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Contribution of Human Capital Development to Economic Growth in the Nepalese Manufacturing Sector

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Abstract:
The manufacturing sector is the engine of economic growth. However, Nepal is unable to make rapid development of the manufacturing sector due to lack of skilled human capital. Therefore, the main purpose of this study is to investigate the contribution of human capital development to economic growth in the manufacturing sector of Nepal. Time series data from FY1995/96 to FY2021/22 were used. The instrumental variables method was used to avoid simultaneous equation bias. The adult regressor literacy rate affects manufacturing real gross domestic product. Similarly, at the same time, other variables such as real export and labor employment in the manufacturing sector affect the dependent variable. Therefore, there is joint dependency between real GDP and human capital. The results of the instrumental variables method shows that human capital development has a positive and significant impact on manufacturing real gross domestic product in Nepal. This study reveals that adult literacy rate and employment in the manufacturing sector are major variables affecting the rise in manufacturing real GDP in Nepal. This study is applicable for government to increase the investment in education to increase the literacy rate and train employed people to increase human capital's productive capacity for the development of the Nepalese manufacturing sector. This study enhances the literature by assessing the role of human capital development in economic growth in the manufacturing sector of Nepal.

Keywords: human capital, adult literacy rate, economic growth, manufacturing sector.

人力资本发展对尼泊尔制造业经济增长的贡献

摘要：
制造业是经济增长的引擎。然而，由于缺乏熟练的人力资本，尼泊尔制造业无法快速发展。因此，本研究

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的主要目的是调查人力资本发展对尼泊尔制造业经济增长的贡献。使用风云1995/96至风云2021/22的时间序列数据。使用工具变量法来避免联立方程偏差。成人回归识字率影响制造业实际国内生产总值。同样，与此同时，实际出口和制造业劳动力就业等其他变量也会影响因变量。因此，实际国内生产总值与人力资本之间存在共同依赖关系。工具变量法的结果表明，人力资本发展对尼泊尔制造业实际国内生产总值具有显着的正向影响。这项研究表明，成人识字率和制造业就业是影响尼泊尔制造业实际国内生产总值增长的主要变量。本研究适用于政府加大教育投入，提高识字率，培训就业人员，提高人力资本的生产能力，促进尼泊尔制造业的发展。本研究通过评估人力资本发展在尼泊尔制造业经济增长中的作用来丰富文献。

关键词：人力资本、成人识字率、经济增长、制造业。

1. Introduction

The nation's wealth has evolved to include human capital as an independent and essential factor of production (Folloni & Vittadini, 2010). This acknowledgment has led developing nations to make efforts to enhance the accumulation of human capital. These efforts often involve investments in public education, government spending on health, and other social services. Human capital is a key contributor to a nation's wealth, prompting developing nations to invest in education, healthcare, and social services to stimulate the growth of human capital for sustainable economic development (Adebiyi, 2006).

Investing in human capital is vital for the economic development of the nation. Jhingan (2005) highlighted that in the context of economic growth, there has traditionally been a greater emphasis on accumulating physical capital than human capital. However, the emergence of new endogenous growth theories has brought attention to the active role played by human capital in driving economic growth. Economists frequently use the term human capital to encompass aspects such as education, health, and other human capacities that, when enhanced, can lead to increased productivity (Todaro & Smith, 2003). Health and education are closely interconnected components of human capital that collaborate to enhance individual productivity (Johnson, 2011).

Nepal has been actively seeking a substantial share of human capital to foster growth across various sectors of its economy by bolstering the manufacturing sector. The contribution of human capital to the domestic economy is contingent on factors such as policies and conditions of existing domestic enterprises. The contribution of human capital to the manufacturing sector of Nepal plays a significant role in the economic development of the nation. Human capital has played a pivotal role in propelling the nation toward a trajectory of high economic growth and development. Therefore, the primary objective of this paper is to assess the specific contributions of human capital to the economic growth in the manufacturing sector of Nepal.

The manufacturing sector plays a vital role in economic development, which relies on its development, indicating an inextricable relationship between the two. Therefore, this study examined the contribution of human capital to the manufacturing sector, particularly manufacturing GDP in Nepal.

2. Literature Review

Economic growth of a country is an outcome of technological change, skill of the decision maker, allocation of existing resources, and existing incentives that are performed by human capital (Jovanovic, 2000). Stock of human capital is a key factor in production and helps to increase the production and productivity capacity of the economy. It increases efficiency and invention in the production sector, which makes a significant contribution to the micro- and macro-level of production. Arrow (1962) emphasized that the generation of new ideas occurs through the experience gained in production activities, a concept known as the learning-by-doing process. Romer (1990) delved into the role of scientific research in fostering economic development. Both concepts are likely connected to economic theories, possibly representing key elements in understanding the dynamics of economic growth and innovation, according to Arrow and Romer.

Solow (1956) developed a growth theory based on human capital and technological change in the economy. Technological progress leads to steady growth, but technological progress is dependent upon the availability of human capital within the country. Therefore, the new key factor in economic development is human capital. Mankiw et al. (1990) empirically tested the neoclassical growth model by collecting data covering 100 countries. This study econometrically proved the validity of the Solow growth model and confirmed the relationship between human capital and economic growth of the country. The economic development of the country is a positive function of human capital because human capital can develop the modern technology necessary to accelerate production (Romer, 1990; Rebelo, 1991). Furthermore, Schultz (1961) stated that human capital development positively contributes to the economic growth of the country because efficient human capital is a stock of capital that is able to efficiently mobilize productive resources. Human capital is both a skill and knowledge property that increases production and productivity within the economy (Beach, 2009; Rastogi, 2002).

Benhabib and Spiegel (1994) and de la Croix and Michel (2002) were in favor of the endogenous growth model and stated that the economic growth rate of a

country is determined by the availability of human capital, which technically determines economies of scale. Therefore, technical progress is determined by human capital, which is necessary to increase production and productivity. Thus, economic growth is influenced by the existing human capital of the country.

Olawumi (2019) analyzed the relationship between human capital development and economic growth in the BRICS countries by employing time series data from 1990 to 2017. The generalized method of moments and ordinary least squares method were used to show the relationship between human capital and economic growth in these countries. Furthermore, one-way ANOVA and the Scheffe pair-wise comparison tests were used to identify the use of human capital in country pairs. The pair-wise test identified that China, Brazil, and Russia were able to utilize human capital to enhance economic growth efficiently, whereas South Africa and India were unable to properly utilize it for economic growth. However, the findings of this study confirmed that human capital development was a major factor that significantly affected the economic growth of the country.

Usman and Adeyinka (2019) examined the effects of human capital development on the economic growth of the ECOWAS countries using data from the World Development Indicators and Human Capital Index from 1980 to 2016. School enrolment and government expenditure on health and education were the proxy for human capital, and gross domestic product was the proxy for economic growth in these countries. The Padroni co-integration test was employed to examine the contribution of human capital to economic growth, and the result showed a positive and significant contribution of human capital to economic growth.

Croes et al. (2020) examined the relationship between human capital development, economic growth, and tourism specialization in a transition economy. The conceptual relationship is characterized by dynamic comparative advantage, Sen's capability approach, and the translog production function. Furthermore, the maximum likelihood method was used to show the relationship between human capital development, economic growth, and tourism specialization in Poland. This study found that human capital development was the major factor that significantly affected economic growth in the short and long run, whereas tourism specialization showed only short-run effects on economic growth. Human capital and the relationship between human capital, economic growth, and human development exhibit a U-shaped pattern. Similarly, Lamba et al. (2020) identified the impact of quality human resources on Indonesia's economic growth. This study found a positive and significant relationship between human capital and economic growth.

Metzger and Shenai (2022) determined the factors that affect economic growth and human development in free societies among 37 OECD countries with Colombia by using time series data of 2000–2019. This study employed a cointegration test and found that the economic growth of these countries is very high even if HDI is low because of the availability of quality human resources. The economic growth of these countries had bi-directional causality with Human Development Index and unidirectional causality with life expectancy at birth and expected years of schooling and standard of living.

Sultana et al. (2022) examined the link between human capital and economic growth in 141 countries, comprising 93 developing and 48 developed countries, using time series data from 1980 to 2008. The generalized movement method was used and found a positive and significant impact of human capital on economic growth in developing countries. However, the impact was different in different countries. Life expectancy at birth posits a negative direction of growth due to a rise in the dependency rate, whereas health expenditure and educational measures resulted in positive and significant growth in developing countries.

The empirical and theoretical literature shows a positive and significant relationship between human capital and economic growth. All these research works related to the macroeconomic growth of the country, but this paper employed only manufacturing GDP as a proxy for economic growth because Nepal has been trying to focus on the proper development of its manufacturing sector.

3. Data and Methodology

The objective of this paper was to examine the contribution of human capital development to the manufacturing sector based on the employed instrumental variables method to avoid the problem of simultaneous equation bias and inconsistent estimates. The data were collected from secondary sources of the Ministry of Industry, Nepal Rastra Bank, and Central Bureau of Statistics during FY1995/96–FY2021/22. Manufacturing GDP was taken as a proxy for growth of the manufacturing sector, and adult literacy rate and employment level in the manufacturing sector were taken as a proxy for human capital development. Furthermore, the Maoist struggle and export were introduced as control variables. Hence, this study's analysis framework is shown in Figure 1.

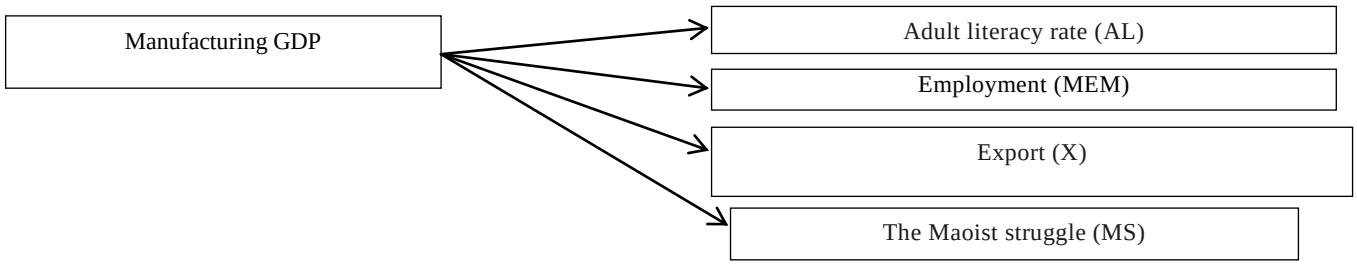

Figure 1. Research framework for human capital and manufacturing growth (The authors)

The impact of human capital on productivity was derived from the neoclassical production function, as shown in Equation 1.

$$Y_t = A_t F(K_t, L_t) \quad (1)$$

The economic environment is characterized by the variable *At* to depict the state of the economy. This representation aims to encompass a range of control and policy variables that influence the productivity level of the economy. The components included in this model were physical capital denoted by *K*, labor denoted by *L*, and production denoted by Y_t. In the production process, physical capital and labor were assumed to combine to produce goods in the receiving country. Political stability plays a role in enhancing the production of goods and services. Consequently, the Maoist struggle (MS) was introduced as an explanatory variable in the model. The active human capital in the country was represented by *AL*, and from Equation 1, we derived the following econometric model:

$$lnRMGDP = \beta_1 + \beta_2 MS + \beta_3 lnAL + \beta_4 lnMEM + \beta_5 ln RX + \mu \quad (2)$$

where *RMGDP*, *AL*, *MEM*, *MS*, *RX*, and μ stand respectively for real gross domestic product in the manufacturing sector, adult literacy rate, labor force, the Maoist struggle as a dummy, export of goods and services, and stochastic disturbance term.

The regressor *AL* affects *RMGDP*. Similarly, other variables such as real export and labor employment in the manufacturing sector (*MEM*) affect *RMGDP*. Thus, there is joint dependency between *RMGDP* and *MEM*. Ordinary least squares estimation of these equations produces simultaneous equation bias. To avoid biased and inconsistent estimates, the instrumental variables estimation method was applied.

4. Results and Discussion

In 2018, the Nepal Rastra Bank categorized manufacturing enterprises into two distinct groups: fast-moving consumer goods (FMCG) enterprises and industrial goods enterprises. Fast-moving consumer goods encompassed firms involved in the production of food, beverages, tobacco, and soap. Industrial goods included firms engaged in the production of metal products, cement, plastic, and similar items. Among all manufacturing firms, 35% were identified as fast-moving consumer goods enterprises, while the remaining 65% were classified as industrial goods enterprises. These industries have played a substantial role in contributing to the overall manufacturing gross domestic product (GDP). Therefore, to show the contribution of human capital to manufacturing GDP, all variables (MGDP, MEM, AL, MG, EX) are converted into real terms. The descriptive statistics of the variables included in the models are presented in Table 1.

Table 1. Descriptive statistics of variables (Calculation based on data abstracted from the Central Bureau of Statistics, 2023)

Variables	Mean	Max.	Min.	Std. Dev.	J-B
RMGDP	86,588.33	231,770	22,466	60,131.31	3.79
AL	52.09	76.30	32.98	13.94	0.8
RX	69,691.91	200,031	19,881.10	36,433.69	1.26
MEM	264,371.1	510,523	169,891	132,417	1.25

Table 1 shows the summary of statistics for a study encompassing a dependent variable, manufacturing real gross domestic product (RMGDP), and three explanatory variables, adult literacy rate (AL), real export (RX), and labor force (MEM). The descriptive statistics encompass measures of central tendency (mean), dispersion (standard deviation), minimum and maximum values, and the Jarque-Bera test.

Examining the descriptive statistics for RMGDP, RX, MEM, and AL, all variables indicate positive mean values. Specifically, the average manufacturing RGDP is Rs. 86588.33 million, ranging from a minimum of Rs. 22,466 to a maximum of Rs. 231,770 million, with a standard deviation of 60131.31. Furthermore, the mean values for RX, MEM, and AL were 69,691.91, 264,371.1, and 52.09, respectively, with corresponding standard deviations of 36,433.69, 132,417, and 13.94, respectively. Table 1 also includes the Jarque-Bera values, providing insights into the distribution nature of the variables in the study, which are normally distributed.

4.1. Instrumental Variables Method

Model 1 illustrates the instrumental method of estimation, establishing a relationship between a dependent variable (lnRMGDP) and four independent variables (lnRX, lnMEM, lnAL, and MS). The model specifically acknowledges that RMGDP influences the MEM, creating a scenario of joint dependency between the two variables. To mitigate the challenges associated with joint dependency and ensure more robust and consistent estimates, the instrumental variable estimation method is employed. In this approach, MEM

(-1) serves as the instrumental variable, offering a solution to potential issues arising from the interdependence of RMGDP and MEM in the model.

Model 1

$\ln RMGDP = 6.39 - 0.11^{**}MS + 0.13^{**}\ln AL + 0.21^{**}\ln MEM(-1) + 0.28^{**}\ln RX$

t-statistics (19.32) (-7.12) (6.34) (9.58) (11.35)

$\bar{R}^2 = 0.86$, $F = 54.57$, $DW = 2.09$, $N = 26$

Note: The authors' estimation of the instrumental method of the regression equation using the data; * significant at 5%; ** significant at 1%

The lnMEM coefficient (0.21) is both positive and statistically significant, indicating a direct correlation between the labor forces and manufacturing RGDP in Nepal. The presence of a robust labor force in the manufacturing sector has a direct impact on the national output of this sector. Consequently, Nepalese products exhibit an upward trajectory with an increase in the labor force. Specifically, a 1% rise in the employment rate in the manufacturing sector leads to a 0.21% increase in manufacturing output.

The real export coefficient (0.28) signifies that a 1% increase in real export results in a 0.28% boost in RMGDP. This positive and statistically significant coefficient implies that expanding exports to international markets enhances the size of the market, prompting domestic producers to elevate production and productivity within their national borders. Consequently, real exports have a positive impact on Nepal's real manufacturing gross domestic product.

The coefficient for the dummy variable representing the Maoist struggle (MS) is negative and statistically significant. The period marked by the Maoist insurgency is characterized by heightened political instability, political deadlocks, and an unstable government. This environment fosters insecurity among investors in the manufacturing sector, adversely affecting RMGDP. The negative and statistically significant coefficient for MS (-0.11) underscores this adverse impact.

Model 1 examines the influence of human capital on RMGDP using the instrumental variable method. The findings indicate a noteworthy impact of human capital on RMGDP. Specifically, the coefficient of lnAL (0.13) suggests that a 1% increase in the literacy rate corresponds to a 0.13% rise in lnRMGDP in Nepal. Importantly, this coefficient is not only positive but also statistically significant. These results align with earlier studies by Croes et al. (2020), Metzger and Shenai (2022), Olawumi (2019), and Sultana et al. (2022), reinforcing the consistent observation that the availability of human capital has positive and substantial effects on manufacturing GDP.

The coefficient of determination ($\bar{R}^2 = 0.86$) indicates that 86% of the variation in RMGDP in Nepal can be explained by MEM, RX, AL, and MS. The F-statistic (54.57) demonstrates a jointly significant impact of the explanatory variables on RMGDP, and the model is statistically fit. The Durbin-Watson (DW) statistic (2.09) falls within the indecisive range, failing to conclusively address the issue of autocorrelation. Consequently, this study employs another tool, the Breusch-Godfrey serial correlation test (as displayed in Table 2), to find out whether Model 1 exhibits autocorrelation issues.

Table 2. The Breusch-Godfrey serial correlation LM test (Calculation based on Model 1)

***F*-statistic**	0.29	**Prob. *F* (2,14)**	0.74
Obs*R^2	0.89	**Prob. χ^2 (2)**	0.63

Despite the DW statistic residing in an inconclusive range, the results of the Breusch-Godfrey serial correlation test, with a $\chi 2$ P-value of 0.63, provide assurance that there is no evidence of serial correlation in the model.

5. Conclusion and Policy Implications

Human capital is a key driver of fostering economic growth in the manufacturing sector of Nepal. Rise in production and productivity in the manufacturing sector due to existing efficient human capital leads to a rise in export and helps to reduce the country's trade deficit. Efficient human capital can use modern techniques and technology that also help to increase the quality of products and reduce the cost of production. If the economy can produce quality goods at low cost, it will increase its competitiveness within the international market and increase export. The rise in export of goods and services increases employment opportunities within the manufacturing sectors of the economy. Therefore, this study is applicable for government to increase the investment in education to increase literacy rate and existing employed people in terms of training to increase human capital productive capacity for development of Nepalese manufacturing sector. Finally, this study enhances the literature by assessing the role of human capital development in economic growth in the manufacturing sector.

6. Agenda for Future Research

This study covered only the macroeconomic variables to investigate the contribution of human capital to economic growth in the manufacturing sector, but it has not considered the effect of human capital on firm-wise economic growth, which is unresolved for future researchers. Furthermore, another possible area for future studies is the contribution of human capital to economic growth in other sectors such as service, agriculture, and hydropower.

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