

# “UNLOCKING ECONOMIC POTENTIALS: THE ROLES OF TECHNOLOGICAL PROGRESS, PHYSICAL CAPITAL AND HUMAN CAPITAL IN LABOUR PRODUCTIVITY”

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**Abstract:** This article discloses the integral relationship between technological progress, human capital, and physical capital in improving labour productivity and driving economic growth, particularly, in developing countries. By combining the existing literature on the topic as well as empirical data, we demonstrate how advancement in technology can streamline processes and increase efficiency, thereby increasing output per worker. Furthermore, we go through the significant role of human capital defined as education, skills, and competencies acquired by employees in maximizing the benefits of technological innovations and improving productivity. We also consider the importance of physical capital investment such as infrastructure and machinery, in creating a conducive environment for increased labor productivity. Our findings suggest that a strategic integration of these three elements not only leads to significant improvements in productivity but also fosters sustainable economic growth and higher GDP in developing nations.

**Key words:** Human capital, physical capital, natural capital, structural reform, efficiency, communication tool, troubleshooting, within effect, between effect, labour productivity



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## INTRODUCTION

Labour productivity growth is vital in any country's economy, especially in developing countries. Labour productivity drives/fosters economic growth through which countries can produce more products with the resources they used to have. Second, the effect of this factor can be seen in everybody's life. Productivity growth means higher profit and more investment opportunities for businesses which in its turn provides workers of those businesses with high wages as well as high tax revenues for government. Third, even with maintaining the recent productivity growth in developing can reduce the gap with the countries acquiring more advanced economic situation. Last but not least, labour productivity is truly significant in today's labour market where the age workers is being considered as the main requirement. Today, most of the countries even with an advanced economy are suffering from ageing population. In countries like Bulgaria, Greece, Italy, Japan, Latvia, Germany, enhancing productivity is important since it is the only way to maintain their economic growth rate. Having considered the aforementioned reasons, it can be concluded that in today's world, we cannot drive economic growth without improving labour productivity.

Investments in capital, technological progress, human and physical capital as well as structural reforms are considered the main drivers of labour productivity. Through investments in the economic factors above, business and government can increase labour productivity.

### Methodology

This study employs a mixed-methods approach that combines quantitative analysis with qualitative insights to comprehensively examine the impact of technological progress, human capital, and physical capital on labour productivity and economic growth in developing countries. To demonstrate the relationship between overall GDP growth and those three factors, descriptive statistical analysis has been made.

### The effect of technological progress on productivity

As is stated above, one of the contributors of labour productivity is technological progress which refers to the enhanced or new methods of producing goods and offering variety of services. Enhancement in technologies can result in increased labour productivity.

### 1. Becoming more efficient

Applying robotics and automation can lead companies towards productivity in manufacturing. First of all, using robotics and automation means a quality and standardized product without any human errors and omissions resulting in defects. Second, manufacturing companies can save time of production, fasten the process of delivery to the markets or other businesses. Third, Automation and robotics can improve safety standards. Last but not least, automation and robotics can give an opportunity to monitor the whole process of production and identify the problems.

### 2. Staff engagement

For companies recruiting employees from different parts of the world, communication and collaboration is significantly important. Technologies can give an opportunity for an employee regardless of his location to follow the tasks, to presents reports and to be on the track all the time. Before the introduction of today's technologies, companies had hesitation about outsourcing since it was difficult for them to supervise their foreign employees on time. Nowadays, with the help of using a single platform, all of the workers locating in different parts of the world can be easily monitored and controlled, ranging from their attendance till task achievements or accomplishments. Using the appropriate communication and collaboration tool can eliminate bottlenecks that can cause delays in production.

### 3. Reducing downtime as well as maintenance cost

When manual process of production is automated, the risk of human errors and error-related issues which result in low quality products, machines breakdowns and downtimes can be avoided or at least reduced significantly. When the process of production is accomplished by different employees, the same standardized error free result cannot be guaranteed since each worker has distinct potential, experience and skills and those abilities cannot be used at the same rate by all employees. Therefore, when the production process is automated, the same result can be achieved form each series of production without incurring the cost for maintenance and downtime.

### 4 Predicting potential problems

Companies using AI-enabled systems in their manufacturing processes can identify the problems before it comes up. AI-enabled systems have the function of analysing vast amount of data of machines in order to predict the up-coming potential problems. When the problem is predicted, the human workforce will be informed immediately so that the downtime can be avoided immediately which in its turn assures the continuous production of outputs.

Only with robust automated maintenance processes and automation-as-a-service<sup>9</sup> (AaaS) this type of technologies can be used. The pre-screening provides manufacturers with insight into the health of machine and its performance. Based on the pre-screening, any problem can be detected and at the same time it gives the manufacturer enough time to think about how to act appropriately to solve the problem without or minimum level of cost and effort.

Producing less variable products, AI-enabled systems can meet the expectations of the companies' customers.

### How physical capital affects productivity

One of the three factors of production along with land (natural capital) and labour (human capital) is physical capital which is the most significant and expansive. The terms human and physical capital cannot be distinguished by some people or misunderstood. In order to be considered as a physical capital that item must be tangible and human made. The reason why those two terms cannot be distinguished or understand is that they can think that everything involved in production process is physical capital. However, human involved in the process is human capital since that factor is not made by human. Apart from human capital another factor; natural capital is also involved in production process. Physical capital such as building computers, machines, equipments and other technologies make the natural capital (raw materials) turn into a product. Production process cannot work appropriately when one of those three factors is absent. We can explain this by the following example: when there is no land to build a plant, there will not be a place to establish machinery, no machinery means no production.

Perhaps, investment in physical capital is the first thing to be considered and can be a barrier for some business start-ups especially when the company is manufacturing goods. It may not be considered as a big barrier for some companies who can only rent a few offices to start offering their service. This can be a law firm which can easily start their business operations only investing in renting an office and some furnishings like desks, chairs. However, it totally another case when the word comes about manufacturing goods. When the company is mainly specialized into manufacturing goods, significant amount of investment is required to start. The capital invested to acquire the long-term assets like plant, equipments, and other properties is the fixed capital since they are specialized to produce an intended product of the company, therefore, difficult to sell and considered illiquid. Those fixed assets can contribute to the overall growth of labour productivity.

- **Manufacturing:** Production rates in manufacturing are increasing rapidly with the advancements in technologies. Application of automation and robotics in manufacturing is worth to highlight since these inventions increased productivity as well as the output of companies. Companies like Tesla and Amazon are using robotics in manufacturing and in their warehouses accordingly<sup>1</sup>.

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<sup>1</sup> [Human Capital Theory | PDF - Scribd](#)

- **Agriculture:** Advanced agricultural technologies like combine harvesters and cultivating tractors changed old farming practices into productive ones. Instead of manual labour which required more time and labour, innovative agricultural technologies are being used. These technologies fastens the process of cultivation and harvesting<sup>2</sup>.
- **Technology Sector:** Companies operating their businesses in tech industry are making vast amount of investments in server farms and data processing centres in order to manage data workloads efficiently in comparison with the ones with smaller and less capable systems<sup>1</sup>.

The productivity rate of companies can be improved by investing in developed machineries, computers and other technologies. Companies are not only ones who benefit from those investments but also the whole economic system leading to the higher living standards of people and the growth of economy.

#### **The origination of human capital theory**

The use of this term is not as new as we think and this can be traced back to the 1776s, when Adam Smith discussed the role of education and acquired skills and abilities in productivity. To him “Production dependent on four types of fixed capital: tools, buildings, land, and the acquired and useful abilities of all the inhabitants or members of the society”. In 1928, Arthur Cecil immortalized this term in a book. He stated that “there is such a thing as investment in human capital as well as investment in material capital” Later in the 1960s the term become popular with the efforts of two American economists Gary Becker and Jacob Mincer. Before that, the term was not known or heard. They used the term to explain how the combination of skills, knowledge, experience that we acquire can be used productively.

#### **Influential Economists and Their Contributions**

1. **Gary Becker:** Often considered the pioneer of human capital theory, Becker highlighted that education and training should be viewed as investments that yield returns in the form of increased productivity. His book, *Human Capital*, published in 1964, laid the groundwork for viewing skills and education as forms of capital that could provide economic benefits similar to physical capital<sup>3</sup>.
2. **Theodore Schultz:** Alongside Becker, Schultz emphasized the importance of human capital in economic development, arguing that investing in people is as crucial as investing in physical goods. He advocated for the recognition of education as an essential factor in economic growth, something that previous economists had undervalued<sup>3</sup>.
3. **Jacob Mincer:** Known for the Mincer equation, Mincer developed methods to empirically estimate returns to education, reinforcing the idea that education enhances earnings and productivity. His work solidified the connection between human capital accumulation and wage growth, which is still referenced in labor economics today<sup>3</sup>.

#### **The relation between investment in human capital and increased productivity**

The increased labour productivity in the company is directly related to investment into enhancing employees overall abilities, skills and experience through variety of trainings. The relation can be explained through the followings below:

##### **1. New acquired skills and knowledge through additional trainings and classes**

When a company invests into the training and additional classes to enhance the ability, skills, experience and adaptability to new advanced technologies, the company can increase the labour productivity at the same time cause when the employee with better abilities and skills can easily accept and adapt the changes in the production process which, in its turn, improves productivity and increases overall output and revenue of the company<sup>4</sup>.

##### **2. Increased Adaptability**

Employees with enhanced skills acquired experience through variety of processes as well as gained higher level of education are tend to be more adaptable to any changes either in the company or in the economy. Though trainings organized by the company, they become far more multifunctional, adaptable and can apply their acquired knowledge into task accomplishments. At the same time, though adapting to the changes with their new skills and knowledge, they contribute to increasing productivity of the company<sup>5</sup>.

##### **3. Productivity Spillover Effects**

Positive externalities can be created when the human capital within the company gets to the higher levels. When some of the employees acquired extra skills and gained new experience, they can make other workers follow them by sharing their knowledge and experience. This can lead to the overall growth of the company's productivity<sup>6</sup>.

##### **4. Long-Term Earnings Potential**

Investment in human capital doesn't only mean increased productivity but also long term revenues both for the company and the employees. When the employees of the company are well-experienced and skilled, the company increases their wages depending on the profit of the company. Evident from empirical findings show that wage premiums is associated with education levels<sup>5</sup>.

##### **5. Economic Growth**

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<sup>2</sup> [What Is the Human Capital Theory and How Is It Used? - Investopedia](#)

<sup>3</sup> [Human Capital Theory | PDF - Scribd](#)

<sup>4</sup> [What Is the Human Capital Theory and How Is It Used? - Investopedia](#)

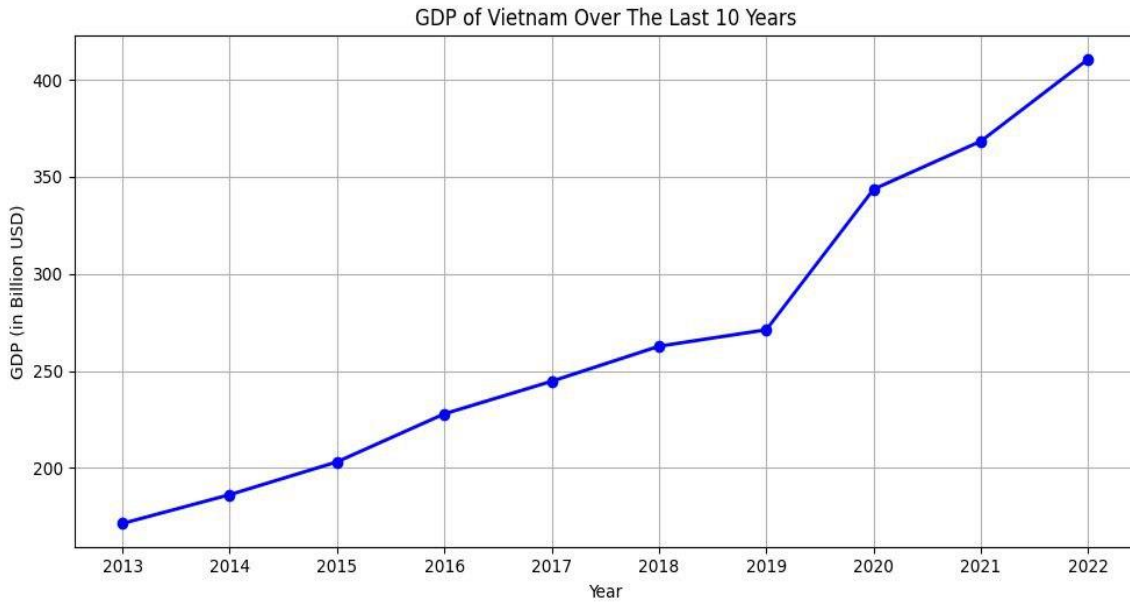
<sup>5</sup> [Human Capital Theory: Implications for Educational Development](#)

<sup>6</sup> [What Is the Human Capital Theory and How Is It Used? - Investopedia](#)

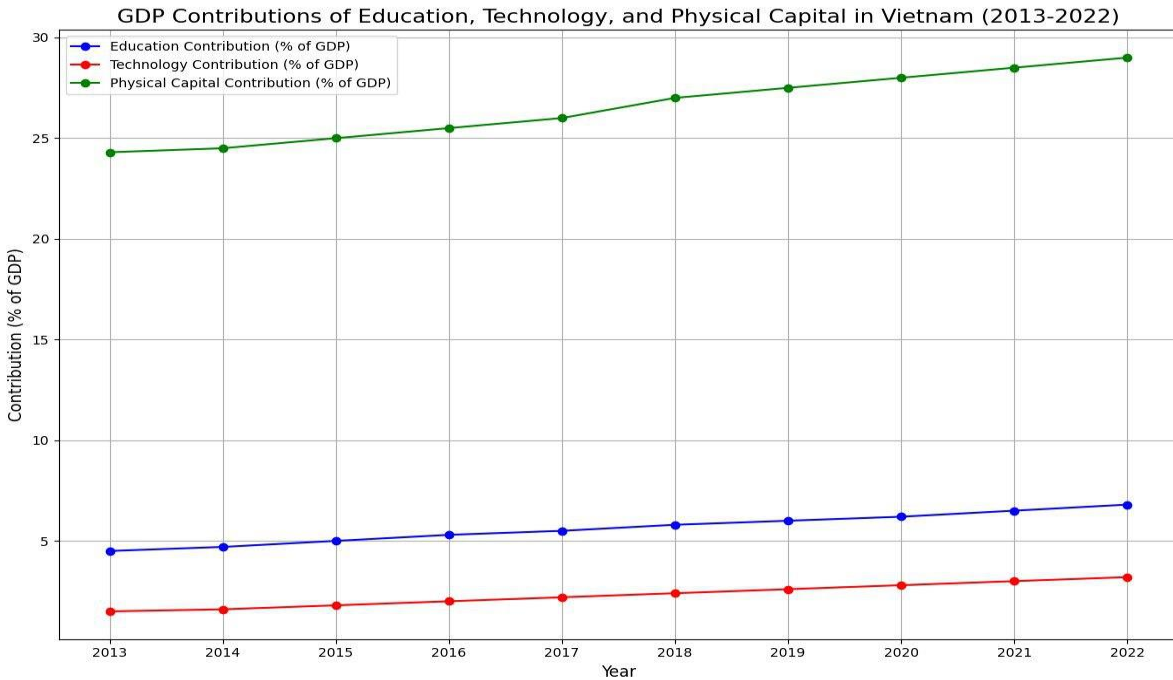
Cultivating a capable and innovative workforce leads to achieve sustainable economic growth in macroeconomic level. When inhabitants of a country are highly educated, well-skilled, experienced, without any hesitation those employees contribute to the overall growth of labour productivity which, in turn, increases economic growth of the country<sup>7</sup>.

The core of the human capital highlights the importance of education, experience and better skills to improve labour productivity. As economy of the country grow, the need for highly educated and skilled employee increases.

The analysis below indicate how the following two developing countries achieved stable growth in their GDP in the last 10 years investing in three important economic factors explained above. To explain the association between overall economic growth and those three factors, countries whose GDP growth is associated with technological progress, human capital and physical capital has been chosen.



1-photo the line graph illustrates yearly GDP growth of Vietnam<sup>8</sup>  
Consistent growth has been witnessed in GDP of Vietnam, from 171.35billion USD in 2013 to 410.67billion USD by 2022.



2-photo the line graph illustrates the GDP contribution from education, technological progress and physical capital from 2013 to 2022

<sup>7</sup> [A Historical Review of the Role of Education: From Human Capital to...](#)

<sup>8</sup> Prepared based on <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=BD>

The consistent growth of GDP is closely associated with investments in these three economic factors. Countries investing in technological progress, education and physical capital tend to have much stronger growth rates. In Vietnam, investments made into these areas created conducive business environment and increased the attractiveness of the country for Foreign Direct Investments and in its turn enhanced overall economic growth. For the Government those three areas have been prioritized as the main part of their economic vision.

#### Conclusion

Having considered the main effects of technological progress, human capital, physical capital to overall economic growth of countries, especially developing countries', it can be concluded that there is an integral association between investments in these three areas and countries' economic growth. To foster a competitive and adaptable economy, these sectors are significant when a developing country is trying to emerge as a developed country in the future..

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