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A REVIEW PAPER ON SKILLS MISMATCH IN DEVELOPED AND DEVELOPING COUNTRIES

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ABSTRACT

The focus of this review research is on skill mismatch rather than educational mismatch. Specifically, this research examines the definition, extent, measurement of skill mismatch, and the impact of skill mismatch on earnings, productivity, and job satisfaction of employed individuals. Skill mismatch occurs when a worker's possessed skills are incompatible with the required task-related skills. Skill underutilization or overskilling arises when the skills of an employed individual exceed those required to perform the job. On the other hand, skill overutilization or underskilling ensues when a worker's skills are below those required to perform the task. The extent of skill mismatch varies from country to country and by measurement approaches: subjective (self-assessment) and objective approaches. The literature review also reveals that underskilling often results in a wage premium and overskilling in a wage penalty. In addition, skill mismatch has a negative impact on productivity and job satisfaction.

Contribution/Originality: This study documents the imbalance between skills employer required and skills workers have and the negative impact of skill mismatch on earnings and job satisfaction. Most empirical evidences are found in developed countries such as US. and Australia because of available of skill data so that the effect of study can recommend educational institutions and government how to improve workers' skills in the labor market. Few studies in skill mismatch are found in developing countries so researchers who are interested in education and labor market can do the research in this field.

1. INTRODUCTION

The debate on mismatch has conventionally been centered around educational mismatch (Duncan & Hoffman, 1981; Green, McIntosh, & Vignoles, 1999; Groot & Van Den Brink, 2000; Hartog, 2000; Sicherman, 1991; Sloane, 2003). Similarly, in Asia the focus of mismatch research is primarily educational or qualification mismatch, as tabulated in Table 1. The focus of this literature review is nonetheless skill mismatch rather than educational mismatch.

Existing studies on mismatch focus on educational or qualification mismatch due to data availability and ease of collection. However, education or qualification fails to account for differences in the quality and the possibility of skill gain or loss following educational attainment, thus rendering it misleading as proxies for workers' skills. According to JRC (2014) a mismatch in education or qualification is not reflected in a mismatch in skills and vice versa.

Table-1. The extent of educational mismatch in Asia

Publication	Definition of educational mismatch	Extent of educational mismatch
Matsumoto and Bhula-or (2018)	Vertical skill mismatch is defined by using OECD method	In low-skilled occupations, the rates of overeducation are: Cambodia 30.9% Indonesia 46.4% The Philippines 54.9% Thailand 30.4% Vietnam 50.8%
Cassandra, Catherine, Melissa, Agerico, and Gerardo (2017)	Educational mismatch is defined by comparing the years of schooling of an employee to those required by the job.	Among males, 57.38% assess their jobs as closely related to their degrees, 26.23% somewhat related, and 16.39% not related. Among females, the corresponding figures are 59.22%, 24.27%, and 16.51%.
Handel, Valerio, and S´anchez Puerta (2016)	Overeducation is measured by self-assessment	Incidence of overeducation is as follows: Laos 41.1% Vietnam 70%
Sam (2019)	Overeducation is measured by OECD method	35% and 33% of Cambodian graduates are overeducated and horizontally mismatched, respectively.
Zakariya (2014)	Overeducation is measured by self-assessment	18% and 28% of workers over- and under-educated, respectively. In terms of mismatch, 52% are horizontally mismatched.
OECD (2015)	Horizontal mismatch or field of study mismatch	Rates of mismatch are 50% and 45% in Korea and Japan, respectively.

Source: Akkaya (2015).

Qualifications and skills are not the same because qualifications reflect the situation at a specific point in time, which is normally in the very distant past. Meanwhile, the process of skill formation and skill loss spans one's entire life.

According to heterogeneous theory, qualifications and skills are weakly correlated (Francis Green & McIntosh, 2007). A typical example would be two workers with identical educational qualifications but heterogenous skills and abilities. Sánchez-Sánchez and McGuinness (2015) argued that when the job requirement does not correspond to the skills necessary for the job and educational attainment is a poor indicator of human capital, educational mismatch is less ideal as a proxy for skill mismatch. Besides, educational mismatch does not imply skill mismatch (Allen & De Weert, 2007; Di Pietro & Urwin, 2006; Halaby, 1994). Likewise, Francis Green and McIntosh (2007) reported a very weak correlation between overeducation and overskilling ($R^2 = 0.2$).

Boateng and Ofori-Sarpong (2002) and Akerele and Opatola (2004) documented that, apart from the possessed qualifications, tertiary graduates in Ghana and Nigeria require non-academic skills, including good personal and social skills, analytical skills, good communication skills, technical and managerial skills. Employers prefer workers who are skillfully equipped as the labor market is highly competitive and on-the-job training is costly.

This review research emphasizes skill mismatch which is defined as discrepancy between the skills of job applicants or employed individuals (supply of skills) and job requirements (demand for skills), giving rise to incidences of overskilling or underskilling. Overskilling refers to the situation in which a worker possesses more skills than required by the current job and his/her skills are not fully utilized (i.e., skill underutilization). Underskilling refers to circumstances where a worker's current skills fail to meet the requirements of the job.

Skill underutilization has several negative consequences for individual workers, businesses, and the economy. At an individual level, the negative ramifications range from attrition to withdrawal from the labor market. In addition, acquired skills that are not utilized and updated become obsolete, thereby diminishing workers' available skills. At the business level, skill underutilization lowers firms' productivity and competitiveness. Skill underutilization also results in unnecessarily higher employment costs and could demotivate current employees. At the macroeconomy level, skill mismatch reduces average productivity as the allocation of resources is suboptimal.

Mavromaras, McGuinness, and Wooden (2007) quantified the costs of skill mismatch in Australia by using the estimated wage penalty associated with overskilling as proxy of individual productivity loss and multiply the penalty estimate by the number of overskilled workers by educational attainment. They estimated the costs of overskilling in 2005 in the country at around 2.6% of gross domestic product (GDP).

The organization of this review research is as follows: Section 1 is the introduction. Section 2 reviews the concepts of skill mismatch and measurement approaches. The extent of skill mismatch in different countries are also discussed. Section 3 details the theoretical background of skill mismatch, and Section 4 discusses the impacts of skill mismatch on labor outcomes. The concluding remarks and policy recommendations are provided in Section 5.

2. SKILL MISMATCH: THE CONCEPT AND MEASUREMENT

2.1. Concept of Skill Mismatch

There exists a large body of literature based on the concept of educational or qualification mismatch, i.e., undereducation and overeducation (Dolton & Silles, 2008; Korpi & Tåhlin, 2009; Miller, 2007; Oosterbeek, 2000; Sloane., 2007; Van Der Meer, 2009). Besides, there are studies that are closely related to the concept of skill mismatch, including underskilling/skill deficit and overskilling/skill (Krahn & Lowe, 1998; Mavromaras, McGuinness, & Fok, 2009a, 2009b; Mavromaras et al., 2007; OECD/Statistics Canada, 2005; Ryan & Sinning, 2009). By comparison, studies on skill mismatch are significantly fewer due to the unavailability of data and challenges associated with skill mismatch measurement. However, the skill-mismatch findings are of greater use and thus interest is on the rise (CEDEFOP, 2010). In skill mismatch measurement, a systematic and timely measure of mismatch is crucial to account for the possibility of skill gain and loss and reflect differences in the quality of qualifications.

According to OECD (2017) skills refer to both cognitive and non-cognitive abilities, in addition to those that are specific to a particular job, occupation, or sector (i.e., technical skills). Cognitive skills include literacy, numeracy and the ability to solve abstract problems. Non-cognitive skills are characteristics across social, emotional, behavioral domains, such as work habits, behavioral traits, and physical characteristics.

It is useful to distinguish between macro/aggregate mismatch and micro/individual mismatch. The focus of this review research is micro- or individual-level skill mismatch. Macro/aggregate mismatch occurs when a reallocation of workers to jobs improves the realized equilibrium in employment levels or output (Boyan, 1979; Farber, 1999; Michael Sattinger, 1993). Specifically, job vacancies and job seekers could be locationally heterogeneous, and aggregate mismatch exists when reallocating job seekers across locations improves the efficiency of matching (Sahin, 2012; Shimer, 2007).

At the micro or individual level, skill mismatch is measured by comparing the skills or qualifications of an employed worker with those required by the job. If the Miller (2007); Oosterbeek (2000); Sloane (2007) worker's skills are compatible with the job requirements, it is regarded as skill-matched. Otherwise, the worker is regarded as over-skilled or under-skilled in relation to the position. Specifically, at the macro level, skill mismatch indicates the gap between aggregate skills supply and demand, typically in a specific geographical unit; and a suboptimal match between available workers and available jobs in terms of skills and/or qualifications. Meanwhile, the micro-level skill mismatch exits when an employee has skill levels that are different from what is required for the job.

2.2. Measurement of Skill Mismatch

This section reviews various approaches to measuring micro- or individual-level skill mismatch and the strengths and shortcomings of the various approaches. Conventionally, there are two methods to measure skill mismatch: subjective (self-assessment) and objective methods.

2.3. The Subjective Method of Skill Match/Mismatch Measurement

Due to the unavailability of objective data on individual skill levels in many developing countries, self-assessment is utilized to measure skill mismatch by directly asking questions about the adequacy of skills; or indirectly asking about the skill level required to perform a job and the skill level that is employed in that position. Skill mismatch exists if there is a discrepancy between a worker's skill level and that necessary for a position. This simplistic comparison however requires several assumptions. In addition, a mismatch might be mistakenly presumed when there is simply a bias toward specific types of answers. Below are examples of skill match/mismatch self-assessment questions:

Statement 1: My current job offers me sufficient scope to use my knowledge and skills.

Statement 2: I would perform better in my current job if I possessed additional knowledge and skills.

The responses on a five-point scale to statement 1 indicate the degree to which available skills are being utilized in the current job, and the responses to statement 2 the extent to which the respondent possesses the required skills. Skill underutilization is determined by the extent to which a respondent disagrees with statement 1, and skill overutilization by the extent to which a respondent agrees with statement 2 (Allen & Velden, 2001).

The following are also examples of skill match/mismatch self-assessment questions (Oluyomi & Adedeji, 2012):

(1) What are the skills employers demand from university graduates?

(2) Levels of skills that Nigerian university graduates display in their workplaces?

(3) To what extent is the mismatch between the skills acquired by university graduates and the demands of their jobs?

The aforesaid study focuses on 11 skills: analytical, entrepreneurial, critical thinking, communication, decision-making, information technology, interpersonal, problem-solving, self-directed learning, technical, and numeracy. For question 1, the demand for workers' skills is categorized into four scales: very critical, critical, less critical, and not critical. For question 2, workers' skill levels are categorized into four levels: very good, good, average, and poor. Skill mismatch is determined by differences between skill supply and skill demand[1] (Pitan & Adedeji, 2012). The extent of skill mismatch is generally high except for problem-solving skills.

A key disadvantage of the self-assessment approach lies in respondents' exaggeration of their own skills and/or the requirements of their job; or respondent's limited understanding of the skills required for a particular job. However, the self-assessment method is applicable to measuring skill mismatch in small-scale studies that focus on specific industrial sectors and occupations.

In Asia, the self-assessment method in commonly used to measure skill mismatch due to ease of data collection. Anuar (2016) surveyed 242 small sized enterprises in various industries in Malaysia (> 5-50 workers) using self-assessment questionnaire and reported the macro-level skill mismatch, where the demand for a particular skill type outstrips the supply of workers with the skill, of 59%, with the most severe skill shortage in the service sector. Espinoza (2015) measured skill mismatch in the Philippines using the subjective approach by surveying 33 firms and interviewing eight industry experts in the private and public sectors; and reported the job-skill mismatch of about 42%.

According to Ramos (2016) skill gap is high among applicants for technical, professional, managerial positions which require workers to perform analytical, non-manual and non-routine tasks. In Singapore, skill mismatch is

[1] Skill mismatch = (SD-ASS)/SD*100, where SD is mean skill demand, ASS is supply relative to demand calculated by SS/4*SD, where SS is mean skill supply

indicated by an imbalance between job seekers and job postings, and the skill gap decreased from 44 % in January 2015 to 36 % in May 2019 (Pant, 2019). In Thailand, Ramos (2016) determined skill gap using subjective assessment and found incompatibility between skills demanded by employers and those taught at schools and universities. In addition, Japanese firms in Thailand experience difficulties recruiting qualified staff, middle management and engineers, especially Thai engineers whose practical skills and foreign language proficiency are lacking (United Nations Development Programme, 2014).

2.4. The Objective Method of Skill Match/Mismatch Measurement

Objective approaches could be adopted if skill proficiency and skill use data are available, including datasets in the Household Income and Labor Dynamics in Australia (HILDA), the *Program for the International Assessment of Adult Competencies* (PIACC), Skills Toward Employment and Productivity (STEP), The Adult Literacy and Lifeskills Survey (ALL), and other national surveys.

Household Income and Labor Dynamics in Australia (HILDA) survey is an annual household-based panel study which began in 2001, initially covering 7,682 Australian households and 19,914 individuals, with panel members increasing over time. The project is funded by the Australian government through the Department of Families, Community Services and Indigenous Affairs. A group, comprising the Institute of Applied Economic and Social Research, University of Melbourne, the Australian Council for Educational Research, and the Australian Institute of Family Studies, is responsible the survey design and management.

HILDA relies on self-reported responses on a seven-point scale in which overskilling (skill underutilization) is determined based on the response to the statement "I use many of my skills and abilities in my current job", where 1 denotes strongly disagree and 7 strongly agree. Respondents answering 1, 2, 3, or 4 are classified as overskilled and those answering 5 or higher as skill-matched (Halaby, 1994; Mavromaras. et al., 2007).

Mavromaras, McGuinness, O'leary, Sloane, and Fok (2010) investigated the extent of overskilling in Australia and its impact on wage levels using HILDA data. They posited that overskilling is a better measure of skill underutilization than overeducation since overskilling is less prone to contamination by unobserved individual heterogeneity. Mavromaras et al. (2007) using the HILDA data, reported that 30.6 % of respondents were moderately over-skilled and 11.5 % severely over-skilled. Furthermore, Mavromaras, McGuinness, O'Leary, Sloane, and Wei (2013) using HILDA 2001–2007, documented overskilling of about 8.4 % for adult male graduates.

The Program for the International Assessment of Adult Competencies (PIAAC) survey is conducted by the Organization for Economic Cooperation and Development (OECD, 2013) based on data of 24 countries: Australia, Austria, Belgium (Flanders), Canada, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, the Netherlands, Norway, Poland, the Russian Federation, the Slovak Republic, Spain, Sweden, the United Kingdom (England and Northern Ireland), and the United States. There are two Asian countries in PIACC survey: Korea and Japan.

PIAAC provides measures of cognitive skills of adults aged 16 - 65 years in literacy, numeracy, and problem solving in technology-rich environments. According to OECD (2013) literacy is defined as "the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential. Literacy encompasses a range of skills from the decoding of written words and sentences to the comprehension, interpretation, and evaluation of complex texts." Numeracy is defined as "the ability to access, use, interpret and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life." The PIACC dataset also contains information on respondents' skills use in the workplace and an extensive set of background variables concerning educational attainment, current employment status, job characteristics, socio-economic background, and personal traits.

There are three PIACC-based approaches to measuring skill mismatch: self-report, job requirement approach, and realized match approach. The PIACC-based self-report approach measures the level of skill use and determines aggregate mismatch using two background questionnaire items Table 2.

Table-2. Self-reported skill mismatch using background questionnaire.

		Do you feel that you have the skills to cope with more demanding duties than those you are required to perform in your current job?	
Do you feel that you need further training in order to cope well with your present duties?		yes	no
	yes	Over-skilled as well as under-skilled	Under-skilled
	no	Over-skilled	Well-matched

Source: OECD (2013).

The respondents are either under-skilled, well-matched, or over-skilled. To measure skill use, respondents are asked which skills they use in their job and to what extent they use them. Skill use data are then compared with the assessed skill levels to determine whether the workers' skills match the required skills. According to Maltseva (2019) numerically underskilled workers in Germany and the US account for 3.93 % and 2.33 %, respectively.

The second approach (job requirement approach) relies on PIACC data on skill levels and subjective (self-report) data. In self-report data collection, workers are asked about different types of tasks performed at work and the skills needed to perform them; and the extent to which their current skills match their job requirements.

For the job requirement approach, Quintini (2012) grouped skill use and the respective skill proficiency into four categories each. If the levels of skill use correspond to the possessed skills, the respondent's skills are well-matched. Respondents are under-skilled if their levels of skill use exceed the possessed skill levels; and over-skilled if the skill-use level is below their possessed skill levels.

Allen, Levels, and Van Der Velden (2013) following Quintini (2012) proposed an alternative approach to measuring skill mismatch whereby mismatch is defined as a deviation of skill use and individual skill level by at least 1.5 standard deviations (SD). If the difference between standardized numeracy skill use and standardized skill score is below 1.5 SD, the respondent is regarded as under-skilled (skill overutilization). If the difference is larger than 1.5 SD, the respondent is over-skilled (skill underutilization). Otherwise, the respondent is well-matched, as illustrated in Figure 1.

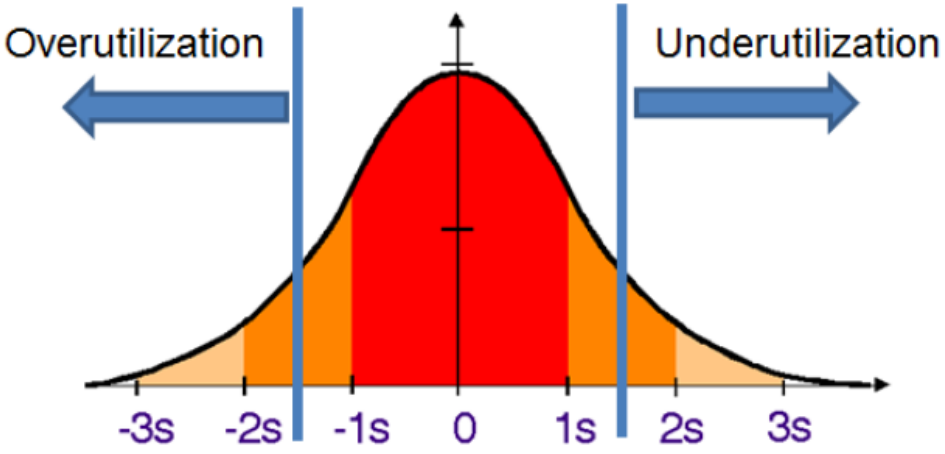

Figure-1. Skill mismatch measure.

Source: Markus, Jakob, and Eduard (2018).

In the third approach (realized match approach), well-matched respondents (based on self-report in PIACC) are designated competency bandwidth by country and occupation. Respondents in the top and bottom 5 % of the skill distribution in each occupation are excluded to control for outliers (Pellizzari & Fichen, 2013). Individuals whose skill levels are below/above the competency bandwidth are regarded as under-skilled/over-skilled, while those whose skills are within the bandwidth are well-matched.

In PIAAC, the respondents report their occupation/profession along with details of work responsibilities. The information is then recoded into the International Standard Classification of Occupations (International Labour Organization, 2012). To achieve a sufficient number of well-matched respondents, only occupations at the one-digit ISCO level are used. Table 3 summarizes the three approaches to measuring skill mismatch based on PIACC survey.

The proportions of mismatched workers vary between the PIACC-based skill-mismatch measures. According to Perry, Wiederhold, and Ackermann-Piek (2014) the share of under-skilled workers in Germany are 3.93%, 30.42%, and 8.36% by using the self-report, job requirement approach (Quintini, 2012) and modified job requirement approach (Allen et al., 2013). As a result, great care should be exercised when choosing between different PIACC-based skill-mismatch measures.

Table-3. PIACC-based approaches to measuring skill mismatch.

No	Approach	Source	Description
1	Self-report	PIACC background questionnaire	Self-report on skill mismatch
2	Job requirement approach	Quintini (2012)	Comparing levels of skills (measured by PIACC survey) and skill use at work (measured by self-report)
		Allen et al. (2013)	Standardized skill and skill use levels derived from Quintini 2012
3	Realized match approach	Pellizzari and Fichen (2013)	Assigning levels of skill mismatch. For the group of well-matched workers (according to PIACC tests), competency bandwidths by country and occupation (one digit ISCO-08) are derived according to average skill levels

Moreover, Pellizzari and Fichen (2017) investigated the extent of skill mismatch in Japan and Korea using PIACC survey and reported the share of workers underskilled in literacy and numeracy of 3.1 % and 3.5 % for Japan; and 5.7 % and 5.6 % for Korea. Meanwhile, the extent of overskilling in literacy and numeracy are 9.3 % and 7.1 % for Japan; and 18.5 % and 15.2 % for Korea.

Skills Toward Employment and Productivity (STEP) survey was developed in 2010 by the World Bank to be used in cross-national skills mismatch assessment in low- and middle-income countries. Survey data include skill profiles of labor force, the extent and skill gaps, the employable skills, and measures to enhance workforce capability. STEP has been implemented in 17 countries, including Armenia, Azerbaijan, Bolivia, China (Yunnan Province), Colombia, Georgia, Ghana, Kenya, Kosovo, Lao PDR, Libya, Macedonia, the Philippines, Serbia, Sri Lanka, Ukraine and Vietnam.

STEP assesses both the demand and supply of skills. The skill demand is determined by using employer survey; and the skill supply by household survey. The survey measures three categories of skills: cognitive, socio-emotional, and job-relevant skills. Cognitive skills are the ability to process information, comprehend complex ideas, reason, remember, relate and overcome obstacles by reflection (i.e., literacy and numeracy skills). Socio-emotional or non-cognitive skills are knowledge, attitudes, and skills necessary to understand and manage emotions, establish and maintain relationships, and make responsible decisions. Job-relevant skills are task-related skills such as computer literacy, machine operation and maintenance, interpersonal relationship, and conflict resolution. STEP is the most comprehensive cross-national skill mismatch assessment since it measures cognitive skills objectively (PIAAC

literacy test) and subjectively (self-report) and also estimates the skill demand based on employer surveys (Appendix 1).

According to Chua (2016) computer skill deficiencies, based on STEP survey, are most prevalent among workers in Bolivia, Colombia, Lao PDR, and Vietnam. Bodewig, Reena, Kevin, David, and Jan (2014) based on 2011-2012 STEP data specific to Vietnam, found that working age Vietnamese (between 15 and 64) are well equipped with basic literacy skills but severely lack advanced skills.

The REFLEX project is a large-scale European survey of graduates, comprising 15 participating countries: Austria, Belgium-Flanders, Czech Republic, Estonia, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Switzerland, and the UK.

In REFLEX, skill mismatch is determined from workers' responses on a five-point scale, where 1 denotes not at all and 5 to a very large extent, to the questions: To what extent does your current work demand more knowledge and skills than you can actually offer; and to what extent are your knowledge and skills utilized in your current work? A score of 1 or 2 is regarded overskilling, while that of 4 or 5 indicates underskilling. A score of 3 is regarded as well-matched.

McGuinness and Sloane (2011) based on UK data from REFLEX survey, determined over/underskilling of graduates five years after graduation; and reported that 33% of UK graduates experienced skill underutilization. Berlingieri and Erdsiek (2012) documented that approximately 9% of graduates in Germany were overskilled. In addition, the shares of overskilled workers were significantly higher in Spain, Italy and the UK, but significantly lower in Norway and Finland.

The Adult Literacy and Lifeskills Survey (ALL) measures the literacy (reading and writing) and numeracy skills of working age adults of 16 - 65 years old between 2003 and 2007 in 10 participating countries. The participating countries include Australia, Bermuda, Canada, Hungary, Italy, the Netherlands, Norway, New Zealand, Switzerland, and the United States.

ALL is a large-scale collaborative effort by governments, national statistics agencies, research institutions and multi-lateral agencies. The key advantage of ALL is that the survey takes into account both the task-related skills and observed measures of skills. However, the disadvantage of ALL is that it focuses exclusively on the incidence and frequency of literacy and numeracy behaviors.

Literacy skill is determined by reported engagement in literacy-related tasks at work and observed individuals' literacy skills, following Krahn and Lowe (1998) in which individuals with literacy engagement scores below and above the median are assigned to the low to medium-low engagement category (low-skill jobs) and medium-high to high engagement category (high-skill jobs), respectively. As a result, there are four match/mismatch categories based on observed skills (skills owned) and skill utilization, as tabulated in Table 4. The numeracy skill match/mismatch follows the same logic.

Table-4. Categories of literacy/numeracy skill match and mismatch.

Skills owned	Skill use(or engagement)	Category of mismatching
Low	Low to medium-low engagement	Low-skill match
Medium to high	Medium-high to high engagement	High skill match
Low	Medium-high to high engagement	Deficit mismatch
Medium to high	Low to medium-low engagement	Surplus mismatch

Source: Krahn and Lowe (1998).

Desjardins (2014) based on ALL data specific to literary skill and excluding Australia and Bermuda, reported literacy-skill mismatch of 29 – 41 % among workers whose skills fail to match their job requirements. Overskilling is highest in Hungary (34%) and lowest in Italy (13%). Furthermore, Desjardins and Rubenson (2011) documented the literacy and numeracy mismatches of 31 – 41 % and 35 – 52 %, respectively, among workers in the ALL's

participating countries. Earle (2011) based on ALL data, found that nearly 40% of New Zealand workers lack literacy and numeracy skills required to carry out increasingly complex tasks of a knowledge economy.

In Thailand, the analysis of skills mismatch relies on the Thailand Productivity and Investment Climate Survey (PICS). The PICS was conducted between March 2004 and February 2005 with 14,000 workers employed in 1385 establishments in manufacturing and 100 in ICT. Individual employees were asked about job-related skills which are still lacking and the compatibility between jobs and their educational background. Meanwhile, employers were asked about challenges and difficulties filling vacancies and shortcomings of existing workforce. The findings reveal that most Thai workers possess inadequate English language and ICT skills, significantly affecting their earnings.

According to Satimanon (2017) Thailand also suffers from skill shortage since vocational graduates account for only 20 % of post-secondary graduates. The proportion is very low compared to Indonesia (30%), Malaysia (50%), and South Korea (45%). The adverse situation is compounded as Thai manufacturers prefer vocational graduates with practical training to those with general skills (Economic Intelligence Center, 2015). Pholpirul and Rkumnuaykit (2012) also found that recent bachelor's degree graduates lack relevant basic and technical skills.

The Chinese General Social Survey (CGSS) is the first national social survey project in China, jointly conducted by Renmin University and Hong Kong University of Science and Technology. The survey collects data from randomly selected households and communities using face-to-face interviews. The skill mismatch is determined from responses to the question: Did your skills and experiences meet the job requirement when you were first employed in this position?" Answers to this question include: matched, overqualified, underqualified, and unknown.

3. THEORETICAL BACKGROUND

3.1. Beveridge Curve

Figure 2 illustrates the Beveridge curves representing imbalance between demand and supply (mismatch) in the labor market. The Beveridge curve assumes that a labor market equilibrium is reached when the number of unemployed (U) equals the number of unfilled vacancies (V). When U does not equal V, an imbalance occurs at the level of the economy, region, industry, occupation, or individual firm. However, the model takes no account of the quality of employed labor relative to the characteristics of filled jobs. Specifically, employed individuals could be under- or overutilized in relation to levels of education, skills, and experience.

In Figure 2 points A and B represent labor market equilibrium. However, point B with higher levels of vacancies and unemployment suggests increased structural unemployment. The phenomenon could be attributed to labor immobility or inadequate or incompatible skills.

Skill mismatch occurs if workers are unable to readily learn new skills or are unwilling to accept jobs that are incompatible wit their existing skills; and if employers are unable or unwilling to redesign jobs to be compatible with the skills of current workers. Meanwhile, geographical mismatch could arise if neither workers nor jobs are fully mobile due to high mobility costs. Ochsen (2009) characterized the Beveridge curves for nine countries, eight of which are European countries, over the period of 1960 – 99; and reported that mismatch is not necessarily lower in those countries with more flexible labor markets.

3.2. Screening Theory

According to screening theory, individuals are sorted and rewarded based primarily on readily recognizable proxies for productivity rather than on productivity itself. One such proxy is education. Since different employers attach unequal importance to each educational indicator, a large percentage of workers are employed in jobs that are incompatible with their education. Specifically, the sorting often results in posting workers in jobs below their capabilities and qualifications. As a result, the workers earn less than those working at their own level, regardless of their actual levels of skills and the degree to which their skills are being utilized.

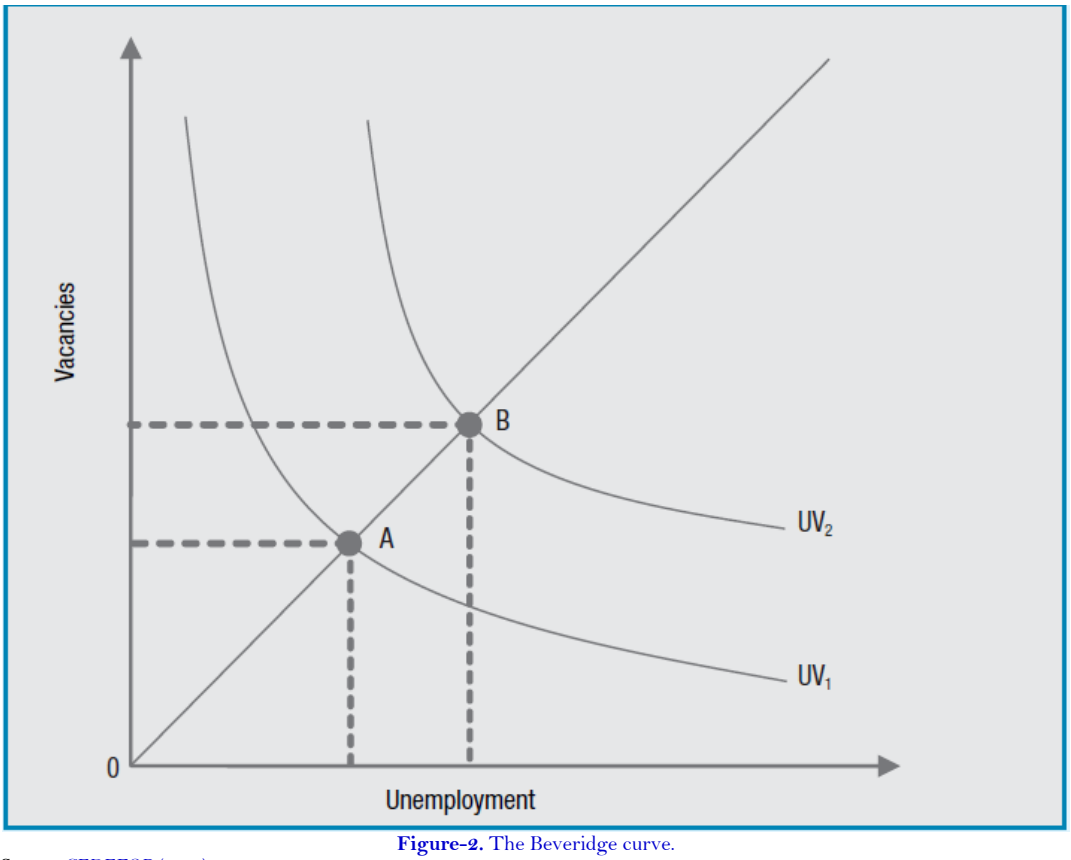

Figure-2. The Beveridge curve.

Source: CEDEFOP (2010).

3.3. Job Assignment Theory

Assignment theory emphasizes both individual and job characteristics. As a result, the theory is ideal for exploring the match and mismatch between a worker's skill profile and the work-related skill content (Hartog, 1981; Hartog, 1985; Hartog, 1986a; Sattinger, 1980; Sattinger, 1993; Tinbergen, 1956).

Specifically, individuals employed in jobs below their skill levels (i.e., underskilled workers) are deprived of opportunity to fully utilize their productive skills, leading to lower earnings. Nevertheless, evidence is inconclusive whether overskilled workers earn more than underskilled workers. In general, if rewards are more closely tied to the job, underskilled workers could earn more than overskilled workers. On the other hand, if rewards are more closely tied to individual characteristics, underskilled workers could earn less than overskilled workers.

Interestingly, a worker's productivity and earnings are also determined by the characteristics of assignment, in addition to job performance. Specifically, similarly educated individuals might achieve varying degrees of performance despite the same assignment, given differences in expected output, skillsets, and technologies used.

3.4. Technological Change Theory

According to Romer (1990) educated individuals are more equipped to cope with changes in jobs brought on by innovations and technological advancement for the following reasons: physical capital has a stronger degree of complementarity with skilled labor than unskilled labor, jobs involving innovations and advanced technology require higher levels of formal education, and technological progress brings about new, diverse responsibilities which require skilled labor with multitasking capability.

Technological change and skill mismatch interact in three ways. First, technological progress could lead to skill underutilization due to the monetary and switching costs associated with adopting new technologies or in altering the work process. Underinvestment in new technologies also results in lost opportunities to enhance productivity. To address sub-optimization, firms should put in place incentive systems to invest in new technologies

and modern production process to enhance productivity. Second, firms that are likely to experience frequent technological disruptions have an incentive to employ overqualified individuals in order to accommodate future labor adaptations. Hiring workers with more skills than required serves as a preemptive strategy for businesses that compete in rapidly changing markets.

However, this practice could result in overskilling. In addition, there is a prospect of skill loss as a result of lack of skill use. Third, it is conventionally believed that technological advancements which require different skillsets often render existing workforce undereducated. However, this notion fails to take into account non-formal education and new skills acquired by workers while being employed. As a result, workers could be regarded as undereducated but they are less likely to be underskilled. According to Hartog (2000) undereducated workers normally possess above-average abilities in relation to their education, and many workers become underskilled as the result of rapid technological changes.

3.5. Job Search Theory

Individuals might accept jobs below their qualifications due to information asymmetry and job-search costs. Specifically, the mounting costs associated with prolonged job search may increase the likelihood that a job seeker accepts a job below his/her qualifications and capabilities, resulting in skill underutilization. This situation is commonplace among young workers who are seeking employment but lack opportunity or networks to help them locate the right jobs.

4. THE IMPACT OF SKILL MISMATCH ON LABOR OUTCOMES

Skills are an essential component of knowledge-based economy. Individual-level skills play a role in labor market success and influence workers' earnings and job satisfaction (Hanushek, Schwerdt, Wiederhold, & Woessmann, 2014).

Skills should be effectively deployed to minimize the incidence of skill mismatch. Skill mismatch occurs either when a worker's possessed skills are below the required work-related skills (under-skilled/overutilization) or when the possessed skills are more than the required skills (over-skilled/underutilization). This section explores the association between skill mismatch and earnings, productivity, and job satisfaction.

4.1. Skill Mismatch and Earnings

According to Allen et al. (2013); Perry et al. (2014); Markus et al. (2018) underskilled workers (i.e., those whose skills are overutilized) tend to earn a wage premium while those whose skills are underutilized tend to suffer from a wage penalty.

Markus et al. (2018) comparatively investigated skill mismatch in five countries: Austria, Belgium, Germany, Spain, and the UK; and reported that overutilization-induced wage premiums vary between 4% (Belgium) and 13% (Spain). Meanwhile, the wage penalty for underutilization in Belgium is 5%, compared to 11% - 13% in the other four countries. Allen et al. (2013) investigated the effect of skill mismatch on earnings using literacy and numeracy skills; and documented that literacy-skill underutilization is associated with a wage penalty of 11% and literacy-skill overutilization with a wage premium of 7%. Meanwhile, the wage penalty and wage premium for numeracy-skill underutilization and overutilization are 4% and 5%, respectively.

According to OECD (2016) greater use of cognitive skills (reading and numeracy) is associated with higher earnings for wage earners and self-employed workers in China. In Lao PDR and Sri Lanka, the basic reading assessment score is positively correlated with employee's wages.

4.2. Skill Mismatch and Productivity

According to Haskel and Martin (1996) skill shortage lowers productivity growth in the UK by 0.4% annually between 1983-99. More specifically, Bennett and McGuinness (2009) reported that, controlling for the effect of selection bias, output per worker is significantly lower in high-tech firms faced with hard-to-fill or unfilled vacancies. In contrast, McGuinness and Bonner, (2002) and McGuinness and Doyle, (2003); McGuinness and Doyle (2005) found no evidence to support the notion that unfilled vacancies significantly lower the productivity of IT and construction firms in Northern Ireland. Forth and Mason (2004) argued that skill shortage arising from applicants' sub-standard qualifications has no bearing on productivity.

Zira (2016) using PIACC data which include Japan and Korea, found an inverse relationship between aggregate numeracy skill mismatch and aggregate productivity. Furthermore, higher productivity is reported for satisfied employees due to lower turnover rates and absenteeism (Deepa, Palaniswamy, & Kuppusamy, 2014; Haorei, 2012). De Castro (2015) documented low productivity levels as a result of low job satisfaction attributable to skill mismatch.

4.3. Skill Mismatch and Job Satisfaction

Skill underutilization normally leads to lower job satisfaction. Workers gain satisfaction from work if they are provided with opportunities to apply their possessed skills to the tasks. Otherwise, they could become dissatisfied with the job. Similarly, overutilized workers could become stressful as they have to perform tasks that are beyond their skill levels, giving rise to low job satisfaction.

According to Sloane (2014) overskilling leads to lower job satisfaction. Interestingly, the author found that, based on pooled cross-section analysis, 22.2% of overskilled workers were dissatisfied with their jobs, but the figure dropped to 6.9% using panel data estimation. Meanwhile, Markus et al. (2018) reported that the relationship between skill overutilization and job satisfaction is statistically insignificant, while skill underutilization and job satisfaction are negatively correlated only in Belgium.

Allen et al. (2013) reported that literacy-skill underutilization is associated with a decrease of 0.13 points on a five-point scale, and literacy-skill overutilization with an increase of 0.12 points. The effect of numeracy-skill underutilization and overutilization on job satisfaction are statistically insignificant.

In Asia, Lu (2015) studied educational mismatch, skill mismatch, and job satisfaction in China; and found that skill-mismatched employees are less satisfied with their jobs. In the Philippines, De Castro (2015) studied 228 call center employees of four business process outsourcing (BPO) companies and reported that skill mismatch negatively affects job satisfaction.

5. CONCLUSION AND RECOMMENDATIONS

This review paper focuses on skill mismatch, rather than educational mismatch, for the following reasons: First, education serves a broader purpose than providing job-related skills. In other words, the purpose of education is expansive than equipping individuals with the skills to fulfill labor market demands. Second, workers' skills have been conventionally and narrowly confined to qualifications upon employment. As a matter of fact, workers acquire and lose skills throughout their entire life through work-related training and informal education. Third, education attaches little importance to the role of technological advancement and disruption in skill mismatch.

Specifically, this review research discusses the definition, the measurement and extent of skill mismatch, and the impact of skill mismatch on labor outcomes. The investigation reveals that existing studies focus primarily on skill mismatch in European countries and developed countries while research on skill mismatch in developing countries is limited.

Skill mismatch is measured by comparing a worker's possessed skills with the required job-related skills. If the worker's skills exceed the required skills, he/she is over-skilled. On the other hand, if the worker's skills are below

the needed skills, underskilling ensues. There are two approaches to measuring skill mismatch: subjective and objective approaches. The subjective approach is the self-assessment of skill gaps, while the objective approach relies on national surveys such as HILDA, PIACC, STEP. Certain national surveys utilize mixed method (subjective and objective methods) to determine skill mismatch.

The findings reveal that skill mismatch exists in both developed and developing countries by varying degrees. Skill mismatch associated with skill overutilization (underskilling) and underutilization (overskilling) has significant implications on workers' earnings, productivity, and job satisfaction. Specifically, overskilling tends to result in wage penalty. Overskilling is also negatively associated with productivity and job satisfaction. As a result, more attention should be given to the issue of overskilling so as to minimize the losses to individuals and the economy.

Additionally, the findings also have policy implications to remediate supply- and demand-side skill mismatch. Labor supply-targeting policies should aim to create course curriculum that are more responsive to labor market demand and to develop non-formal education and work-based training systems.

Labor demand-targeting policies should aim to promote the adoption of technologies and practices to fully utilize available sets of skills. Meanwhile, policies that coordinate labor supply and demand should emphasize coordination between various labor-market stakeholders to address labor-market skills mismatch (Desjardins & Rubenson, 2011). In addition, governments should foster collaborative efforts between businesses, related government agencies, and educational institutions to tackle skills mismatch.

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