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Taxonomy and Methods of Estimation of Investment in Human Capital: Practical Practices

Min Raj Paudel

Central Department of Education, Department of Economics Education, Tribhuvan University

ORCiD: https://orcid.org/0009-0000-3177-4365

Email: minrajpaudel94@gmail.com

Abstract

The investment in human capital is the sum of all types of education costs. It reflects the economic burden on pupils or their parents, the government, and donor agencies for gaining and providing education and skills to the people. The main objective of this study is to analyze the taxonomies and methods of estimation in investment and how fixed asset depreciation is applied in calculating capital investment in educational institutions. The analysis concludes there are several taxonomies of investment, and some overlap with each other in meaning. In practice, these concepts are broadly categorized into private, institutional, and social. The ingredient approach is practically used to analyze these taxonomies. The diminishing balance is considered the best method for estimating the depreciation value of the capital assets. The useful life of assets and the rate of depreciation should be standardized and defined using real sources. Without separate analyses of private and social investments in human capital, allocative efficiency analysis is impossible.

Keywords: Investment-in-human-capital – concepts – approaches – methods – survey – random

Introduction

Human capital refers to the economic and non-economic value of education, which can be enhanced through graduates' experience, skills, knowledge, training, networks, collaboration, and creativity and innovation capacity. Theodore W. Schultz formally introduced the term 'human capital' in 1961. He argued that education and training are considered investments that generate returns, just as investments in physical capital (Schultz, 1961). Gary S. Becker later expanded this concept, and distinguished to general human capital (skills transferable across employers) and specific human capital (skills valuable only to a particular firm) (Becker, 1962). There are four core theoretical perspectives of investment in human capital- investment to education (education, training, and health) (Becker, 1962; Schultz, 1961), returns to education

(schooling, experience, and earnings) (Mincer, 1974), economic growth (long-run difference in GDP per-capita) (Lucas, 1988), and health (health as a capital) (Grossman, 1972).

Investment in human capital is widely acknowledged as a fundamental driver of individual advancement and national development. It is expected to yield long-term economic and social benefits for individuals and the society as a whole (Spada et al., 2023). It is believe that human capital is difficult to measure numerically. However, some approaches are developed and applied. Among them, cost-based approach, income-based approach, and indicator-based approach are commonly used. The cost-based approach sums all expenditures on education, training, and health, and income-based approach discounts the lifetime earnings in current value, while indicator-based approach includes the survival rates, schooling, and learning outcomes (Bourdieu, 1986).

The number of educational institutions, physical infrastructure, students, teachers, administrative staff, and quality of education determines the size of investment in human capital. Therefore, the national-level plans and policies should link inputs to outputs and outputs to outcomes (Kefela, 2010). For this, analysis of investment in human capital is needed. In Nepal, the number of schools, universities, and student enrollment are gradually increasing every year. The establishment of schools has more than doubled between 1987 and 2025. During the same period, the establishment of universities has grown by nearly ten times, and student enrollment has also increased by almost triple. The government of Nepal has also invested around 10 percent of its total budget in human capital in the past ten years, on average (MOF, 2025).

The average (per student) cost of education in Nepal rises steeply across levels. At the early childhood education and development (ECED) level, at the primary level, at grades 6-8, at grades 9-10, at grades 11-12, and at higher levels, the average annual costs in 2022 are NPR 7,014, NPR 15,459, NPR 16,482, NPR 27,083, NPR 35,528, and NPR 49,000, respectively (MoEST, 2022; UGC, 2022). The involvement of the private sector in higher education is also considerable (Dangol & Shakya, 2017). The investment made by this sector has not been estimated in actual figures, especially in developing countries like Nepal (Thapa & Izawa, 2024). However, it is claimed that such investment has crossed NPR 500 billion in Nepal (Rauniyar, 2018). The existing studies in Nepal have tended to focus on private rate of returns to an additional year of schooling. For example, Agiomirgianakis et al. (2019) have estimated only the rate of return to an additional year of schooling, and Carnoy et al. (2013) have estimated only direct private and social rates of returns to higher education. Thus, due to the lack of comprehensive analysis of investment in human capital, these studies are not able to guide students, parents and policy makers in a proper manner.

The volume of investment in higher levels of education from both private and government sectors and the number of universities and colleges are increasing in Nepal. But the

economic performance of higher education, increasing graduates' unemployment, increasing educational costs, and low wage rates in the labor market are serious issues in the academic industry in Nepal. Likewise, the investment in human capital is an entry point for the analysis of these issues. Thus, analysis of investment in human capital is needed at first to address these issues. Without such evidence-based analysis, there is a risk of misallocating resources, reinforcing existing inefficiencies, and failing to implement necessary reforms in Nepal's education system. Likewise, the results obtained from an analysis conducted without the correct selection of the taxonomy of investment, calculating methods, and analysis techniques may mislead the stakeholders.

In this scenario, the aims of the study are to analyze the comprehensive taxonomy and methodological frameworks to determine their suitability for measuring investment in human capital, and to assess how fixed asset depreciation is applied in calculating capital investment in educational institutions. The study focuses on the research questions of how are the direct and indirect investment in education conceptually differentiated in the economics of education literature, what distinguishes recurring investment from non-recurring investment in academic institutions, and how do they affect total educational expenditure, wow do private, institutional, and social costs of education overlap, and what are the implications of this overlap for cost analysis, what are the key differences between the ingredient approach, cost modeling approach, and resource cost model in calculating investment in human capital, to what extent does the ingredient approach provide a more comprehensive and step-by-stem framework for investment in human capital analysis compared to other approaches, what practical challenges arise when applying investment analysis models in developing economies, especially in Nepal, and how does the diminishing balance method compare to the straight-line method in estimating the depreciation of educational fixed assets?

Methods

This study is based on a literature review. It uses a survey research design. According to this design, researchers make a long-term plan for further study (Gothberg, 1990). This design is related to the systematic collection of relevant data (Singh, 1998). In this design, the researcher first selects the text, then reads and writes, and finally summarizes and clarifies the text (Mcmenamin, 2006). All these processes and criteria are followed in the study.

This study uses purposive sampling technique, and is used to keep the results of the study within the scope of the study's objectives and research questions. Only reliable, authentic, and research-based books, articles, reports, and PhD dissertations are used in this study. The main sources of the required data for this study are JSTOR, ProQuest, Academia, NDLI, ResearchGate, ELSEVIER, Google Scholar, and the World Bank's Library. The five key terms such as ‘cost of education’, ‘investment in human capital’, ‘economic analysis of education’, ‘estimation techniques’ and ‘analysis techniques’ are used to search the related texts in the online

databases and libraries. The searching process is also based on a certain process which is as follows. First, the option of 'access type' is selected as 'contents that I can access'; then, 'related articles, books, and research reports' is selected as 'educational content'; no limit is specified as 'publishing date'; 'economics of education' is selected as 'subject area'; and finally, 'relevance' is selected as 'relevance' in the option to sort the text. Only those texts that have complied with at least one of the following three criteria are included in the study. First, those texts that have defined the cost of education or investment in human capital. Second, those texts that have analyzed investment in human capital using quantitative calculation methods. Third, those texts that have evaluated investment approaches and models.

During the searching materials, 250 were collected, but only 50 are included in the study. Because the included materials are completely within the selection criteria. The date and time are not limited to any limit while searching the materials. Because all new and old materials are equally important for this study. While the purpose of this study is to review theoretical literature, not empirical. The presentation of the results is presented in the form of text and equations.

Results and Discussion

Human capital theory argues that investing time and money in education leads to increased wages in the future. That is why, a person allocates more time and money to education that maximizes income over his lifetime (Fitzsimons, 2017; Harrison et al., 2019). The several studies conducted beyond Nepal show several concepts, estimating methods, and results (Arshad & Ghani, 2015; Carnoy et al., 2013; Cegolon, 2014; Fan et al., 2010; Ferreyra et al., 2017; Fulford, 2012; Harberger & Guillermo-Peón, 2012; Hoque et al., 2020; Lewis & Lee, 2020; Melianova et al., 2020; Montenegro & Patrinos, 2014; Moreno & Patrinos, 2020; Poteliene & Tamasauskiene, 2016; Psacharopoulos & Patrinos, 2018b; Qureshi, 2012; Rizk, 2019; Romele, 2013; Sinning, 2014; Tangtipongkul, 2015). Therefore, the study presents the taxonomies, analyzing approaches, and estimating methods of investment in human capital.

Taxonomy of Investment in Human Capital

The investment in human capital refers to the amount of money spent to acquire or impart education. In other words, it is called the costs of education. It represents expenditure on salaries, school buildings, equipment, and other goods and services with alternative uses (Khandagale & Pandya, 2014). It is a measure of the economic contribution of a student, an academic institution to educate an individual or a group of people (Babalola, 1995). This cost is expressed in terms of personnel facilities, expenditure of materials and tools, academic program costs, and other input costs (Lewin & McEwan, 2001). However, most economists have treated investment in human capital as the private and the public domains (Majumdar, 1984), expressed as individual and institutional domains, and further direct and indirect (Tilak, 1985a). There are several taxonomies of the investment in human capital. These are recurring and non-recurring, monetary, private and the public (Majumdar, 1984), institutional, and direct and indirect (Tilak, 1985a).

Among different taxonomies, the recurring and non-recurring investment in human capital are commonly used in practice. The recurring taxonomy of investment is known as current expenditure and variable expenditure. It is incurred every year and has direct correspondence with the output of the system or with variable factors (Tilak, 1985). Likewise, the recurrent taxonomy is the investment for educational inputs or services that are expended in a period of one year. It consists of personnel costs such as salaries, and non-personnel costs such as investment of instructional materials, and student welfare (Akpotu, 2008; Babalola, 1995; Coleman, 2010; Frank & Bernanke, 2009; Mcafee et al., 2007; Psacharopoulos & Woodhall, 1995; Tsang, 1995).

The non-recurring taxonomy of investment is also an important part of investment in human capital which is known as capital and fixed investment. This investment cannot be changed with a change in the number of pupils, teaching and non-teaching staffs, and correspondence with the buildings, land, and other types of infrastructure, or with fixed factors (Tilak, 1985). It can be argued that goods such as books that last several years could be counted as capital equipment, but if these books purchased by the pupils are almost always counted as recurring investment. In practice, the distinction between recurring and non-recurring investment is often one of administrative convenience. The expenses for the long-lasting items, such as buildings, land, equipment, tools, and technology-based items are paid for out of a separate budget, but these expenses are necessarily to be incorporated as a part of non-recurring investment (Tilak, 1985). It means that capital investment measures that investment, which is invested in those items that can be reused repeatedly to meet the same needs.

Monetary taxonomy of investment in human capital refers to the cash payments made on educational inputs (Norris, 2022). It is classified into current and capital (Babalola, 1995), and these two taxonomies of investment are distinguished by time period. For example, when goods and services are purchased for short-term benefits, usually for less than one fiscal year. It is called the current monetary investment. The investment on buildings and equipment that can be used for a long time, is called capital monetary investment (Greenlaw & Shapiro, 2011). The concepts of current and capital investment are similar to the concepts of recurring and non-recurring investment.

Institutional investment in human capital represents the expenditure of academic institutions like schools and colleges (McClure et al., 2023). These institutions receive income from several sources, like student fees, governments' grant, donor agencies' donation, etc. The operation of educational institutions is possible because of this taxonomy of investment. In other words, this taxonomy of investment plays major role in daily functions of the academic institutions (Tilak, 1985). This taxonomy of investment is also classified into recurrent/current and non-recurring/capital investment.

Private taxonomy of investment indicates pupils' or their parents' investment in human capital. The pupils need several types of educational materials such as books, stationary, uniform, etc. In addition, they should expend in paying of school and university enrolment

charges, tuition fee, annual fee, hostel charge (rent), transportation expenses, tiffin charge, college uniform charge, private coaching charge, practical exam fee, research proposal and research report writing charge, research viva charge, educational tour and research field visit charge, recommendation and certification charge, library card and identity card charges, etc. (Majumdar, 1984). The burden of these all fees and charges are incurred by the pupils or their parents. Therefore, it is considered as an economic burden of the households (Benson, 1995; Tsang, 1995). However, this taxonomy of investment helps to determine private demand for education (Psacharopoulos & Woodhall, 1995). This taxonomy of investment depends on the nature of educational institutions like private and public, expensive of goods and services, and co-curricular and extra-curricular activities of the educational institutions.

The public taxonomy of investment in human capital reflects the government's investment and donor agencies' donations in education (McClure et al., 2023). The government investment is also known as duties towards education. It refers to the actual direct investment. All kinds of donations, like donor agencies' aid, different types of social institutions' donations, and helping hands' donations, are included in the public investment in education (Akpotu, 2008). This concept is similar to the institutional investment in education. It means that public taxonomy of investment is accounted in the title of institutional investment. Because the sources of investment of the educational institutions are the government funds, and donation of donor agencies.

The direct private taxonomy of investment in human capital refers to the actual direct expenditures by students or their parents (Akpotu, 2008). This taxonomy of investment is known as the monetary investment for inputs. Sometimes it is known as visible investment in human capital (Tilak, 1985). This taxonomy of investment is also classified into private investment which incurred by private sector like pupils or their parents, and social investment which incurred by public sectors like government and donor agencies (Asep et al., 2016). According to Lewin and McEwan (2003), direct investment is the personnel expenses for human resources or human capital. The personnel expenses are input costs for facilities, material costs for computers, printed materials, books, stationaries and references, transportation costs, and living expenses. Poteliene and Tamasauskiene (2016) have suggested that expenditure on alcohol and tobacco, hotel and restaurant, any types of grants, scholarships, helps and facilities should be excluded from the direct educational investment. The direct social investment indicates the salary of teaching and non-teaching staffs, expenditure on books for library, expenditure on teaching tools and materials and expenses on other goods and services, and likewise, the value of the use of buildings and capital equipment. It is the sum of private investment and institutional investment. It refers to the total investment that society bears to provide education (Morosan et al., 2010). For example, government provides monetary budget to the educational institutions like schools and colleges for teacher salaries, and development of infrastructure (Jacques, 1969). The concepts of direct private and social investment are similar to the concepts of private monetary and social monetary investment, respectively.

The indirect private taxonomy of investment in human capital indicates the foregone earnings. It is also sometimes referred to as invisible investment for education (Tilak, 1985). It is embodied in the opportunity costs of the pupils. It is of lost profit in the form of lost opportunities and sacrificed by students while studying (Asep et al., 2016). The opportunity cost is defined as the potential gain from the best alternative forgone (Caillods, 2011), when a choice needs to be made between several mutually exclusive alternatives (Sartori et al., 2014). These represent a loss of productive capacity, a loss of current output for the economy as a whole, and a loss of earnings for the individual (Coombs & Hallak, 1972; Woodhall, 1992).

The indirect social taxonomy of investment in human capital refer to the opportunity cost of investment made by the government (Tilak, 1985). It is embedded in the lost educational benefits due to invested in other sectors. In other words, it reflects the lost benefit of education due to investing in other sector by the government (Adrian et al., 2010). This investment cannot be directly identified (Babalola, 1995). It compares educational outputs with outputs from other sectors (Karoly & Bigelow, 2005). It is the potential benefit from the best alternative when choosing between several mutually exclusive alternatives (Sartori et al., 2014). Finally, indirect social investment expresses monetary values by comparing educational output with output from sectors other than education (Coombs & Hallak, 1972; Woodhall, 1992).

The incremental taxonomy of investment in human capital measures the total additional investment that is associated with the efficiency of educational institutions or their educational progress. This investment is directly related to decisions made by the educationalists for better education policies or heads of the education institutions for better education outputs (Noch & Kusto, 2018). The marginal taxonomy of investment in human capital refers to the investment of an additional unit of educational output. When an additional unit is produced, the total investment increases. The change in total investment due to that additional unit of output is the marginal investment (Psacharopoulos & Woodhall, 1995). Some economists prefer the term incremental investment instead of marginal investment (Asian Development Bank, 2013). Average taxonomy of investment in human capital refers to the amount of money or resources devoted to each pupil in the existing system. It is also called unit investment (Cheslock et al., 2016). It actually provides insight into the pattern of educational spending (Aghenta, 1993).

Finally, the investment in human capital is defined as the total value of spending on education by students or their parents, governments, donor agencies, the community, and the students' discarded earnings. It is an essential part of estimating and analyzing the rate of returns to education. There are several taxonomies of educational investment: recurrent investment, non-recurrent investment, money investment, incremental investment, marginal investment, total investment, average investment, private investment, social investment, institutional investment, public investment, direct investment, indirect investment, and opportunity investment. Some taxonomy of investment mentioned above are similar, such as recurring investment, current investment, and variable investment; non-recurring investment, capital investment, and fixed investment; incremental investment and marginal investment; indirect investment, foregone

earnings, and opportunity investment; direct investment and money investment; and total investment and social investment. In addition, the value of these investments overlaps with each other. Therefore, these investments can be broadly classified into private (direct and indirect), institutional, and social (direct and indirect) for the purpose of their analysis.

Analyzing Approaches and Methods

The reviewed literate shows that there are several approaches that can be used in the analysis of investment in human capital. Among them, Finance Analysis Model (FAM), Cost Modeling Approach (CMA), Resource Cost Model (RCM), and Ingredient Approach (IA) are mainly used (US Department of Education, 1999). CMA and RCM are very similar to each other. They identify and assign a monetary value to all inputs from economists' perspectives (Parrish & Chambers, 1996), where resources are measured whenever possible in terms of physical ingredients and are organized in service delivery. RMC is related to IA, and most researchers have used the IA. The United State Department of Education has developed the IA approach (US Department of Education, 2003). Levin (1975), Levin (1983) & Levin & McEwan (2001) have recommended the IA (as cited Parrish & Chambers, 1996). This approach provides the most fundamental units for ascertaining costs (Levin & McEwan, 2002). IA relies on identifying all resources or ingredients consumed in the intervention and valuing each ingredient (McEwan, 2012). In order to fix the cost of educational inputs, the researcher can organize all types of educational costs into three phases and eight steps (Institute of Education Sciences, 2020a).

Similarly, in the case of non-recurring investment, past and future monetary value of fixed assets should be reduced into current monetary value. For this, there are several methods such as Straight-Line Method, Double Declining Balance Method (Diminishing Balance Method), etc. (Anthony et al., 2011; Peterson, 2002; Pillai et al., 2006). The diminishing balance method is commonly used in a decreasing charge over the useful life (Accounting Standards Board of Nepal (ASB), 2018, p. 170). The government of Nepal also uses this method (Koirala et al., 2007, p. 365). Under this method, a fixed rate or percentage of depreciation is charged each year on the asset's diminishing value or book value. This method assumes that an asset should be depreciated more in earlier years of use than later years because the maximum loss occurs in the early years of use (Bajracharya et al., 2016, p. 147). If the depreciation rate is given, the value of fixed assets is estimated by diminishing balance method (Jonick, 2017, pp. 143-150). The most common formula for estimation of depreciation value of physical assets is presented in Equation 1.

$$Depreciation = Investment\ of\ Assets \times \frac{Rate\ of\ Depreciation}{100} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This equation requires two valid values. The first is the actual value of the investment, which is initially invested to purchase or construct capital assets, and the second is the rate of depreciation. The value of the investment can be obtained from administrative records, but the rate of depreciation must be obtained from an authentic source like the government or its bodies.

In Nepal, the Government of Nepal has clearly stated this provision in the Nepal Income Tax Act 2058. This Act recommends the diminishing balance method for calculating depreciation. According to this act, depreciable assets are categorized into four groups such as (i) buildings, structures and similar other structures of permanent nature, (ii) computers, data processing equipment, furniture, fixture and office equipment, (iii) automobiles, buses and mini-buses, and (iv) construction and excavation equipment. The depreciation rates of 5, 25, 20 and 15 percent, respectively, are fixed for these four types of goods in section 3 of schedule 2. Similarly, the formula (I × II) is mentioned in section 2 of schedule 2. "I" means the depreciation base amount in the class of the property at the end of that income year, and "II" means the rate of the depreciation deduction. Likewise, this act has mentioned one additional provision: if the deduction base amount of the depreciable properties is less than two Thousand Rupees, all the remaining amounts must be computed for additional depreciation investment (MoLJPA, 2019).

Likewise, the next important part of the depreciation calculation is the working life of the assets. Determining the minimum life of the assets in years is crucial when calculating the depreciation of net worth or non-recurring assets of educational institutions. In this regard, Pandit (1972) assumed a working life of 100 years for RCC buildings, while Salim (1997) used 50 years, and the Government of Nepal has also recommended 50 years. If the asset's working life is unavailable or poorly defined, rental value is an alternative solution. Tilak (1995) has used the rental value of buildings in his study. Similarly, furniture, equipment, technology, vehicles, machines, library books, and laboratory and workshop equipment are treated as assets, and their useful lives should also be defined.

After estimating the depreciation value of assets, the total value of non-recurring investment of capital assets is estimated (Woodhall, 1992). The total value of non-recurring investment is sum of all depreciated values of capital assets. The common method for it is presented in Equation 2.

$$Non\text{–}recurring\ Investment = Depreciated\ Value\ of\ Infrastructures + Buildings + Equipment\ and\ Tools \ldots\ldots\ldots\ldots\ldots (2)$$

The important of recurring investment in human capital is considered as the non-recurring investment. It is a part of institutional investment, which includes teaching and non-teaching staff's salaries, maintenance expenses, utilities, office expenses, student services and co-curricular and extra-curricular activities expenses, and miscellaneous expenses (Babalola, 1995). The common method of estimation of recurring investment is presented in Equation 3.

$$Recurring\ Investment = Amount\ of\ Salary + Maintenance + Utilities + Services + Offic\ Expenses + Social\ Security\ Contributions + Miscellaneous\ Expenses. \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The institutional investment is the sum of recurring and non-recurring investment in human capital. It is worth mentioning here that since student's tuition fee is included in both direct private investment and institutional investment. Therefore, it should be deducted from

either one of the investment while calculating the actual investment. It is also significant factor of investment in human capital (Institute of Education Sciences, 2020b). When the estimating institutional investment in human capital, Equation 4 can be used.

$$Institutional\ Investment = Recurring + Non\text{–}Recurring\ Investment \ldots\ldots\ldots (4)$$

The private investment includes pupils or their parents' direct monetary investment such as tuition fees, transportation and vehicles' expenses, books and stationery expenses and etc., and indirect investment (students' foregone earnings) during schooling (Psacharopoulos & Patrinos, 2004; Woodhall, 2004). The direct private cost (DPC) is the sum of above mentioned expenses which is estimated (Ismail et al., 2016) using the Equation 5.

$$DPC = Tuition\ Fee + Transportation\ and\ Vehicles' Expenses + \cdots + etc \ldots\ldots\ldots (5)$$

The private foregone earnings (PFE) is known as indirect private investment in human capital, which is defined as the opportunity cost or the next best alternative. It is not easy for measuring this type of investment in the case of education (Babalola, 1995). Because it is related to time value of money, and includes the lower level's earnings. Likewise, when estimating PFE, the tax amount should be deducted from the gross earnings. Montenegro and Patrinos (2014) has used Equation 6 in their study, which is also considered the best.

$$PFE = Gross\ Private\ Foregone\ Earnings - Tax \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

In this context, Pandit (1998) has said that indirect private investment is foregone earning, and from it, the tax-liability should be deducted, if any, on such earnings.

The total private investment in human capital is the sum of direct private investment and private foregone earnings. Tilak (1985); Woodhall (1992) have suggested two equations to measure the total private investment of education, and they are presented in Equation 7 and Equation 8.

$$C_h = C_d + C_f \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$C_d = f + C_m \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where, C_h represents the household (individual or private) investment of education, and C_d stands for direct private investment and C_f is foregone earnings or opportunity cost. The f denotes all kinds of fees and C_m denotes the maintenance cost of institutions. The total private investment (TPI) includes all expenditure incurred by the students/parents (Woodhall, 1992). It is calculated by Equation 9.

$$TPI = Tuition\ Fees + Non - tuition\ Fees + Foregone\ Earnings \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

The social investment in human capital is the sum of total private investment and institution investment. It includes the value of teachers' time, books, materials, and other goods or services, and used buildings and capital equipment. The value of students' time is also measured in terms of alternative uses (Woodhall, 1992). This investment is also analyzed

separating into direct and indirect investment. The direct social investment (DCI) is estimated using the Equation 10.

$$DSI = C_r + C_{nr} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (10)$$

Where, DSI indicates the direct social investment in human capital, C_r represents the recurring investment, and C_{nr} includes the non-recurring investment. Additionally Tilak (1985) has used next equation in his study but looks like Woodhall's equation. It is also presented in Equation 11.

$$C = C_h + C_i \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (11)$$

Where, C represents social investment in human capital and C_h and C_i represent the total private investment and total institutional investment, respectively. Accordingly Asep et al. (2016), direct social investment (DSI) of education is the sum of direct private investment and direct public investment of education, and these investments can be measured using the Equation 12.

$$DSI = Direct\ Private\ Investment + Direct\ Public\ Investment \dots \dots \dots \dots \dots \dots \dots \dots (12)$$

The total investment indicates the social investment in the case of education, which is the sum of private and institutional investment. It is also defined as sum of fixed and variable investment or capital and current investment of education (Babalola, 1995). It is presented in Equation 13.

$$TI = Total\ Private\ Investment + Institutional\ Investment \dots \dots \dots \dots \dots \dots \dots \dots (13)$$

Marginal investment (MI) is the investment of additional one unit of output. It is calculated by investment for upper level of education minus investment for immediate lower level of education (Psacharopoulos & Woodhall, 1995). It is presented in Equation 14.

$$MC = Upper\ Level\ Costs - Lower\ Level\ Costs \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (14)$$

Average investment (AI) is obtained through the total investment divided by unit of output (Asep et al., 2016; Białek-Jaworska, 2015). Traditionally, it is computed simply by adding up the total institutional expenditures for all purposes and dividing by the number of student (Bowen, 1981). It is calculated per year, or per teaching hour, or per whole duration of a course, or costs per working day, etc. Psacharopoulos and Woodhall (1995) have suggested the different methods to calculate of average investment. These methods are presented in Equations 15, Equation 16, and Equation 17.

$$AI = \frac{TI}{N} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (15)$$

Where, TI denotes the total investment in human capital or total investment in education, and N is the student number.

$$Geometric\ Mean\ (X_{GM}) = \sqrt[N]{(X_1 + X_2 + \cdots \dots + X_n)} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (16)$$

$$LogX_{GM} = \frac{1}{N}(logX_1 + logX_2 + \cdots \ldots + logX_n) = \sum \frac{logX}{N} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (17)$$

Finally, there are many approaches to analyzing the investment in human capital. Each approach offers unique perspectives and methods. Among these, the ingredient approach is well-defined and provides step-by-step guidelines for calculating investment in human capital. Therefore, it clearly helps to identify and account for all relevant investment components: direct investment (tuition fees, book costs) and indirect investment (opportunity cost of student time). In addition to the ingredient approach, there are various techniques and formulas available to estimate the investment in human capital. Likewise, it is important to note that some formulas appear to overlap or repeat for the same value calculation. If not carefully managed, they can lead to confusing process or outcome. However, it is advisable to use all relevant formulas in the study to ensure a comprehensive analysis. Because one formula may focus on direct private and social investment, another may emphasize the calculation of institutional investment, and another may do well in calculating recurring and non-recurring investment.

Conclusion

There are different types of taxonomies of investment in human capital. Among them, concepts of some taxonomies are interconnected or overlapped with each other in meaning. In practice, these concepts are broadly categorized into private, institutional, and social. For analyzing these taxonomies of investment, the ingredient approach is practically used in the research. This approach breaks down the analytical process, promotes identification of all components, and reduces the risk of omission and double-counting. Likewise, the diminishing balance is considered the best method for estimating the depreciation value of the capital assets. The Government of Nepal and the Nepal Accounting Standards have also recommended this method. The useful life of assets and the rate of depreciation should be standardized using real sources. Without separate analyses of private and social investments in human capital, allocative efficiency analysis is impossible. Finally, these taxonomies, approaches, and methods provide a practical path from raw data to meaningful information. This theoretical synthesis can be used as a standard framework for analyzing human capital investments in the Nepalese context based on real data.

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