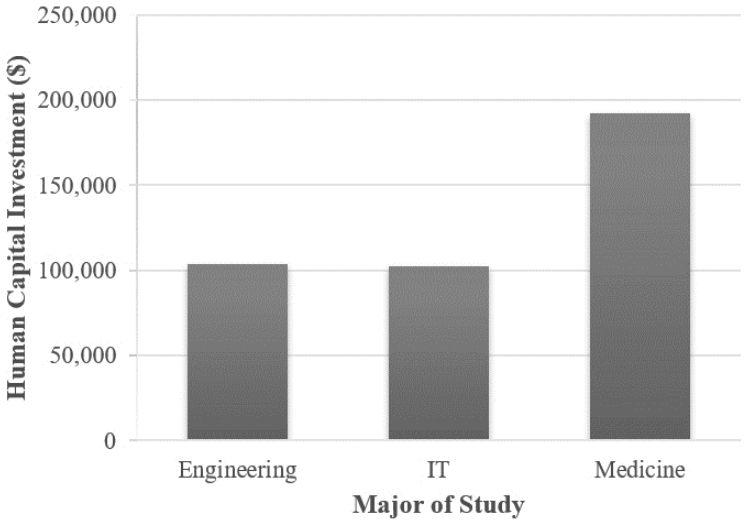

Figure 1: Human Capital Investment

Human capital investment in medical education is 84.84 percent higher than in engineering and 87.13 percent higher than in information technology. Meanwhile, investment in engineering major is 1.24 percent higher than in information technology major.

Returns on Human Capital Investment

A study of returns from human capital investment in education considers the average monthly monetary returns from working during the first year of employment after graduation. These returns consist of income from salaries and bonuses. The study found that graduates from the medical major received the highest average monthly returns, at $2,107.92, followed by engineering at $746.67, and information technology at $719.42, as shown in Figure 2. On average, the average monthly returns from working during the first year across all three academic majors amounted to $1,191.34.

Investing in a medical major provides a 182.31 percent higher return than investing in an engineering major and a 193 percent higher return than investing in an information technology major. In the meantime, investment in engineering provides a 3.79 percent higher return than investing in information technology.

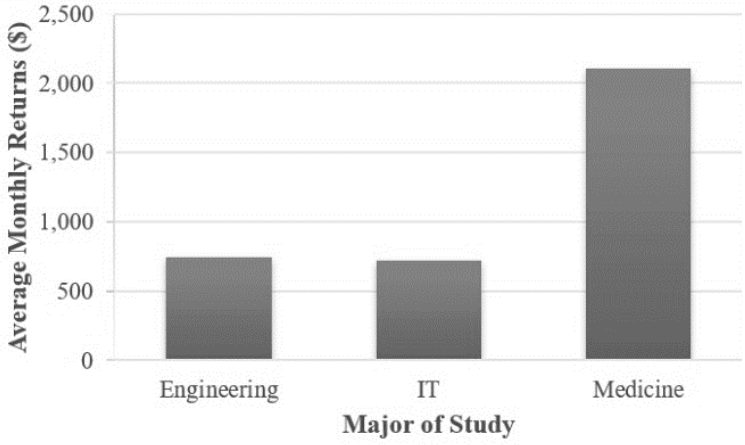

Figure 2: Average monthly returning during the initial year of employment

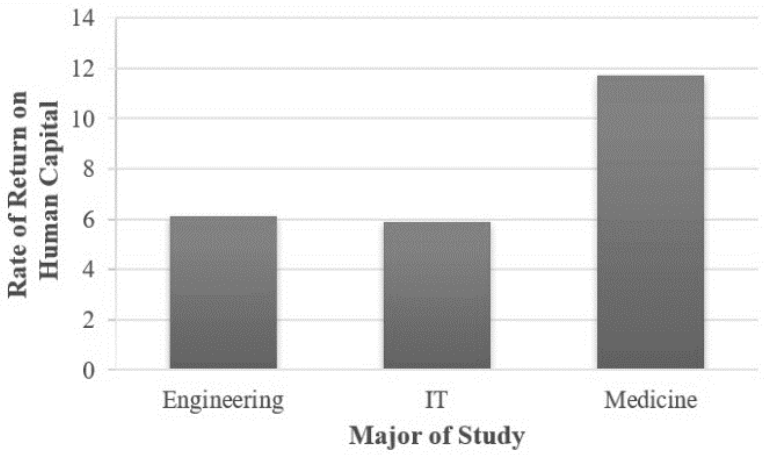

Figure 3: Rate of return on human capital

The rate of return for the first year is 11.74 percent in the major of medicine, 6.13 percent in engineering, and 5.89 percent in information technology, as shown in Figure 3. The average rate of return across all three majors is 7.92 percent.

Assuming consistent monthly monetary returns for graduates from all three majors, the break-even period for educational investment is approximately 9 years for medical education, 16 years for engineering, and 17 years for information technology.

Quality of Life Assessment

The study found that investments in all three academic majors yield monetary returns that can result in a good quality of life. Investment in engineering and information technology education leads to graduates having a high-medium quality of life level, while investment in medical education leads to graduates having a high quality of life level.

In engineering and information technology majors, graduates receive an average yearly return of $746.67 and $719.42, respectively. These returns fall within the income range of $333.93 to $768.74, indicating that individuals who complete their education in these areas have a high-medium quality of life. For graduates in medicine, the average yearly return is $2,107.92, which falls within the income range of $769 and above, indicating that individuals who complete their education in this field have a high quality of life.

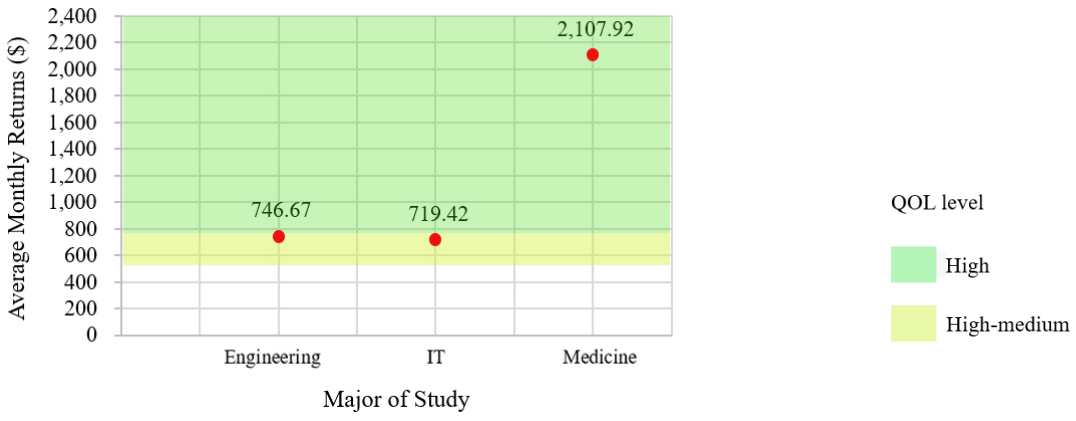

Figure 4: Assessing the quality of life (QOL) of engineering, information technology, and medicine graduates.

According to the study's findings, graduates with a major in engineering, information technology, and medicine had a higher quality of life than those with income at or below the poverty and minimum wage levels. In 2021, Thailand's national average minimum wage was approximately $221.65 per month, falling within an income range of $221.44 to $333.93, indicative of a medium-level quality of life. Those with a monthly income at or below the current poverty line, set at $80.01, experience a poor quality of life.

Conclusions and Recommendations

Investment in human capital in science and technology education is crucial for stimulating economic growth and improving the quality of life. The study results show that individuals who complete their education in science and technology majors: engineering, information technology, and medicine enjoy a good quality of life. Therefore, promoting and supporting education in these areas is essential for the development of the country and the enhancement of people's quality of life.

Promoting Human Capital Investment in Education

Promoting investment in human capital in science and technology education requires cooperation from multiple sectors, including the government, educational institutions, and the private sector.

1. Government

The government can support and create opportunities for access to education in science and technology through various policies. For example, allocating funding for scholarships or financial assistance to students who are interested in or pursuing undergraduate degrees in science and technology fields, especially students from disadvantaged backgrounds. Such initiatives will help reduce financial barriers to education and address educational inequality, particularly in fields with shortages that require significant educational investment, such as medical studies.

The government can still allocate an additional budget for education to support educational institutions in acquiring sufficient resources for the development of graduates in this field. With this budget, educational institutions can improve their facilities and procure educational equipment, especially in fields that require high-value educational equipment, such as medical and engineering. The government should encourage educational institutions to incorporate technology and innovation into the learning processes, for example, supporting the use of teaching technology and online learning development.

These roles of the government sector align with the national education plan 2017-2036, which aims to provide access to educational opportunities, ensure educational equality, improve educational quality, and enhance efficiency in response to the challenges of the contemporary world.

In addition to promoting education, the government also plays a key role in promoting a high-quality life for graduates, such as creating opportunities for employment by encouraging investment in science and technology to increase job opportunities in these professions. Moreover, the government should regulate and enforce the fair regulation of labor laws and regulations to protect workers' rights, guarantee workplace safety, promote access to

affordable and high-quality healthcare services, and foster work-life balance through appropriate working hour policies.

2. Educational institutions

Education institutions ought to enhance their science and technology curricula to remain up-to-date and ensure a high standard, thus enabling the production of graduates equipped with knowledge and skills that align with present and future labor market requirements.

Moreover, these institutions should actively endorse research initiatives, fostering the generation of fresh knowledge and offering students opportunities to engage in research projects. One of the primary objectives of educational establishments is to augment the workforce in these domains, thereby addressing the shortage of professionals. They should also prepare their facilities and teaching equipment to be fully equipped for creating an optimal learning environment, as certain scientific and technological disciplines necessitate the utilization of cutting-edge technology.

3. Private sector

The private sector can promote human capital investment for science and technology education through financial support. Examples, providing scholarships to capable but financially disadvantaged students, research grants for researchers, and funding for various creative and innovative projects, which encourage the discovery and development of new technologies.

Furthermore, the private sector can collaborate with educational institutions to develop curricula that better align with the industry's needs and the job market. Providing internship opportunities for students helps enhance their knowledge and skills by allowing them to learn from real-world experiences.

Studying Quality of Life Factors

Quality of life is a complex topic that requires consideration of various elements. To develop quality of life, the following key factors must be studied:

1. Health and well-being

Caring for both physical and mental health, including engaging in regular exercise, maintaining a balanced diet, getting adequate rest, and preserving mental well-being, are all essential factors that enhance the quality of life. Moreover, residing in a home and working in an environment that provides clean, suitable living conditions, while ensuring safety for both life and property, also plays a significant role in promoting a high quality of life.

2. Work-life balance

Despite the high salaries and employment security available to those who complete their education in engineering, computer technology, and medicine, most people in these fields frequently work hard, are under a lot of stress, and struggle with health problems. These factors, in turn, significantly reduce their quality of life. Maintaining a balance between work, relaxation, family time, and leisure improves quality of life.

3. Financial security

This research divides the quality of life according to income levels, which is a factor reflecting economic well-being. However, having a good quality of life should also prioritize

financial stability. Good financial planning is a way to create financial stability in both the present and the future, especially during the post-retirement phase. This helps reduce stress and increase life satisfaction.

4. Happiness and life satisfaction

Happiness and satisfaction are also factors in assessing the quality of life. Happiness stemming from strong relationships within the family and with friends, as well as satisfaction with life and work resulting from doing a job one enjoys and is skilled at, all play a significant role in determining a person's quality of life.

5. Contribute to society

Participating in society and collaborating with others are crucial in shaping the quality of life. These actions foster happiness, stability, and purpose in one's life.

Utilizing education and skills to positively contribute to society, addressing issues, mentoring others, and undertaking impactful projects, as doctors do, fosters a sense of involvement in resolving challenges. These actions enhance one's joy, self-fulfillment, and satisfaction in personal achievements, all of which profoundly influence the overall quality of life.

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