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THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Understanding the demand for and supply of skills in the oil and gas industry in Ghana: A case study of what TVET institutions offer and what exploration and production oil and gas companies need



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Understanding the demand for and supply of skills in the oil and gas industry in Ghana: A case study of what TVET institutions offer and what exploration and production oil and gas companies need

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A Thesis Submitted to the Wits School of Education

Faculty of Humanities

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Author's declaration

I declare that this thesis is my own unaided work. It is being submitted for the degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



Hans Awude

February 2023

Abstract

The study analyses the relationship between mid-level technical skills providers and the demands of core technical jobs in Ghana's oil and gas exploration and production companies. It is important for policy makers and researchers to understand the complexities of skills demands of the Ghanaian oil and gas companies and those supplied by TVET institutions within a TVET system that is small and weak and that has structural inconsistencies.

The literature identifies middle-level occupations as core technical skills occupations in high demand by the Ghanaian oil companies. However, the literature further argues that the oil companies have concerns about the quality of TVET education and cannot readily recruit qualified graduates from the local labour market. It further highlights a perceived skills mismatch between TVET qualifications and the core technical skills required by industry. At the same time, the International Labour Organization and others claim that TVET graduates fail to get jobs because their skills fail to match the skills required in the oil and gas industry.

The study set out to investigate the following questions:

- What are the structural and institutional constraints behind the perceived skill mismatches between TVET qualifications and the upstream sub-sector of the oil companies?
- Why are the TVET institutions mandated to supply core technical skills and occupations not meeting the employment and hiring criteria of the oil companies?
- What are the relationships between TVET providers and the oil and gas industry concerning on-the-job training?
- What is the government's response to the perceived skills mismatches?

For the study data were collected from three key role-players: exploration and production oil and gas companies, TVET providers, and regulatory and intermediary bodies The data collected were supported with a desktop review. The study adopted a descriptive design and systematic descriptive analysis because these methods are well-suited to answering the research questions.

The findings of the study show that while there is a widespread perception of a skills mismatch among the key role-players and researchers, more important is a structural dislocation that policy reforms have not addressed to date, despite efforts to do so, making it impossible for TVET providers to supply skilled workers to the oil and gas industry. The study explored why TVET graduates with core technical competence are not employed directly from TVET universities, a phenomenon widely attributed in the literature to a skills mismatch. A key finding is that the exploration and production oil and gas companies require international professional certification for all mid-level technical jobs which none of the Ghanaian TVET providers can offer.

Key Words: Skill, qualification, competency-based training, technical and vocational education and training, Ghanaian exploration and production oil and gas companies.

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Abbreviation and Acronyms

AfDB	African Development Bank
AGI	Association of Ghana Industries
ALARP	As Low As Reasonably Practicable
AOGC	Accelerated Oil and Gas Capacity Building
BDC	Bulk Distribution Companies
BECE	Basic Education Certificate Examination
BOST	Bulk Oil Storage and Transportation
CAGR	Compound Annual Growth Rate
CBT	Competency-based Training
CME	Coordinated Market Economy
COTVET	Commission for Technical and Vocational Education and Training
CWB	Canadian Welding Bureau
DESA	United Nations Department of Economics and Social Affairs
ERP	Economic Recovery Programme
FCUBE	Free and Compulsory Universal Basic Education
FPSO	Floating Production Storage and Offloading
GDP	Gross Domestic Product
GEA	Ghana Employers Association
GES	Ghana Education Service
GIC	Ghana Investment Centre
GIZ	German Corporation for International Cooperation
GNPC	Ghana National Petroleum Corporation

GNPC	Ghana National Petroleum Corporation
GTPCW	Ghana Transport, Petroleum and Chemical Workers Union
GWB	Ghana Welding Bureau
HND	Higher National Diploma
HND	Higher National Diploma
HSE	Health Safety and Environment
ICT	Information and Communications Technology
ILO	International Labour Organization
IMF	International Monetary Fund
IOC	International oil Companies
IOGP	International Association of Oil and Gas Producers
ISCED	International Standard Classification of Occupations
ISCO	International Standard Classification of Occupations
KimTech	Kikam Technical Institute
KNUST	Kwame Nkrumah University of Science & Technology
KSAs	Knowledge, Skills and Abilities
LME	Liberal Market Economy
MELR	Ministry of Employment and Labour Relation
MoE	Ministry of Education
MoFA	Ministry of Food and Agriculture
MoU	Memorandum of Understanding
NACVET Training	National Co-ordination Committee for Technical and Vocational Education and
NCCA	National Council for Curriculum Assessment

NCTE	National Council for Tertiary Education
NEPAD	New Partnership for Africa's Development
NLC	National Liberation Council
NPA	National Petroleum Authority
NVQ	National Vocational Qualification
NVTI	National Vocational Training Institute
OCTP	Offshore Cape Three Point
OECD	Organization for Economic Co-operation and Development
OMC	Oil Marketing Companies
PC	Petroleum Commission
PEF	Private Enterprises Federation
PNDC	Provisional National Defense Council
RMU	Regional Maritime University
SAP	Structural Adjustment Programme
SOE	State-Owned Enterprises
SOGA	Skills for Oil and Gas Africa
SSSCE	Senior Secondary School Certificate Examination
SURF	Subsea Umbilicals Risers & Flowlines
TEN	Tweneboa, Enyenra, Ntomme
TOR	Tema Oil Refinery
TTI	Takotadi Technical Institute
TTU	Takoradi Technical University
TVET	Technical and Vocational Education and Training

UNDP	United Nations Development Programme
WAEC	West Africa Examination Council

CHAPTER ONE

1.0 Introduction and background

This study seeks insights into the structural and institutional constraints related to demand and supply of skilled workers in the upstream sub-sector of Ghana's oil and gas industry. The context of the study is a TVET system widely seen as weak and an oil and gas industry that is a priority for economic development. The research problem, discussed in more detail later in this chapter, is that the International Labour Organization (ILO) and others claim that Ghanaian TVET graduates fail to get jobs as their knowledge and skills do not match the knowledge and skills required in the oil and gas industry. The rationale for this research lies in the need to understand the relationship between TVET as providers of mid-level skills for technical occupations and the demand of the exploration and production of oil and gas companies in Ghana for skilled workers. It is expected that the study contributes insights towards understanding the complex and challenging relationship between education and work in this context and perhaps beyond this context.

The inspiration for this project came from extensive reading on the Technical and Vocational Education and Training (TVET) system in Ghana and its challenges, especially the lack of extensive research into the demand for and supply of skills to industry, particularly the oil and gas companies engaged in exploration and production. This thesis builds on and contributes to the work of researching the relationship between education and work. Although several studies and theories have examined the relationship (Allais & Yael, 2018), there is a paucity of literature concerning policy and structure in the Ghanaian context as found in the European political economy of skills tradition and its account of East Asian success. This study aims to provide

insight into the relationship between TVET institutions as skill suppliers and the oil and gas upstream sub-sector, an emerging industry in Ghana.

The study analyses the relationship between mid-level technical skill suppliers and core technical jobs in Ghana's exploration and production oil companies. It is essential to understand the intricacies of skills demand and supply between the companies and TVET institutions within a TVET system that is small and weak, with structural inconsistencies because stakeholders in the sector have concluded that there is a skills mismatch.

According to Suleman and Zaato (2021), there is a 59 per cent Ghanaian representation as core technical staff in the upstream operations in oil exploration and production companies. Some studies give local training in core technical skills, monitoring experience building and localizing core technical positions as recommendations for increasing the number of Ghanaians in the core technical staff roles (Ackah & Mohammed, 2018). However, studies indicate that Ghanaian oil and gas companies have a poor view of the quality of TVET education (COTVET, 2021), and claim that, they cannot readily recruit qualified graduates from the local labour market.

I argue that the role of TVET is key to the contribution of education in support of economic development. However, unfortunately, in many countries, especially developing countries, TVET is saddled with underfunding, policy borrowing, shifting the cost to students who can least afford it, and fragmentation of vocational education and privatization (Education International, 2016). Moreover, TVET qualifications have been narrowly-focused on specific skills for particular occupations rather than a broad range of knowledge and skills that will give them some flexibility in the labour market (Allais, 2014). While public vocational institutions and teachers have taken

the blame for lack of funding, they also take the blame as the cause of economic underperformance, mismatches between vocational education qualifications, skill shortages and the labour market (Education International, 2016).

1.1 Institutional overview of Ghana's educational system with focus on TVET

Technical and Vocational Education and Training in Ghana takes two forms: formal TVET made up of public and private provision and non-formal TVET largely made up of apprenticeships. Darvas and Palmer (2014) argue that the largest provider of skills training is the informal apprenticeship system. Technical and Vocational Education and Training in Ghana is often associated with the outcome of formal public TVET even though the sector is responsible for less than 10 per cent of the technical and vocational skills acquired (Darvas & Palmer, 2014); the majority of TVET provision is through informal apprenticeships.

The task of Ghana's TVET is to raise the earning of people, improve the productivity and the skilled workforce, industry-focused, competency-based and lifelong learning training programmes and complimentary services (COTVET, 2021; Darvas & Palmer, 2014). The World Bank (2017) states that the weak TVET system negatively impacts the provision of skills for the economy as Ghana tries to industrialize. Systems and structures that support TVET in Ghana include the Ministry of Education, Commission for Technical and Vocational Education and Training, TVET institutions (pre-tertiary and tertiary), Trade Associations and industry. At the tertiary level, TVET is provided by Polytechnics and Technical Universities. Ghana has eight technical universities and two polytechnics. At present, Ghana does not have a unified qualification framework for general education and TVET (Walther et al., 2017). However, both formal and non-formal TVET operate

on the same TVET Qualifications Framework. Vally and Motala (2014a) states the Ghanaian National Technical and Vocational Education and Training Qualifications Framework (NTVETQF) is structured to accommodate occupational skills acquisition and academic knowledge (Adotevi & Kyari, 2020). The Commission for Technical and Vocational Education and Training was established by the Education Regulatory Bodies Act 2020 (Act 1023) (Mohammed et al., 2022). The Commission is mandated to regulate, promote and administer technical and vocational education and training for transformation and innovation for sustainable development (COTVET, 2021; ILO, 2020).

Government is responsible for funding TVET through budgetary allocation to the responsible Ministries that are involved in TVET. Another source of funding is from development partners, civil society and faith-based organizations (UNESSCO-UNEVOC, 2016). TVET in Ghana faces a number of challenges, including finance (IIEP-UNESCO Dakar, 2020), training of TVET teachers (s instructors) and evaluators and negative perceptions of TVET among students and the society at large (UNESSCO-UNEVOC, 2016).

Technical and Vocational Education and Training occupies a space between secondary schooling, universities, and the labour market. It also seeks to fill the gap between jobs requiring professional occupations requiring deep and abstract underpinning knowledge and few skills (Oliver et al., 2019). Labour market demand has significant implications for TVET as employers, in their capacity as hiring decision-makers, face uncertainty about the possible distance between the potential and actual performance of a potential employee. Because of uncertainty and unequal power play between parties, institutions play a central role in determining the character of labour

demand and how it shapes the workplace (Oliver et al., 2019). Contemporary approaches to analyzing the political economy of TVET as to how TVET institutions developed and the functions they serve are underpinned by human capital theory, and institutional and capability approaches (Oliver et al., 2019).

1.1.2 Competency-based training and learning outcomes

A competency-based training approach was adopted in Ghana in 2000 when the country was experiencing solid economic development and facing significant training requirements" (IIEP-UNESCO Dakar, 2020, p. 19). However, this approach only involved a small percentage of TVET institutions, mainly at Proficiency Level 1 & 2 Certification (IIPE- UNESCO, 2020). It was a bold approach that assumed links between education and work. However, the approach has encountered many difficulties, some of which have also emerged in other countries: employers do not participate, employers disagree, employers often do not know what their skills needs are, employers tend to list generic skills, and training providers cannot design training programmes from occupational standards (Brockmann, Clarke, & Winch, 2011; Keep, 2015; Keep & James, 2012; Martin, 2017; Wolf, 2002)

1.1.3 The political economy of the oil and gas industry in Ghana

Recently the oil and gas industry in Ghana has come into sharp focus as a boost to the industrial sector of the economy. The first commercial oil production began in 2007, with over 80 per cent of oil and gas exploration successful between 2008 and 2014 (GNPC, 2016). The ILO (2012) at the *Global Dialogue Forum on the future needs for knowledge, skills and training in the oil and gas industry* identified that a wide range of skills was lacking. The gaps included technical, soft

and managerial skills with a particularly acute shortage of skills in technical occupations such as petrochemical engineers, petroleum engineers, and geologists, described as a significant challenge to the sector. The position of the ILO is confirmed by Falcon, Pegram & Kolios (2018, p. 6) who argued for job localization and defined it as: "a process of training and developing nationals with the appropriate qualifications, competencies and experience to enable oil and gas companies to replace expatriates with nationals."

Pegram & Kolio (2018) acknowledged inadequate experience and skills within the local labour market as a challenge to the job role localization legislated by the Parliament of Ghana in 2013 in the Petroleum (Local Content and Local Participation in Petroleum Activities) Regulation, 2013 (LI 2204) (Page & Tarp, 2020). This legislation requires companies to increase local supply chain utilization and the provision of local employment prospects. According to local content law, the implementation challenge calls for an introspective investigation into the demand and supply of skills in the sector.

1.1.4 TVET systems throughout the world

Historically, skills formation systems were analysed through sociological research, country-specific typologies, and Labour Market theories (Gerhard et al., 2017). Transition studies look at education-to-work transitions but also capture so-called micro-transitions. The relationship between education and the world of work is highly contested (Allais, 2014; Wolf, 2002). There have been competing theories with fundamentally different assumptions about skills in general and technical education systems (Lauder et al., 2017). An evaluation of these theories regarding some of the assumptions for policy argues that universal theories, for reasons including their lack

of capacity to provide policy guidance in a specific context, are flawed. Similarly, particularistic theories cannot adequately address the impact of global skill formation processes on national systems (Lauder et al., 2017).

Some researchers suggest that thinking more broadly about occupations and occupational streams may be beneficial (Wheelahan, 2010). The solution to the current status-quo of generalist qualifications as constituted in secondary and higher education qualifications and job-specific competencies in TVET, proposed by Wheelahan & Buchanan (2015) is an intermediate stage during which 'vocations' and 'vocational streams' shape the future evolution of qualifications and skills. Wheelahan & Buchanan argue that the labour market greatly structures individuals' educational routes, including the transition to TVET from schools. TVET qualifications based on competency-based training assume a direct linkage between qualifications and jobs and are too simplistic and narrowly focused and aggravate skill mismatches between education providers and industry.

The weakness of TVET in Ghana is not, therefore, entirely surprising given what we know about the history of TVET systems. Every country wants a skilled population. Why are they not succeeding? Why do countries differ so much in their education and training systems? There is no simple answer to these questions. Gerhard, Bosch and Warhurst in (Gerhard et al., 2017), show that in every country, even in countries with similar levels of economic development and similar technologies, products and services are surprisingly different in terms of workers' general and vocational training. Patterns of similar typologies have emerged in international comparative research, path dependency, institutional complementarities, and political systems. They are worthy

of study because they foreground the question of why countries differ so much in their educational systems (Hall & Soskice, 2004).

Busemeyer & Trampusch (2019) argue that TVET systems are determined by the relationship between state, capital and labour. They described three different models: In model 1, the state's involvement is limited, as is the case in the US and UK; in model 2, as is the case in the Nordic Countries Germany industrial relations are highly regulated; in model 3 in developmental states, such as South Korea, the state has well-defined policy interventions (Busemeyer & Trampusch, 2019).

1.1.5 Skills and industrial development

The role of industrial development has had a role in the economic growth of many countries including the Republic of Korea, Taiwan, and China, leading to a reduction in poverty (Morris, 1996). Some countries have achieved growth with equity, whereas in others, inequality remains high. The current understanding of economic growth based on the neoclassical growth model developed by Solow (1956) remains dominant with governments. In this model, capital accumulation is a significant factor contributing to economic growth. In criticizing the neoliberal model, Chang (2010) challenges the myth that capital has been released into a free-floating atmosphere in a liberalized market economy.

The continuing recognition of the success story of the “Asian Tigers”, where the state supports economic growth through its investment in skills development, is without ambiguity (Ashton et al., 2002b). A World Bank report shows that government investment in primary and secondary education yielded higher social returns than private investment at those levels as well as economic

growth (Ashton et al., 2002a). Some recent analyses by development economists (Collier, 2007; Easterly, 2007; McGrath, 2010; Sachs, 2008; Stiglitz, 2006) on the role of education in national development, differ in regard to the role of education. For example, education appeared to be a positive force for development in the case of Easterly (2007), while Stiglitz (2006) saw it as a significant focus of the East Asian economic boom. On the other hand, Collier (2007) considers infrastructure more fundamental than education in promoting development. Drawing from this context, McGrath wanted to know if educationists needed to make a case for education's contribution to economic development. Alternatively, should they resist the lure of significant claims for education, they may prefer to focus on how education makes a difference, both positive and negative, in people's lives without any genuine concern for more critical questions of development. The role of education in the relationship between skills and industrial development is a highly contested one from the literature.

Similarly, Bejakovic's (2005) review of Wolf (2002) argued that quality and not quantity of education is vital. Bejakovic compared two developing countries with similar GDPs, Bolivia and Indonesia, which spent a similar percentage of their GDP on education. While Indonesia prioritized primary education with much emphasis on rural children, Bolivia spent about the same percentage of GDP on secondary and tertiary education for urban children. Generally, much better results were obtained from Indonesia. Similarly, investment by one of the "Asian Tigers", South Korea, achieved tremendous economic development and growth with a well-targeted and coordinated and well-designed reform of the educational system (Bejakovic, 2005). In her concluding statements, Wolf (2002) argued in favour of education but not in its present form and organization where the

quality of knowledge and skills is sacrificed for enrolment and examinations to guarantee economic success.

1.2 Statement of problem

Skills Gap Analysis and Audit reports show that the oil and gas industry in Ghana views the quality of TVET education as inadequate. Mid-level occupations require core technical skills that are in high demand by the oil companies but are not readily available in the local labour market. The reasons given are that applicants for such mid-level positions lack core technical skills, and have inadequate educational qualifications and prior experience (COTVET, 2021, p. 792). At the same time, the ILO and others claim TVET graduates fail to get jobs as their skills do not match the skills required in the oil and gas industry (Falcon et al., 2018; ILO, 2012). The skills mismatch between the education system and the labour market manifests through the disparity between supply and demand for labour (Radovic et al., 2016). The phenomenon can involve different kinds of mismatches, including vertical and horizontal mismatches. Horizontal mismatch measures the extent to which graduates secure jobs in an occupation that is unrelated to their principal field of study. Vertical or hard-to-fill vacancies have arisen due to a lack of qualified candidates at the firm level. Genuine skill shortages only relate to situations where the available supply cannot meet the demand for skills by employers (McGuinness et al., 2017; Uzair-ul-Hassan & Noreen, 2013). This study explores the relationship between TVET institutions, the providers of technical occupations and the skills demanded by the oil and gas upstream subsector within the technical operations field.

In Ghana, TVET qualifications assume a direct link between qualifications and jobs. In reality, the labour market is much more complex. This complexity may lie behind the perceived skill

mismatches. While research has been published on the relationship between education and work (Allais, 2014; Becker, 1993; B. Bills, 2003; Schultz, 1961; Shalem & Allais, 2018; Wheelahan & Buchanan, 2015; Winch, 2010; Young & Muller, 2014), the literature on the European political economy of skills tradition and its account of East Asian success is much more elaborate in structure and policy. Therefore, this study aims to unpack the labour market complexities within the Ghanaian context.

1.3 Significance of the project

The justification for this research comes from increasing interest in the relationship between TVET as providers of mid-level skills for technical occupations in the oil and gas industry in Ghana and the need for a wider understanding of the complex and challenging relationship between education and work.

1.4 Objectives

The purpose of this research is to explore the relationship between TVETs as providers of mid-level skills and technical occupations and the occupational skills demands of the oil and gas upstream sub-sector. A qualitative and partly quantitative approach to the study was adopted to understand better the demand and supply of skills in the oil and gas upstream sub-sector and the perceived skill gaps and skills mismatches alleged by COTVET, the ILO and others (COTVET, 2021; Darvas & Palmer, 2014; Falcon et al., 2018; ILO, 2012). Generally, this project explores the relationship between education and work and how structural and institutional factors constrain or enable the transition of TVET graduates into oil and gas companies.

1.5. Research questions

Put into context, understanding the relationship between TVET and the oil and gas upstream sub-sector in Ghana, and understanding of the demand for and supply of skills and suspected skill mismatches will be a step towards achieving the objectives of this research. Therefore, the study seeks to answer the following:

1. What are the structural and institutional constraints behind the perceived skills mismatches between TVET qualifications and the occupational skills required by the upstream sub-sector oil companies?
2. Do TVET institutions responsible for supplying core technical skills and occupations meet the employment hiring criteria of the upstream sub-sector oil companies?
3. What are the relationships between TVET providers and industry concerning on-the-job training?
4. What has been the government's response to the problem of perceived skills mismatches?

1.6. Scope of study

The research explores demand for and supply of skills in the upstream (exploration and production) sub-sector of Ghana's oil and gas industry. The study involves consultations with stakeholders, including the Ghana Education Service, Commission for Technical and Vocational Education and Training (COTVET), Technical and Vocational Education and Training Institutions, Ministry of Employment and Labour Relations, Petroleum Commission, Ghana Employers' Association, General Transport, Petroleum and Chemical Workers' Union and the Association of Ghana Industries. The study also explores relevant theories and concepts by engaging with transition

theories, labour market theories, human capital theory, competency-based training and some empirical issues such as skills, knowledge and qualifications of potential employees in the oil and gas industry.

1.7. Structure of the thesis

The thesis consists of seven chapters. Chapter one explains the context of the study—a Ghanaian TVET system widely seen as weak and an oil and gas industry that is a priority for economic development. The objectives are to understand better the demand for and supply of skills for the upstream oil and gas sub-sector and the perceived skills gaps and skills mismatches as alleged by COTVET, the ILO and others.

Chapter two provides an overview of Ghana's educational system with a particular focus on vocational education. It shows how small and weak the TVET system is compared to the general education system. The chapter suggests that the TVET system is saddled with a negative image and is struggling to respond to the country's industrialization drive. The chapter also discusses historical accounts of TVET systems throughout the world, showing what has worked within the context of historical trajectories of industrialization, educational structures and different patterns of industrial relations for different countries. The chapter argues that the weakness of TVET in Ghana is not surprising, given what is known about the history of TVET systems throughout the world.

Finally, the chapter reviews the political economy of the oil and gas industry in Ghana, providing insights into local content law, which gives meaning to local participation as a priority in the oil industry in the Ghanaian context.

Chapter three reviews literature relevant to answering the research questions. The chapter provides an overview of skills in industrial relations and takes a position on the definition of *skill*, and argues that as much as skills and their mode of acquisition are essential to development, other economic factors must go hand-in-hand with skills provision to engender economic growth.

The chapter draws on the relationship between education and work literature and argues for a holistic approach to linking education and work: how occupation, work, knowledge and skills, labour markets, and qualifications are related. It also explores some of the complexities of the transition from education to the labour market.

The chapter further explores debates on the relationship between industrialization and skills: first, in the context of the Asian Model and second, in the context of Ghana, highlighting how Ghana's manufacturing sector evolved and its contribution to the industrialization agenda, bearing in mind skills as a contributing factor. Human capital theory complements other relevant concepts.

The literature also discusses the problems of implementing Competency-Based Training, Occupational Standards, and Learning Outcomes across Africa. The concept of Competency-Based Training is of interest because the changing world of work constantly challenges graduates from TVET colleges and affects employers' perception of skill needs and hiring decisions based on social, economic, and institutional factors.

Chapter four describes the research design and process. It explains that this is a case study informed by a literature review in which data were collected from a questionnaire administered to key personnel in two exploration and production oil and gas companies and interviews with key

role-players in the oil and gas companies, TVET institutions and regulatory and intermediary bodies and supported with a desktop review. Fifteen interviews were conducted documentary analysis was carried out. For analyzing the data, I built an analytical framework from the literature reviewed and in doing so analyzed the data using key concepts raised in the literature in order to discuss the findings in relation to the research questions.

The desktop review included the following documents: 1) Skills gap analysis and audit of seven sectors report to analyse the skills gap within the oil and gas sector. 2) Local content implementation and development in Ghana's upstream sector – the study analysed the employment linkages to understand how the law impacts skills provision to the industry. The chapter also discusses the limitations of the research.

Chapter five presents findings from the three categories of role-players (TVET providers, industry, regulatory and intermediary bodies) according to the codes outlined in the final section of chapter four and supported by a desktop review. The first main finding identified skilled work, mid-level occupations as reservoir engineer, subsea engineer, operations engineer, drilling engineer, senior accountant, and the criteria according to which mid-level or intermediate level skills jobs are measured. The second main finding is that the most important criteria and employment requirement of companies is a university degree. Similarly, professional training and relevant skills, analytical and communication skills are essential.

The third main finding is that the forms of knowledge and skills required by industry, from the most important to the least important, are diagnostic and reasoning skills, handling multiple tasks, and social and teamwork skills: formal knowledge, rules. In terms of the future of mid-level and

intermediate jobs, the skills required in the industry are traditional. Moreover, these will probably remain the same despite technological advancement. Workers will learn the new work methods by training or through the management of the change process. These categories of workers play a role within the company and transition with experience to higher levels.

Chapter Six presents a synthesis of the separate findings illustrated in chapter five in order to address the research questions. While there is a widespread perception of a skills mismatch among key role-players and researchers, the findings suggest that there is a structural dislocation that policy reforms have not addressed to date despite efforts to do so, making it impossible for TVET providers to supply skilled workers to the oil and gas industry. The six critical sets of findings that led to this conclusion are discussed in the chapter. Finally, the chapter argues that beyond the demand for and supply of skills, economic, political, social and cultural institutions and arrangements shape skills formation and the transition from education to the world of work.
The chapter concludes with different role-players' responses to the question, "***In an ideal world, how should employers, education and training providers and other stakeholders collaborate to ensure the oil and gas companies get appropriately skilled workers?".***

The study concludes in **Chapter seven** by arguing that institutions and their appropriateness are of greater importance than thinking more broadly about "occupations and occupational practice" in linking mid-level skilled graduates to work in the upstream sub-sector of Ghana's exploration and production oil and gas companies.

CHAPTER TWO

The context of the Study

2.0 Introduction

Chapter two provides an overview of Ghana's educational system with a particular focus on the vocational educational system. It shows how small and weak the TVET system is compared to the general education system. The chapter further reviews the historical accounts of TVET systems throughout the world, showing what has worked within the context of historical trajectories of industrialization, educational structures and different patterns of industrial relations for different countries TVET system throughout the world.

In Ghana, Technical and Vocational Education and Training represents a significant intersection between education, youth and the labour market. What is noticeable about this context is that, formal TVET provision is at the pre-tertiary and tertiary levels of Ghana's educational system but, is not highly regarded. Furthermore, while recent educational reforms have considered TVET a critical component of the educational system little has been to strengthen this component. This chapter provides an overview of Ghana's educational system with a critical focus on TVET and how reforms of the educational system have influenced its mission and vision.

2.1 An overview of Ghana's educational system

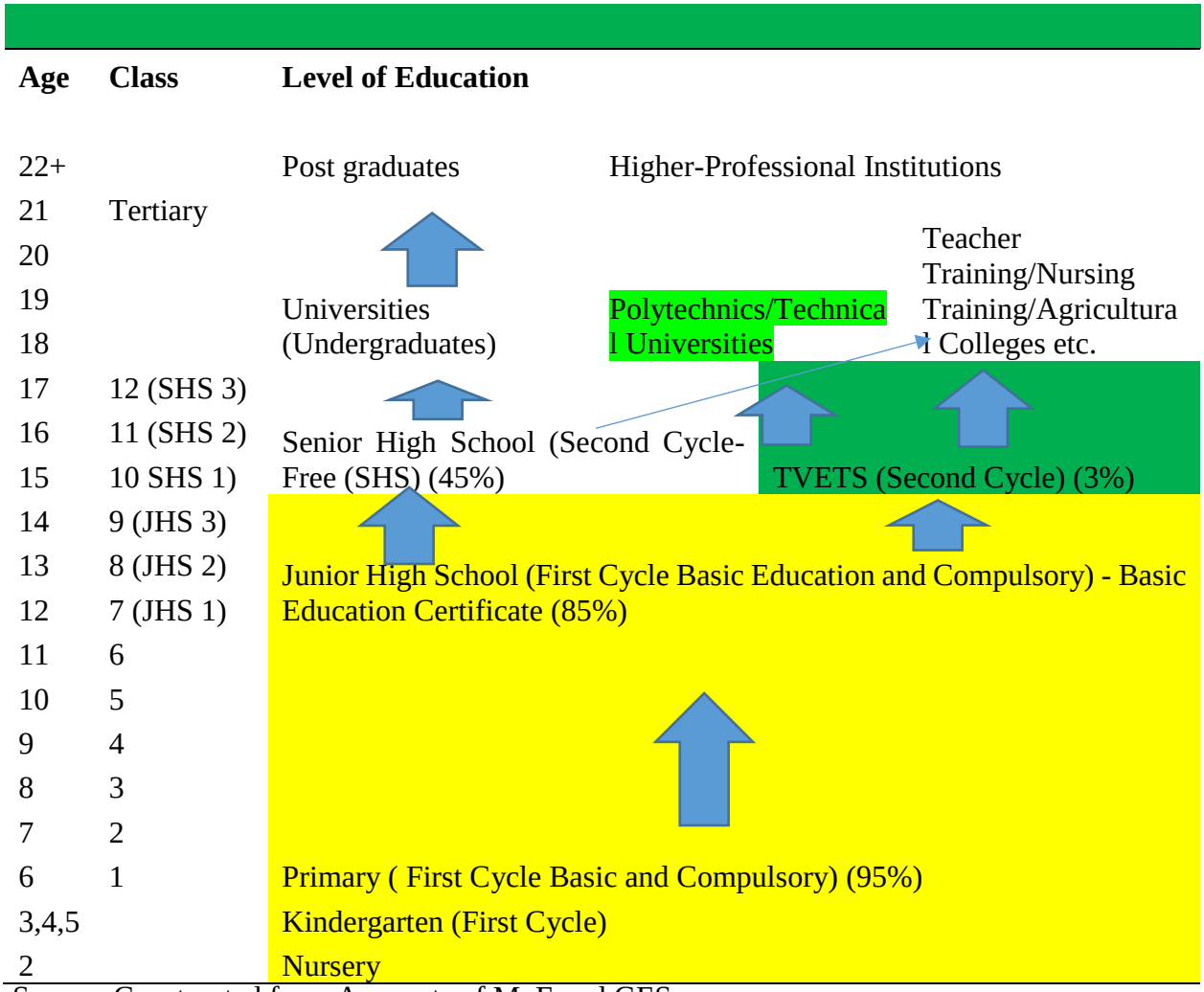
This chapter situates the research in context by providing an overview of Ghana's educational system and the position of the TVET sector within it. The chapter further explores the qualification framework developed by the Commission for Technical and Vocational Education and Training which aims to improve and link up with the labour market appropriately.

2.2 An institutional overview of Ghana's educational system

Ghana's educational system can be categorized into first cycle basic education, second cycle secondary schooling and third cycle tertiary educations. The first cycle of education terminates at the Junior High School level with the first external examination - Basic Education Certificate Examination (BECE). The second cycle concludes with the second external examination – Senior Secondary School Certificate Examination (SSSCE). Both are conducted by the West African Examination Council (WAEC). The Ghanaian Education Service (GES) is responsible for managing Basic Education, Secondary Education and Technical and Vocational Education and Training (pre-tertiary) while The National Council for Tertiary Education (NCTE) is liable for managing tertiary education in Ghana.

Figure 1 below provides an institutional overview of the entire educational system. The aim is to show how the formal TVET system is structured within the general education system and the pathways available to students in various categories of institution.

.Figure 1 An institutional overview of Ghana's educational system



Source: Constructed from Accounts of MoE and GES

After independence in 1957, the education structure comprised six (6) years of primary school and four (4) years of middle school which constituted basic education. The official age at which pupils begin schooling was six (6) (Akyeampong, 2016). Currently, Donkoh et al. (2016) argue, the structure has two (2) years of Nursery school, two (2) years of Kindergarten, six (6) years of primary and three (3) years of Junior High School (JHS), constituting the first basic/cycle of free

and compulsory education in terms of the constitution of Ghana. The official age for completing Junior High School is fifteen (15) years. A three-year second cycle takes the student from JHS to Senior High school, Vocational/Technical schools and formal or informal apprenticeship depending on students' qualifications and abilities. The official age of completion of this second cycle is eighteen (18) years. Tertiary education consists of 3-year post-secondary and 4-year First Degree University Education followed by other higher-professional degrees.

According to the World Bank, Technical and Vocational Education and Training in Ghana is often linked with the outcome of formal public TVET; even though the sector is responsible for less than 10 per cent of Technical and Vocational Skills acquired, with the majority learners obtaining knowledge and skills through apprenticeships (Darvas & Palmer, 2014). Formal TVET institutions are positioned at the pre- tertiary level of the educational system to produce mid-level skills for industry and accommodate new entrants from those who have completed Junior High Schools studies. However, they are mostly students who are unable to obtain places in Senior High School because of the competitive nature and the limitations of infrastructure at the Senior High Schools. (Akyeampong, 2016). Total enrollment in pre-tertiary TVET institutions, decreased from 68,892 in the 2006/2007 academic year to 59,110 in the 2016/2017 academic year as compared to enrolment in senior high schools of 414,491 in 2006/2007 and 880,770 in 2016/2017 (Ghana Education Service, 2017). These numbers show an inverse relationship between TVET and regular or general education. Again, in comparative terms, the percentage of trained teachers in pre-tertiary TVET institutions within the same time frame increased marginally from 52.4 per cent to 54.8 per

cent, whiles in Senior High Schools, it increased from 81.8 per cent to 86.4 per cent (Ghana Education Service, 2017).

Eight (8) other Ministries provide TVET at the pre-tertiary level - the Ministry of Education (MoE), Ministry of Employment and Labour Relations, and Ministry of Food and Agriculture (MoFA), among others. There are public and private TVET institutions with faith-based organizations and NGOs providing and managing the majority of the private institutions in Ghana. The major provider of skills training, however, remains the informal apprenticeship system (Darvas & Palmer, 2014). This system trains more than 440,000 youth at any given time; there are about four (4) informal apprentices for every trainer at informal public and private training centres combined, at no cost to the government (Darvas & Palmer, 2014). About one per cent of the 440,000 youth were part of the "National Apprenticeship program" initiated by the government to improve informal apprenticeships by providing skills in the informal sector (Darvas & Palmer, 2014)

Table 1 shows the types of enrollment in formal TVET institutions and illustrates the distribution of enrollment among TVET providers at the pre-tertiary level in the2017/2018 academic year.

2.2.1 Type of enrolment in TVET institutions by sector

Table 1 shows enrollments in pre-tertiary TVET institutions, public and private and at the tertiary levels.

Table 1 Type of enrolment in TVET institutions - 2017/2018

Type of Enrolment in TVET Institutions by sectors - 2017/2018	
Institution	**Enrolment**
GES	49,418
Other Ministries	8,328
Private	5,836
Total	**63,582**

Source: Ministry of Education EMIS 2018

Enrollment in public Technical and Vocational Training institutions constitutes 90 per cent of total enrollment in the academic year, while the private institutions at this level enrolled almost 9.2 per cent of students (Ghana Education Service, 2018b). This shows that government has considerable responsibility in the direct management and investment in the TVET system with coordination machinery to leverage skills supply to industry.

Table 2 below illustrates enrollment numbers in SHS in public and private institutions at the pre-tertiary level in the 2017/2018 academic year for a comparative analysis of percentages of enrollment in TVET and SHS.

Table 2 Type of Enrolment in SHS - 2017/2018

Type of Enrolment in SHS - 2017/2018		
Institution	**Enrolment**	
	SHS	892,015
Public	GES(VET)	54,186
Private	SHS	66,804
Total		**1,013,005**

Source: Ministry of Education EMIS 2018

Senior High Schools enrolled 1,013,005 students in the 2017/2018 academic year. This number constitutes 45 per cent of qualified students from the First Cycle Basic Education level, while

TVET institutions during the same academic year at the same level, enrolled 63,582 students, constituting about 3 per cent of students exiting from the first cycle to second cycle institutions. (Ghana Education Service, 2018). The rest either drop out or find informal apprenticeships (Darvas & Palmer, 2014).

Technical Universities and Polytechnics provide Post-Secondary TVET. Only students who have graduated from technical schools can proceed to the universities along this line of progression. Those graduating from technical institutes can only proceed to polytechnics and apprenticeships (UNESCO, 2016). For this research, Post-Secondary TVET is under consideration. The educational structure and the government's priority in investing and focusing on education makes the availability of the appropriate skills to industry problematic as the policy focus has always been towards general education in past educational reforms. If given the needed support and attention, TVET could play a supportive role in bridging the skills gap between demand for and supply of skills to industry.

Table 3 illustrates enrollment in tertiary education in a differentiated categorization for comparative analysis in the 2017/2018 academic year. The illustration is essential because it gives insight into the representation of TVET at the tertiary level and the involvement of the private sector.

Table 3 Type of Enrolment in Tertiary Institutions - 2017/2018

Type of Enrolment in Tertiary Institutions - 2017/2018			
Institution	**Public**	**Private**	**Total**
Universities	268,992	66,022	335,014
Technical Universities/polytechnics	33,365	N/A	33,365
Colleges of Education	44,813	5,196	50,009
Specialized Institutions	10,323	N/A	10,323
Nurses Training College	1,634	938	2,572
Collages of Agriculture	760	N/A	760
Total	**359,887**	**72,156**	**432,043**

Source: Ministry of Education EMIS 2018

There are ten Technical Universities/Polytechnics, all public, constituting 10 per cent of tertiary institutions. Technical Universities' and Polytechnics' share of enrolment in the 2017/2018 academic year in tertiary institutions was 7.7 per cent of total enrollments (Ghana Education Service, 2018b). The low percentage of TVET participation in tertiary institutions and the labour market suggests a lack of vital knowledge and skills available to the oil and gas industry.

2.2.2 Management and coordination of TVET systems and reforms

For this research, reform means intended or enacted attempts to correct an identified problem (Ayeetey & Kumbur, 2017). This section discusses the historical antecedents of vocationalization as a concept in educational reforms and implications for skills development in Ghana.

Ghana's educational reform goals have primarily been influenced by globalization and a World Bank driven by global competition (Kuyini, 2013). TVET has always been identified as providing

mid-level skills for industry. Unfortunately, in Ghana, progress in this area has been slow (Akyeampong, 2016). Educational reforms date back to the colonial history of Ghana, where;

> scholars in comparative education frequently cite the case of Achimota as an early example of educational transfer in which an American model – industrial education for African Americans – was transferred to the African Continent (Steiner-Khams & Quist, 2000, p. 272).

This American model - the Hampton-Tuskegee - was borrowed by the British from Virginia's Hampton Institute and Alabama's Tuskegee Institute as the first British educational institution in Africa (Steiner-Khams & Quist, 2000). The concept of vocationalization of the school system could be traced back to this era where supporters of the model considered it as enabling education for citizens, while in sharp contrast, opponents thought it had racist underpinnings and segregated "natives" from "whites" (Steiner-Khams & Quist, 2000). Vocationalization probably had its roots in this concept with the concept continuing to play a role in education and training debates for some time to come. In addition, major educational reforms associated with various political regimes took inspiration from vocationalization and other influential factors such as globalization, funding and political ideologies from both within the country and the international community.

There were changes in the educational sector as the government changed through both coups and democratic elections. As argued by Donkor et al.,(2016) and William and Baffour-Awuah (2015), the Accelerated Development Plan of 1957 and Education Act of 1961 ushered in the first educational reform after independence. The main objective of the reform was to produce

scientifically and technically minded people, and in the words of Dr Kwame Nkrumah, the first president of Ghana;

> Our whole educational system must be geared to producing a scientifically-technically minded people. Because of the limitations placed on us, we have to produce, of necessity, a higher standard of technical education than is necessary in many of the most advanced countries of the Western World (Akyeampong, 2016, p. 2).

The statement was profound as it points to the intention of giving priority to technical and vocational education and training. Foster (1977) notes that Ghana's education has emphasized vocational and agricultural training since independence in all documentary sources, but the reality on the ground is the reverse.

After 1961, the next major educational reform was in 1968, and this reform expanded secondary education and slowed down the expansion of university education, relating the reform more directly to the country's development needs (Donkoh et al., 2016). The Dzobo Report – "The New Structure and Content of Education 1974" focused on vocational education and training. It abolished the Middle School grammar school education and replaced it with Junior Secondary School (JSS) and Senior Secondary School (SSS) to prepare the majority of the children whose formal education terminated at the JSS and SSS for the world of work (Akyeampong, 2016). The implementation of the policy had its challenges as products from the system were said to be "half baked" due to inadequate workshops, structures, tools and instructors for practical work to support the system (Akyeampong, 2016).

Evans Anform spearheaded the fourth major reform as the reform committee chairman in 1987. This 1987 reform made basic education free and compulsory and reduced schooling from 17 years to 12 years (Donkoh et al., 2016). In 2007 another reform articulated an orientation towards international competitiveness with options for students at the JHS to join General Education and Technical and Vocational and Agriculture Training or enter an apprenticeship scheme with some support from the government (Akyeampong, 2010; Kuyini, 2013). In 2017, the government of Ghana moved to implement the free Senior High School policy progressively to give more Ghanaians the opportunity to attain secondary education. However, this policy did not include TVET students who studies do not fall under the Ghana Education Service.

Akyeampong (2010) argues that the Free Compulsory Basic Education (FCUBE) programme launched by the Ghana Government in the 1990s resulted in the largest cohorts of primary school leavers ever witnessed in Ghana in the mid-2000s. The programme increased the demand for post-basic education opportunities. A body to manage and coordinate formal TVET became necessary to allow its proper institutionalization in the general educational system. The Council for Technical, Vocational Education and Training (TVET) coordinating body is the Council for Technical, Vocational Education and Training (COTVET). Ghana experimented with several bodies, from the National Vocational Training Institute (NVTI) in the 1970s to the National Coordinating Committee for Technical and Vocational Education and Training (NACVET) in the 1990s. In 2006 COTVET was established to coordinate the supply side of skills within TVET (Baffour-Awuah & Thompson, 2012; Darvas & Palmer, 2014).

According to John Benjamin (2018), the Council for Technical and Vocational Education and Training (COTVET) was established by Act 718 in 2006 to formulate policies on TVET and skills development across pre-tertiary and tertiary education in both formal and informal sectors of the economy. COTVET was also mandated to coordinate, harmonize and supervise the activities of public and private TVET providers, including apprenticeships in the informal sector (Darvas & Palmer, 2014). The coordination function of COTVET has, however, been challenged by the existence of parallel agencies like the "Enterprise and Skills Development Programme" which performs a duplicating function (Darvas & Palmer, 2014). Afo (2015) argues that the TVET and Science, Technology and Innovation (STI) sectors are not well aligned with the demands of the labour market, limiting the country's growth prospects compared to other African countries like Mauritius and Botswana. The labour market, simply put, is a market in which job seekers (both employed and unemployed) compete for jobs and employers compete for workers. It is a market that renders one employed or unemployed (B. Bills, 2003). Otoo (2019) states that Ghana's labour market is characterized by informality of employment and employment relations, high-income inequality, low wages, and job insecurity with a National Minimum Wage below 2 US dollars.

This section has outlined Ghana's educational system, particularly TVET, which has undergone reforms over the years and has prioritized TVET. However, the vocationalization of the regular school system has not helped because of the challenges associated with it in terms of inadequate infrastructure, unqualified instructors and other logistics. This is relevant to the study as this context either strengthens or constrains the educational pathways of TVET graduates into the

labour market and, therefore, skills produced in technical and vocational education and training programmes.

2.2.3. Technical and Vocational Education and Training Qualifications Framework

This section examines the qualification framework of Technical and Vocational Education and Training and its relationship to the labour market. The TVET Qualification Framework aims to advance the different pathways for TVET graduates (UNESCO, 2016). The Council for Technical and Vocational Education and Training Legislative Instrument gave legal backing to a qualifications framework which starts from level one and ends at level eight. Proficiency 1 & 2 (Levels 1 and 2) is awarded by NVTI/Informal Associations. Certificates 1 & 2 (Levels 3 and 4) are awarded by Ghana Education Service - TVET, while Polytechnics award higher Diploma and Bachelor of Technology (Levels 5 and 6). Master of Technology and Doctor of Technology degrees occupy the seventh and eighth levels respectively and are awarded by Technical Universities. This framework indicates that TVET graduates can progress to acquire level 8 qualifications moving beyond polytechnics by entering technical universities.

Figure 2 TVET Qualification Framework

LEVELS	QUALIFICATION	STATUS	CERTIFYING INSTITUTION
8	Doctor of Technology	Formal	Technical Universities
7	Master of Technology	Formal	Technical Universities
6	Bachelor of Technology	Formal	Polytechnic/Technical Universities
5	Higher Diploma	Formal	Polytechnic/Technical Universities
4	Certificate 11	Formal	GES-TVET

3	Certificate 1	Formal	GES-TVET
2	Proficiency 11	Informal/Non-formal	NVTI/Informal Trade Associations
1	Proficiency 1	NVTI/Non-Formal	NVTI/Informal Trade Associations

Source: COTVET Legislative Instrument LI 2195 of 2012

Generally, qualifications serve three purposes: entry to or progression in the labour market, higher-level studies within the educational system, social inclusion, and social mobility in society (Giles & Coles, 2013). All three purposes apply to this study, especially entry to or progression in the labour market. Enrolment in the ten polytechnics in the 2016/2017 academic year for various qualifications ranging from Technical Certificate, HND, B. Tech, to BSc was 47,119 relative to 193,164 in public universities, specialized public universities and private universities (Ghana Education Service, 2017). Analysis of the entry qualifications and progression by TVET graduates into the labour market relative to the upstream oil and gas sub-sector is investigated in this research.

Figure 3 Level descriptors of NTVETQFW

Level	**Qualification**	**Enable learners to: (Knowledge)**	**Enable learners to: (Skills & Attitude)**
1	***Proficiency 1***		1. Confirm competence in the use and handling of hand tools of the trade. 2. Require basic skills of trade and craft and the ability to perform routine and predictable tasks. 3. Require close supervision.

			4. Require practical and oral tests for qualification.
2	***Proficiency 2***	1. Demonstrate basic numeracy, literary IT and entrepreneur skills. 2. Enable learners to be assessed orally,	1. Confirm competence in the use and handling of hand tools and machinery. 2. Require performance of varied activities that are routine, predictable and noncomplex in nature. 3. Require limited supervision. 4. Require practical and oral tests for qualification.
3	***Certificate 1***	1. Demonstrate a broad knowledge base incorporating some technical concepts. 2. Demonstrate knowledge of the theoretical basis of practical skills. 3.Demonstrate knowledge in numeracy, literacy, IT and entrepreneur skills	1.Require a wide range of technical skills. 2. Are applied in a variety of familiar and complex contexts with minimum supervision. 3. Require collaboration with others in a team.
4	***Certificate 2***	1. Demonstrate broad knowledge base with substantial depth in area(s) of study. 2. Demonstrate a command of analytical interpretation of a range of data. 3. Present results of their study accurately and reliably.	Require broad skilled competence in different tasks in varied contexts. 2. Require a wide range of technical and supervisory skills. 3. Are employed in different contexts.
5	***Diploma***	1. Demonstrate specialized in- depth	1. Require the ability to adapt and apply knowledge and skills to

		knowledge in their area(s) of study. 2. Analyze and interpret a range of data and be able to determine appropriate methods and procedures to deal with a wide range of problems. 3. Communicate methods, procedures and outcomes accurately and reliably.	specific contexts in a broad range of work activities. 2. Demand specialized technical and /or supervisory skills. 3. Require minimum supervision.
6	***Higher Diploma (HND)***	1.Demonstrate considerable theoretical knowledge and solid practical skills in their areas(s) of study. 2. Integrate, contextualize and apply knowledge to a range of complex technical or professional activities. 3. Have a command of planning analytical, supervisory and management functions under minimum direction. 4. Display qualities and transferable skills for employment.	1. Require a wide range of highly specialized technical and / or managerial with conceptual and creative skills. 2. Require qualities and transferable skills necessary for formal and self-employment. 3. Involve some level of organizational ability, resource mobilization, management and personal responsibility. 4. Ability to work or lead a group.
7	***Bachelor of Technology (B. Tech.)***	1. Demonstrate high level conceptual knowledge in a broad range of complex and changing contexts.	1. Apply methods, technics and modes of practices learnt and reviewed, to consolidate, extend and apply their knowledge and

		2. Demonstrate basic research skills. 3. Undertake tasks involving high level organizational ability, resource mobilization, management and personal responsibility. 4. Demonstrate a significant degree of strategic thinking and judgment. 5. Have a high level of supervisory and management capabilities.	understanding to initiate and carry out projects. 2. Promote further training, development of existing skills and acquisition of new competencies that will enable them to assume responsibility within organizations in self-employment. 3. Require qualities and transfer of skills necessary for formal and self-employment. 4. Communicate information in a variety of formats appropriate to both specialists and non-specialist audiences.
8	***Master of Technology (M. Tech.)***	1. Have a systematic understanding of knowledge and a critical awareness of current problems and/or new insights in the academic fields of study or area of professional practice. 2. Possess comprehensive Understanding of relevant techniques in research or advanced scholarship. 3. Demonstrate originality in the application of knowledge, together with a practical understanding of established techniques of research.	1. Involve the resolution of complex issues and making sound judgment in the absence of complex data, and communicating these conclusions to both specialists and non- specialist audiences. 2. Require self-direction and originality in tackling and solving problems, and acting independently in planning and implementing tasks at a professional or equivalent level. 3. Continue to advance their knowledge and understanding, and to develop new skills to a high level. 4. Promote qualities and transferable skills necessary for employment, initiative and personal responsibility and decision making in

		4. Critically evaluate current research, methodologies and advanced scholarships in the discipline, and where appropriate, to propose new hypothesis.	complex and unpredictable situations, and the exhibition of independent learning ability required for continuing professional development.
9	***Doctor of Technology (D. Tech)***	1. Creation of new knowledge through research of the quality that extends the frontier of knowledge in the discipline. 2. A substantial acquisition of knowledge which is at the forefront of technology or area of professional practice. 3. Ability to conceptualize, design and implement a project to generate new knowledge, or applications at the frontier of technology or professional practice.	1. Make informed judgment on complex issues in the area of technology or professional practice often in the absence of complete data and be able to communicate ideas and conclusions clearly to specialist and non-specialists in the discipline. 2. Exhibit qualities and transferable skills necessary for employment requiring the exercise of personal responsibility and initiative in complex and unpredictable situations

Source: Appendix 2: National Technical and Vocational Education and Training Qualifications Framework (NTVETQF) and Level Descriptors

2.3 Historical accounts of TVET systems throughout the world

The weakness of TVET in Ghana is not entirely surprising, given what is known about the history of TVET systems in Africa and the world. Allais (2015a) argues that technical and vocational education and training have recently been given much attention by the international community, which was not the case in the 1970s, 1980s and 1990s. This section explores why wealthy liberal market economies and coordinated market economies have experienced difficulties with

vocational education and the development of mid-level skills and the negative cycles that perpetuate this difficulty.

Every country wants a skilled population. Why are some countries not succeeding? Why do countries differ so much in their education and training systems? There is no simple answer to these questions. In international comparative research, Gerhard Bosch demonstrated that in every country, even in countries with similar levels of economic development and similar technologies, products and services, there are surprising differences in workers' general and vocational and training (Warhurst et al., 2017).

Hall and Soskice developed a theory which aimed to distinguish two types of capitalism based on neoclassical economics. The Liberal Market Economy (LME) model relies heavily on market relations to resolve coordination problems, and the Coordinated Market Economy (CME) relies on consensus-enhancing institutional infrastructure between firms as well as employers and unions (Hall & Soskice, 2004). It is of interest because of the comparative typologies the models present for future debates. With reference to the relational conception of the firm, Hall & Soskice (2004) argue that firms must develop relationships to resolve coordination problems central to their competencies. Fundamental to this objective could be seen industrial relations, vocational education and training, corporate governance, inter-firm relations and competencies of employees for the survival of the firm. While LMEs coordinate their activities through hierarchies and competitive arrangements, CMEs do the same by depending on non-market relationships, including networks and collaborative approaches. Institutions like regulatory systems, strong trade unions, employer associations, and extensive networks of cross-shareholding facilitate and reduce

the uncertainty actors have about the behaviour of others and allow them to make credible commitments to each other (Hall & Soskice, 2004).

In addition to formal institutions, other informal rules, cultures, and history are often essential and relevant to attaining the relevant equilibrium in the context of coordination in the political economy. The concept of historical trajectory is the build-up of institutions, their operating procedures and repeated historical experience in coordination to allow actors to coordinate effectively with each other (Hall & Soskice, 2004).

This literature is of interest to the study because of the statements on comparative typologies. While CMEs rely on education and training systems to provide firm-specific skills with assurance from firms that the workers trained will not be poached, LMEs provide vocational training through formal education systems that focus on general skills. While France and Germany have a well-developed industrial setup and therefore have developed specific skills within special industrial schools, Denmark has depended on collective school-based training systems because of its small and medium-sized enterprises (Hall & Soskice, 2004). From his investigation into forms of skills training for industrial workers, Martin (2017) argues that four factors contribute to the evolution of these systems to support vocational skills: patterns of industrial development, political features of the state, legacies from pre-industrial patterns of cooperation, and characteristics of industrial relations. Specific skills which constitute certified occupation skills and which usually involve Employers' Associations and Labour Unions in the oversight and administration of skills training, are the hallmark of CMEs (Busemeyer & Trampusch, 2012; Martin, 2017). Industrial-Specific skills are developed within special industrial schools with inputs from social partners and are easily

transferable within companies at the industry level (Martin, 2017). Martin categorizes France and Sweden as representative of this ideal type, while Germany and Switzerland rely on firm-specific skills and school-based instruction.

Germany, Switzerland and Austria have developed a dual model: firm-specific-based apprenticeship and school-based instruction, but most importantly, the emphasis has been on apprenticeship in Germany, while Austria has paid more attention to school-based skills development (Martin, 2017). CME and LME typologies were developed in the context of the advanced capitalist economies and the application of their comparative typologies. However, they could be a guide in understanding the context of TVET in developing countries like Ghana.

The way institutions complement one another reinforces the differences between liberal and coordinated market economies. As a result, few countries have managed to build robust TVET systems, and only in particular contexts. Martin (2017) argues in support of four broad factors contributing to the evolution of various systems of vocational skills: legacies from pre-industrial patterns of cooperation, industrial development and economic cleavages, and political features of the state and characteristics of industrial relation systems. General skills and specific skills have been developed either in the regular secondary school systems classified as general skills or in industrial schools and apprenticeship programmes classified as industry or firm-specific occupational skills (Martin, 2017). Busemeyer & Trampusch (2019) argue that TVET systems are determined by the state, capital, and labour relationships. They may take the form of liberal systems where the involvement of the state is limited as the case in the US and UK; a Cooperative Model as in the case of Germany and the Nordic Countries where industrial relations are highly

regulated; a Developmental Model as in South Korea where the state has well-defined policy interventions (Busemeyer & Trampusch, 2019; Guile & Unwin, 2019).

Historically in the advanced capitalist world of Liberal Market Economies (LME), equilibrium outcomes of firm behaviour are equally related to demand and supply conditions in competitive markets. However, CMEs adopt strategic interaction among firms and other role-players (Hall & Soskice, 2004).

With reference to the relational conception of the firm, Hall & Soskice (2004), argue that firms must develop relationships to resolve coordination problems central to their competencies. Fundamental to this objective, corporate governance, industrial relations, vocational education and training, inter-firm relations, and employee competencies are vital to the firm's survival.

Switzerland, Germany and Denmark are countries where skill formation is evident in successful vocational education in which both firm and the state play a role in mid-level skills funding, training, and collaboration in schools and workplaces. The governance and management of the training institutions by intermediary associations, includes the employer and employees (Renold et al., 2018). However, Martin (2017) queries the long term survival of such a system in capitalist economies characterized in recent time by a decline in manufacturing while the demand for higher education is rising.

The main point of this section is to show the importance of coordination among role-players in skills provision and to emphasise the role of the state, industry and industrial relations mechanisms in the demand and supply of mid-level core technical skills.

2.4 The political economy of the oil and gas industry in Ghana

According to the conventional understanding of political economy of oil in the 1970s, Morse (2023) argue that:

> The main elements of the political economy of oil consisted of four factors: resource nationalism; producer control over oil prices; the use of oil as a political instrument for producing countries and as a tool for the international redistribution of wealth; and the collective response of vulnerable oil-importing countries to that threat (such as the adoption of consumer taxes on petroleum products, the building of strategic reserves and the passing of anti-boycott laws) (Morse, 2023, p. 4).

However, the alternative view, a departure from the conventional, considered the following additional factors: the role of domestic politics in setting international agendas; the importance of interdependence among economies and the role of the United States in the world of political economy (Morse, 2023).

The political and institutional characteristics that define countries can be broadly aligned according to the type of political regime and the capacity of the state (Resnick, 2019). Achieving economic transformation in Ghana will require more activist economic policies within the confines of the state's capacity. Resnick (2019) argue that technical capacity to identify winning industries of to facilitate transition to higher value-added sectors hinders strong structural transformation. Ghana's sustained economic growth in recent decades reflects concerted effort to maintaining political fundamentals (Resnick, 2019).

Ghana's economy had expanded at an average of 7 percent per year since 2017 until the coronavirus pandemic reduced growth to 0.5 percent in 2020 (US Department of Commerce, 2022). The economy remains highly dependent on the export of primary commodities such as cocoa, gold and oil and is vulnerable to external shocks (US Department of Commerce, 2022). Challenges to Ghana's economy include high government debt, access to foreign capital at an affordable rate, low internally generated government revenue and inefficient state-owned enterprises (US Department of Commerce, 2022). The domestic currency, the cedi experienced a 4.1 percent depreciation against the US dollar in 2021 as against a depreciation of 3.9 percent in 2020 (US Department of Commerce, 2022).

Good jobs or what might be called decent jobs are difficult to obtain and keep in Ghana (K. N. Otoo, 2019). Despite consistent economic growth, the formal sector has been dwindling in its contribution to total employment. Ghana's unemployment rate is estimated at 12 percent and more than 50 percent underemployed in 2020 (Fosu, 2020). The slow pace of job creation in the formal employment sector and the increasing demand for jobs have turned the labour market into an "employers market" Employers dictate the terms and conditions of employment. Workers who are lucky to have formal sector employment have come under severe pressure. The overriding imperative has been for them to keep their job (K. N. Otoo, 2019).

The oil and gas sector is particularly important to Ghana's industrial development. This section presents an overview of the industry's trajectory and main actors in the value chain but focuses on the upstream sub-sector dominated by international oil and gas companies.

The oil and gas industry is operational within three streams: upstream, midstream and downstream. Upstream, also referred to as exploration and production, is dominated by international companies. The international oil and gas companies in Ghana are primary stakeholders in the industry because of their massive financial and technical investment in the exploration and production of oil and gas. Their interest is not only to recoup their investment but also to make profit on their investment (Osei-Tutu, 2013). The Petroleum Commission was set up in 2011 to regulate the activities of the upstream industry (Osei-Tutu, 2013; Petroleum Commission, 2019). The midstream involves activities between the oil well head and the refinery – transporting the oil and gas from the oil fields to the refineries onshore and to storage. The downstream activities are carried out by Oil Marketing Companies (OMCs), Bulk Distribution Companies (BDCs) and Bulk Oil Storage and Transportation (BOST). The activities of the downstream industry are regulated by an Act of Parliament (NPA Act 2005, Act 691) and by the National Petroleum Authority (NPA) while the Ghana National Petroleum Corporation (GNPC), Ghana's National oil company established in 1983 by PNDC Law 64, was subsequently provided with a regulatory framework by the petroleum (Exploratory and Production) law 1984, Law 84 (Amponsah & Opei, 2017; Petroleum Commission, 2019; Tanoh, 2016). The Ghana Gas Company was established as a subsidiary of GNPC in 2015 to develop the Western Corridor Gas infrastructure project including the Atuabo Gas Processing Plant (Skaten, 2018). A summary of the actors in the oil and gas industry is presented in Fig. 3 showing policy, regulatory and industry players.

Figure 4 The main actors along the oil and gas value chain

<table>
<tr><th colspan="5">Main Actors along the Value Chain</th></tr>
<tr><td></td><td>Upstream</td><td>Midstream</td><td colspan="2">Downstream</td></tr>
<tr><td>Policy</td><td colspan="4">Ministry of Energy and Petroleum</td></tr>
<tr><td>Regulatory</td><td>Petroleum Commission</td><td>Energy Commission & Public Regulatory Commission</td><td colspan="2">National Petroleum Authority</td></tr>
<tr><td rowspan="3">Industry Players</td><td>International Oil Companies</td><td rowspan="3">Ghana National Gas Company</td><td colspan="2">Tema Oil Refinery</td></tr>
<tr><td rowspan="2">Ghana National Petroleum Corporation</td><td colspan="2">Bulk Oils Storage & Transportation</td></tr>
<tr><td>Bulk distribution companies</td><td>Oil Marketing companies</td></tr>
</table>

Source: GNPC 2016

2.4.1 Local content law and practice

Local Content Law and Practice was introduced in the initial stages of oil finds in Ghana to safe-guard employment for citizens of Ghana (Ackah & Mohammed, 2018). Azapagic (2004), cited in Ackah and Mohammed (2018), argues that historically there is a common trend in jobs being taken over by foreigners. Outsourced labour is likely to bring workers from different parts of the world to exploration sites on the excuse of the nonexistence of a locally available skilled workforce. Ose-Tutu (2013) identifies inadequate human resource capacity, due to a weak educational infrastructure, and inadequate technological know-how and infrastructure base as challenges to local content and participation.

Policy and legislative development on local content and participation became a priority for the country in 2010 when extraction of oil and gas began in commercial quantities. Urgent attention was given to employment and other petroleum activities in order to avoid the resource curse also known as the "paradox of plenty" (Osei-Tutu, 2013). As a result of corruption, conflict, appreciation of the exchange rate and foreign ownership resulting in poor development outcomes, countries with similar natural resources have fallen prey to the phenomenon (Osei-Tutu, 2013). The UNDP gave input into the local content process on how Ghana could circumvent this paradox (Osei-Tutu, 2013). In 2013, Legislation LI 2204 (Petroleum Local Content and Local Participation in Petroleum Activities) regulations were passed by the Parliament of Ghana (Ackah & Mohammed, 2018). As part of the fulfilment of this legislation, provision was specifically made for promotion of Ghanaian nationals for jobs and recruitment, training in the oil sector. The law stipulates the following milestones as documented by Ackah and Mohammed (2018, p. 9):

> At least 50 percent of the management staff of IOCs are Ghanaians from the start of petroleum activities.
>
> At least 80% within 5 years after the start of the petroleum activities;
>
> At least 30 percent of technical staff are Ghanaians from the start of petroleum activities of the licensee and the percentage shall increase to at least 80 percent within 5 years after the start of petroleum activities and 90 percent within 10 years; and other staff are 100% Ghanaians.

In terms of accountability with respect to this law, research was carried out in 2015 by Ackah & Mohammed (2018) detailing the following estimated employment statistics in the sector:

> Total number of employed in the upstream sector – 6,940 of which 5,590 (81%) were Ghanaians and 1,350 (19%) expatriates (Buah, 2016) In comparing the employment statistics with the local content targets, it was observed that the targets for management and staff were met. There was a huge gap in the area of technical staff, especially engineers and technicians. The Petroleum Commission has begun taking steps to bridge the gap by allocating 20% of the engineering design of Subsea Umbilicals, Risers& Flowlines (SURF) for the TEN oil field project to be executed by Ghanaians through GNPC (Ackah & Mohammed, 2018). Some of the IOCs are equally prioritizing Ghanaians in the execution of their projects, for example 25% of engineering man hours for the construction ENI's on-going gas processing plant at Sanzule is being executed by Ghanaians. According to the Petroleum Commission, the reason behind the huge salary disparities between Ghanaian employees and their foreign counterparts is that most of the Ghanaian staff lack the requisite technical skills needed for the industry; Ghanaians possess academic qualifications but lack technical skills and competencies to fill engineering and technical areas in the oil and gas industry (Ackah & Mohammed, 2018, p. 9).

The following questions need to be addressed: How many of these categories of employees were hired from the TVET institutions in Ghana directly or indirectly and how were they hired? Is there any collaboration between the TVET institutions and the oil and gas industry?

While the ILO (2012) argues the need to decrease reliance on expatriate workers, the difficulty of empowering local workers through policy persists. The Ministry of Energy and Petroleum Commission collaboration brought together artisans and academic institutions to solicit views on the Petroleum Commission's determination to establish Ghana Welding Bureau (GWB). The autonomous professional institution will empower Ghanaian artisans to take over the local content of the petroleum sector (Isaac, 2022). The institution will be essential in achieving the global competitiveness required for Ghanaian skills for certification and standards. The proposed institution is to be affiliated with the international welding body (Isaac, 2022).

The *COMPREHENSIVE EMPLOYMENT OF SKILLS FOR EAST AFRICA IN THE OIL AND GAS SECTOR (E4D/SOGA) PROGRAMME* was launched to addressing skills deficiencies in the local labour market in four East African countries (Uganda, Kenya, Tanzania and Mozambique) (Exarheas, 2016; Korina et al., 2019). The German Corporation for International Cooperation (GIZ) integrated approach model to employment promotion in the oil and gas sector involves integrating the supply and demand side of the labour market as well as using active labour market policies and instruments (Korina et al., 2019). The Skills for Oil and Gas Africa (SOGA) initiative is estimated to work with the private sector and government to deliver support for training to institution (Exarheas, 2016). Exarheas (2016) highlights jobs related to core technical occupations

in exploration and production oil and gas sub-sector. This initiative alone cannot equip graduates from training institutions to seize job opportunities in the oil and gas sector.

The oil and gas industry has many challenges in keeping up with technological advancement (Akyazi et al., 2020). The professional skills and competencies required by the oil and gas sector are in a continuous process of evaluation due to widespread digitalization Akyazi et al., (2020) argue that the oil and gas sector must improve the quality and relevance of its skills to meet the current and future requirements of industry 4.0. They further argued that to make these improvements, roadmap is needed to predict the skills in the mid-term.

There are international certification standards that oil and gas companies uphold. Canada has a unique welding certification system that involves third-party certification by CWB (cwbgroup, 2022). The certificate requires three essential elements of focus: the welding personnel, supervisory personnel and welding procedures to provide an additional level of confidence and assurance for weld quality and knowledge level of fabricators against the requirement of the standards (cwbgroup, 2022).

2.5 The oil and gas industry standard qualifications

Industries operating in a high-hazard environment must manage complex technical and social processes in a competitive economy (Griffin et al., 2014). Safety, management and organizational processes are essential to the oil and gas sector. Appropriate social and human capital to manage in an uncertain and interdependent context depends on the following factors: safety skills and expertise; processes and routine Human Resource Management Systems and Information Systems; safety culture and team processes (Griffin et al., 2014).

Ariweriokuma (2009) makes a case for the contribution of Africa's oil and gas resources to the global energy market and argues that:

> "Under the domain of exploration and production depends on the gamut of cutting-edge technology, all technologies used in the upstream sector are imported. This practice erodes the advantages created by oil in the continent" (Ariweriokuma, 2009, p. 17).

OPITO is a global not-for-profit skills body for the energy sector. The Global Qualification portfolio aims to support employers and learners, to develop skills and competencies within operations and maintenance activities across the energy sector (OPITO, 2022). The vocational qualifications enable the learner to acquire knowledge and skills in their place of work that meet recognized standards necessary to perform the role and are delivered through an OPITO-approved centre (OPITO, 2022). City & Guilds offer many international vocational qualifications in oil and gas. The Advanced Diploma in oil and gas maintenance provides the skills and understanding to work as a technical engineer in the oil and gas industry (City & Guilds, 2022).

2.6 Conclusion

Formal public Technical and Vocational Education and Training in Ghana provides only 10 per cent of the country's Technical and Vocational Education and Training. The majority of skills provision is through apprenticeships. Therefore, investigation of the formal TVET system is of interest to this study as a source of skills supply to industry and for understanding the problem of a perceived skills mismatch in the oil and gas sub-sectors. This investigation is interested in the formal TVET system because it represents a significant intersection between education, the youth

and the labour market and highlights the relationship between education and work. TVET institutions in Ghana are public and private at the pre-tertiary level, with the majority (90 per cent) being public and the remaining 10 per cent private. Post-secondary TVET is made up of 10 Technical Universities/Polytechnics, all public institutions constituting 10 per cent of tertiary institutions in general.

The chapter has demonstrated that the Technical and Vocational Education and Training sector is small, weak and has not been able to respond positively to major educational reforms over the years although reforms have recognized its role in economic development and industrialization. The ratio of enrolment in Senior High Schools and TVET institutions at the pre-tertiary level was 15:1 in the 2016/2017 academic year with total enrollment in pre-tertiary TVET institutions decreasing from 68,892 in 2006/2007 to 59,110 in the 2016/2017 academic year compared to an increase from 414,491 in 2006/2007 to 880,770 in 2016/2017 in Senior High Schools enrollments. Although several attempts have been made to reform education to provide technical skills for economic development, the results have had limited success to date.

Ghana's educational reform goals have primarily been influenced by globalization and the World Bank, driven by global competition. The reforms over the years considered TVET as an essential component of the educational system but have achieved little to improve it.

The oil and gas sector is crucial to Ghana's industrial development. Policy and legislative instruments to develop local content participation became a priority for the country in 2010 when oil and gas exploration and production began in commercial quantities. The policy aimed to avoid the common trend historically presented in different parts of the world, where foreigners take over

exploration sites on the excuse of the absence of a locally available skilled workforce. The oil and gas industry across the world applies global standards and qualifications in terms of knowledge and skills as the bases for employment. This contextual background is essential to this study as it foregrounds available employment opportunities and how TVET could prepare workers to take up these opportunities.

CHAPTER THREE

Literature Review

3.0 Introduction

One of the problems of the relationship between education and work has always been a possible "skills gap", "skills mismatch", or "education/labour market mismatch", leading to employers complaining of skills shortages. When graduates from learning and training institutions do not have the skills required by industry, they are not employable (Allais, 2015b). This chapter reviews literature which focusses on the relationship between education and work and how this relationship has been researched and conceptualized in order to address the research questions.

The notion of 'skill' is a highly contested one. The chapter provides an overview of skills in industrial relations and takes a position on the definition of *skill,* arguing that as much as skills and their modes of acquisition are essential to development, other economic factors must go hand-in-hand with skills provision to engender economic growth. The chapter further discusses how knowledge underpins skills, tasks, and work; and how employers emphasize the task process of work. The chapter further discusses the views of some researchers on thinking more broadly about occupations and occupational streams instead of focusing narrowly on skills development.

The chapter also discusses the problems of implementing Competency-Based Training, Occupational Standards, and Learning Outcomes across Africa. A skilled population is a key to economic development, primarily through industrialization. However, how these skills are acquired and the institutions through which they are acquired vary from country to country. Some researchers suggest that thinking broadly about occupations and occupational streams is more

beneficial than focusing narrowly on CBT. The Competency-based training concept is of interest because the changing world of work constantly challenges graduates from TVET colleges and affects employers' perception of skills needs and hiring decisions based on social, economic, and institutional factors.

The chapter provides an overview of key debates on and issues in the relationship between education and work. The chapter does this by exploring some of the complexities with respect to the transition from education into the labour market.

The chapter explores debates on the relationship between industrialization and skills, first, in the context of the Asian Model where the state has well-defined policy interventions and substantial investment in skills development plan (developmental model) and second, in the context of Ghana, highlighting how Ghana's manufacturing sector evolved and its contribution to industrialization. Human capital theory complements other relevant concepts like CBT. And so the chapter draws on the relationship between education and work literature and argues for a holistic approach to linking education and work: how occupation, work knowledge and skills, labour market, and qualifications are related. It also explores some of the complexities of the transition from education to the labour market.

3.1 The notion of skills and its definition in relation to education and work

The concept of 'skill' is a highly contested one (Allais, 2012). In "The Three Logics of Skills in French Literature", Mournier argues that current difficulties concerning education and VET policies arise from a very loose definition of skills (Mournier, 2001) which leaves unanswered several questions such as how to reach consensus on a definition of skills; which standpoints on

skills does a definition need to reconcile; what are the expected and tangible effects on labour mobility and, importantly for this study, is there a tension between occupation-specific and more generally portable skills. Workers are likely to define skills differently from employers. For workers, their skills result from the knowledge and experience they have acquired both before entering employment and during their careers. On the other hand, employers tend to define skills in terms of requirements of the job (Rigby & Sanchis, 2006).

3.2 Relationships between education and work

This section provides an overview of some of the key debates on and issues in the relationship between education and work. This section will argue for a holistic approach to thinking about linking education and work, that is, how occupation, work knowledge and skills, the labour market and qualifications are related. The section also explores some of the complexities with regard to the transition from education into the labour market.

3.2.1 Transitioning from education to the labour market

Studies on the transition from education to the world of work attempt to describe the relationship between an educational programme and its destination, mediated by a set of institutional arrangements that include qualification systems, curriculum content, labour market arrangements and information and advice systems (Allais & Nathan, 2014; Vally & Motala, 2014b). Simply put, transition systems describes features of educational arrangements which shape young people's education-work transitions (Raffe, 2008). A social approach to transition systems, as argued by Raffe (2008, p. 278), emphasizes "the holistic relationships among different social and economic institutions, including education and training, the labour market and industrial relations systems,

the production systems, family structures and cultures and so on". Raffe (2008) draws on other theories including labour market segmentation, social stratification and social reproduction, human capital, networks, signaling and inside-outsider theories to analyze transition systems.

Hannan, Raffe and Smyth (1996) cited in Raffe (2008), argue that transitional linkages between education and the labour market are a key dimension of transition systems. Iannelli and Raffe (2007) propose that in systems with strong linkages, vocational education follows "employment logic" and with systems with weak linkages follows "education logic". Raffe (2008, p. 285) argues that in countries with strong linkages employers and trade unions have a large role in the design, updating, delivery and assessment of vocational programmes, there is frequent contact and communication between education and labour market institutions, labour market signals and education are strong and clear.

Allais and Nathan (2014) support this argument and suggest that skills developed in vocational programmes reflects employers' demands and are more likely to allow for the development of recruitment networks for young people (Vally & Motala, 2014b). For the broader economic environment, stages of economic development, the strength of the economy, the exposure to the international economy and the size of the informal family economies are critical factors in analyzing transition systems (Raffe, 2008). Occupations and qualifications are key currencies in the labour market.

Occupations create a specialized division of labour. Definitions of occupation (Clarke, 2011, P. 103; Winch, 2010, p. 12) show the importance of education as a form of socialization into bodies of knowledge and into practical experience, in a highly regulated manner.

Two types of countries were identified by the OECD's 1999 interim report; "those with occupational organized labour markets and institutionalized "holistic" vocational educational education pathways providing the framework for very many young people's transition to work with safety nets for those who fall through the cracks; and those countries with relatively open labour markets that value generic employability attributes, rather than specific occupational qualifications" (OECD, 1999, p. 19). Organized occupational groups negotiate, usually mediated by the state, with other groups to establish the scope of their specialization (Allais et al., 2021).

Allais el al. (2021, p. 90) argue in line with labour market processes;

> How regulated the labour market is and the extent of the co-ordination between key social actors (government, unions and employers) in the labour market determines the functioning of qualifications as a symbolic rhetoric of competence or a substantive indicator of the nature of the occupational work involved in the field of practice.

The use of qualifications to access the labour market, their symbolic power, market value, and legitimacy vary with different types of labour market, and more specifically with the regulation of occupations (Allais et al., 2021). "On the African continent, often the occupations for which TVET prepares people are not regulated, or are less regulated than they are in Europe. This has implications for the ability of reforms of TVET systems to achieve their goals" (Allais et al., 2021, p. 86).

3.2.2 Human Capital Theory

Historians and economists commonly recognize and credit Adam Smith and Sir William Petty as the primary originators of human capital theory. According to this theory tangible and physical assets are the hallmarks of economic strength, including labour. Investment in capital equipment increases the value and profit of a business. Human capital theory was resurgent in the 1960s through the work of American economists Theodore Schultz (1902-1998) and Gary Becker (1930). In this period, they began to carefully map out the connections between education and its impact on the ability of the humans to earn higher wages. Schultz was credited with coining the term "human capital" and was the first to write about the connection between education and productivity (Becker, 1993). In his significant address to the American Economic Association in 1960, he told his audience, "investment in education was the key to productivity and economic growth" (P. Brown et al., 2020, p. 1)

In modern human capital theory, human behaviour is based on the economic self-interests of individuals operating within freely competitive markets and education increases worker productivity (Becker, 1993). The value of the state in developing a legal framework to protect the individual is key to this philosophical position. Though human capital theory explains the relationship between education and work, it is not the only theory underpinning this study. Rather, it is used to complement CBT and other theories and concepts.

Schultz (1961) argues that education is an investment in future income and that economic costs and returns are the driving force in shaping why and how people approach learning. Schooling-acquired skills are typically seen as 'general' and transferable across employers whereas 'specific'

skills are acquired in the workplace. Employers act rationally by selecting on the basis of educational credentials and similarly job seekers act rationally by investing in their own human capital (Becker, 1993; B. Bills, 2003). Tan (2014, p. 415), a proponent of human capital theory argues that "Rational choice theory suggests that individuals seek to maximize their own interest by making optimal decisions in the entire domains of their lives" To the economist, it is measurable, quantifiable and convenient to track from a study point of view the individual rather than society. Tan further argues that the rationale …

> .. is to form a framework that enables simplifying the natural world's complexity and creating an artificial world to compensate for the absence of laboratory experiments to apply the theory to the real world. In this way, it becomes easy to find a representative agent through which human behaviours in the market can be evaluated and predicted (Tan, 2014, p. 417).

Rational choice theory provides a model which is easy to critique but difficult to replace (Tan, 2014). It is however, challenged by labour market screening theory, where employers screen and job seekers signal their productive capacities. To Stiglitz (1975), cited in Bills (2003, p. 445), "Screening is a mechanism by which markets react to imperfect information about the qualities of individuals". Though not backed by empirical evidence, Bills (2003) believes that schooling is exclusively a signal, adding no productive capacity to those who acquire it. Weiss (1995) combines signaling and screening into "sorting" workers according to their unobserved abilities, which human capital did not attempt to define or operationalize. For Weiss, the sorting model is an extension of the human capital theory that seeks to provide additional information to employers

and he concludes that the difference between the signaling and screening models is that firms move first in the signaling model. By contrast, students or job seekers move first in the screening model.

With reference to signaling theory, Tan (2014) and Weiss (1995) show that education may increase an employee's wage without necessarily increasing his or her productivity. They consider that the education level is simply taken as proof of an employee's capabilities due to imperfect information in the labour market. Second, Tan (2014) argues that signaling theory has more explanatory power than human capital theory and shows that titles and degrees are sometimes more highly valued than their actual value in the labour market.

As argued by proponents of human capital theory, the rate of return in the labour market is directly proportional to the investment in human capital. Wolfs (2002) argues in support of this statement and adds that a higher wage might reflect education's contribution to growth and productivity, which justifies government spending on education. By contrast, Carnoy (2019) argues that demand for and supply of education lead to a self-motivated rate of return. Wages were driven down as more people obtained primary education, leading to more investment in secondary education as the economy created more jobs for secondary school leavers. However, as time went on, wages that were forgone when more time was spent in secondary education, also went down, leading to demand for higher levels of education. Once everyone has a secondary education, the return rate for secondary education begins to fall, so people demand tertiary education. However, the rate of return on tertiary education (wage) declines once the supply of potential employees with higher education increases. Policymakers have to figure out what is best as the labour market and the economy changes.

From his analysis of the rate of returns in the contexts of Mexico and Kenya, Carnoy realized that apart from the claim of individual rational "choice" in human capital theory, the state was a significant factor in influencing the rate of returns on investment in education. The state does that by controlling the educational system in its entirety to the advantage of the middle class (Carnoy, 2019). Carnoy argues that it cannot be said that individual students and their families have absolute control over the "rational" choices they make. Although a correlation between education and lifelong earnings exists, this does not prove that a person's level of education determines their level of earnings (Carnoy, 2019). The individual's socialization and cultural disposition are not sufficiently taken into account in human capital theory.

Many studies (Brown et al., 2008; Brown & Lauder, 2006; McCowan & Unterhalter, 2015; Tan, 2014) have pointed to severe conceptual deficiencies in the notion of human capital, as well as severe difficulties in actually measuring the “capital” through education and the rates of return obtained from it. For example, Bowles & Gintis (1975) object to the treatment of labour as a commodity to be bought and sold and argue that what is bought in labour is labour-power. They are equally not convinced that market forces should determine the issue of the relationship between education and income and are firmly convinced that human capital theory perpetuates a class system in society. Social reproduction is not considered by human capital theory but shapes education and the labour market. In their words, excellence seems to be imposed by the elite leading to the reproduction of a class society (Bowles & Gintis, 1975).

Collins (2007), drawing from Durkheim and Weber, set out to test the validity of two hypotheses from the perspective of technical-function theory and later conflict theory.

1. *a*) The educational requirement for jobs in industrial society increases because the proportion of jobs requiring low skills decreases and the proportion requiring high skills increases.

   b) The educational requirement of jobs in industrial society rises because the same jobs are upgraded in skills requirements

2. Formal education provides required job skills;

   a. Are better educated employees more productive than less educated employees?

   b. Are vocational skills learned in schools or elsewhere? (Collins, 2007, p. 1005)

Collins (2007) explains that technical-function theory is a subset of the functional theory of stratification, which seems to agree with the human capital theory on the premise that persons occupy occupational positions with the ability to perform in those occupational roles. He is critical of technical-function theory arguing:

> Then, the technical function theory of education does not give an adequate account of the evidence. Economic evidence indicates no clear contribution of education to economic development beyond the provisions of mass literacy. Shifts in the proportions of more skilled and less skilled jobs do not account for the observed increase in education of the American labour force. Education is often irrelevant to on-the-job productivity and sometimes counter-productive; specifically, vocational training seems to be derived more from work experience than formal school training. The quality of schools themselves and the nature of

> dominant student cultures suggest that schooling is very inefficient as a means of training for work skills (Collins, 2007, p. 1007).

Contrary to technical-function theory, conflict theory argues that standards of work performance in a job reflect power dynamics within different groups, and groups tend to protect their group members and keep non-members out. This position is contrary to the human capital theory's tenet that the rate of return in investing in human capital is directly proportional to the rate of return in the labour market.

Cultural capital is an accumulation of knowledge, behaviour, and skills at the individual's disposal to demonstrate his or her competence. This theory has been valuable in explaining how stratification occurs within an educational system and, to some degree, as an explanation for unequal life chances of schooled people (Bills, 2003). Bills argues that the best jobs are held disproportionately by the most highly schooled in any contemporary society. Bourdieu (1996) warned that the technocrats and governments who head today's capitalist firms and government offices have at their disposal a range of influences and designations – of forecast, education and ancestry. The theory holds that it is not the sole preserve of schooling to enhance productive capacity in the sense of those cognitive or technical skills technically associated with job performance. One of the explanatory weaknesses of cultural capital theory is that employers cannot rely solely on cultural capital when hiring for specialized technical positions or applicants for lower-status jobs (Carnoy, 2019).

Bills (2003) argue that the human capital theory specifies that at any given level of skill supply among job seekers, the hiring principles used by employers are consequential from processes of

technological change, workplace organization and enhanced managerial efficiencies (D. Bills, 2003). In contrast, credentials theories attribute employer preferences and practices to credential inflation in the educational system (D. Bills, 2003). This theory also holds that the highly educated can control access to elite positions in the labour market not because of superior skills or knowledge and that the ratio between education and productivity is smaller than between education and rewards Boylan 1993 cited in (D. Bills, 2003). "Credentialists hold that education operates by conferring status rather than skills, which groups and individuals use in competing for income and other rewards" (D. Bills, 2003, p. 454). The central question threaded through human capital, screening, signaling, control, cultural capital, institutional and credentialist theories is how employers and job seekers acquire and use labour market information.

The Ghanaian economic context is characterized by high informality, a weak manufacturing and industrial base and a complex labour market and presents a unique challenge for which none of these theories may be adequate for understanding the relationship between the knowledge and skills supplied by TVET providers and the knowledge and skills demanded by the exploration and production oil and gas companies in Ghana.

There are differences in how different academic fields see the world of work. While a sociologist is preoccupied with jobs and occupations, labour economists see things through the lens of productivity and wages. Keep & Mayhew (2014) investigated how skills, the economy and the labour market interact using an interpretive model in addressing inequality of earnings and income. They also critiqued the beliefs of policy makers that improving educational attainments of students from lower socio-economic backgrounds can enable them to compete more effectively for elite

jobs. And also increasing the supply of educated employees can transform the level of demand for skills by employers. In their view skill supply does not always create its own demand. But they are quick to add that the nature of the labour market and its interactions with education and training are not straightforward (Keep & Mayhew, 2014).

From this literature, the key points for my study are employer perceptions of skills needs and employer hiring decisions on the one hand and the perceptions of policy-makers and providers of education and training on the other, all within specific social, political, institutional and economic contexts that affect the relationship between education and work. The main points from the above, which I aim to explore, are theories and concepts that explain the relationship between education and work within the setting of my study. The objective is to understand the structural and institutional constraints behind demand and supply in Ghana's oil and gas industry's upstream (exploration and production) sub-sector.

3.2.3 What research says about why it is difficult to find a close fit between education and work

According to Young et al. (2006), reform of vocational education in the South African context has neglected the question of vocational knowledge. Highlighted in Young et al (2006), drawing from Bernstein's analysis highlighting the weakness in attempts to base vocational knowledge on national occupational standards by treating all knowledge as potentially explicit and vertical, the standards-based approach fails to recognize the fundamental differences between theoretical and work place knowledge (Young et al., 2006).

The argument has been that a vocational curriculum needs to include both conceptual knowledge and practical knowledge bearing in mind that the vocational route faces in two directions – further study and employability. This relationship is a complex one because each refers to a different kind of knowledge (Young et al., 2006).

Reformers of educational systems have recognized that skills and knowledge needed in the new science-based sectors such as engineering, chemical and the new electrical industries cannot be developed on the basis of traditional work-based apprenticeship (Young et al., 2006). Tension between changes in learning demanded by employers and the relative lack of change in the college-based curriculum each appear to be based on different forms of specialization. The standards-based approach to a vocational curriculum, on which the National Vocational Qualifications are based, aimed to solve the problem of 'academic posture' of all institutions including those with a focus on vocational education (Young et al., 2006) by recognizing that in many cases employees needed knowledge and skills that could not necessarily be acquired in work places. However, narrowly focused vocational programmes that rely on the standard-based approach deny learners access to the rules governing the production of knowledge by the scientific and professional communities (Young et al., 2006).

The relationship between education and work is a contested one because it involves consideration of the holistic relationship among different social and economic institutions, including education and training, the labour market and industrial relations systems, the production systems, family structures and cultures (Raffe, 2008). As noted by Allais et al., (2021, p. 80) :

> Education and work are two different social spheres. Education and work are organized differently. Knowledge is used in both but in different modes. The knowledge produced in education is radically different from the specific and discrete forms of everyday working knowledge.

This complexity makes decision-making by education and training authorities in vocational and higher education in preparing students for the world of work very challenging in part because the relationship between competent practice on the one hand and knowledge, skills, and abilities on the other, sometimes characterized as the relationship between "theory" and "practice", is complex (Allais et al., 2021). These complexities could explain why competency-based training reforms and occupational standards do not always achieve their objectives.

The objective of formal technical and vocational education and training is to prepare students for the world of work through competency-based and occupational standards with the longer term goal of increased productivity and development of the country. Strong linkages between vocational education and industry are what Iannelli & Raffe (2007) call "employment logic", while "education logic" is associated with weak linkages. Skills developed in vocational programmes reflect employers' demand and are more likely to allow for the development of recruitment networks for young people (Vally & Motala, 2014b). For the broader economic environment, stages of economic development, the economy's strength, the exposure to the international economy and the size of the informal family economies are critical factors in analyzing transitions between education and work (Raffe, 2008). However, there is an are unresolved strain between parties in designing qualifications that certify competence (Winch, 2021). This strain has led to

policymakers' recommendation of a qualification that will equip young people for both the present and the future. On the other hand, employers are more concerned about a qualification that will signal the ability to operate in the workplace at present and less about education that is future-directed (Winch, 2021).

Being competent requires the right combination of skills, knowledge, and experience, and "the ability to undertake responsibilities, and to perform activities to a recognized standard (Pegram et al., 2018). Brown et al., (2020) argue that the value placed on education, training and work experience depends on the demand and supply of skills. However, and most importantly, understanding the future of work impacts human capital.

This literature review is particularly important for the study because it foregrounds the complexities in decision-making in vocational qualification discourses, the relationship between education and work, supply and demand of skills and the future of work and will be used to inform the data chapters of this study.

3.3 Industrialization and Skills development in Ghana and elsewhere

The issue of skills is important because it is seen as key for industrial development, and industrial development is crucial to development in general. This section explores debates on the relationship between industrialization and skills, first, in the context of the Asian Model and second, in the context of Ghana, highlighting how Ghana's manufacturing sector evolved and its contribution to the industrialization agenda. I argue that as much as skills and their mode of acquisition are important to development, other economic factors like political orientation and industrial policy must go hand-in-hand with education policy to effectively engender economic growth.

A World Bank Report (1993) titled "The East Asian Miracle: Growth and Public Policy" argued that the economic success of Asia was due to the ability of various governments to get the basics right as a result of their market friendly-approach and their investment in skills development. According to World Bank report, government investment in primary and secondary education yielded higher social returns than private returns at those levels. It is this investment that had substantial effect on economic growth (Ashton et al., 2002a).

At the time of the World Bank report many employers in Asia required unskilled labour for relatively labour intensive industries, but this situation subsequently changed substantially, as production moved to value-added goods and services in these economies. Employers came to require workers with high levels of general education and skills in team-working and problem solving in addition to technical skills (Sung & Raddon, 2017).

Unlike Japan which had strong technological capabilities and a well-developed educational system in the 1950s, the majority of people in Singapore, Taiwan and South Korea had low levels of education and very low levels of technological capabilities (Ashton et al., 2002b). The "Tiger" societies had no alternative other than to adopt the Japanese type of industrial policies without necessarily reinventing the wheel and had to devise ways of upgrading the skills of the labour force in targeted industries to avoid skill shortages. This led to innovative ways of managing skill formation at the national level leading to a developmental characterized by centralized control over the education system, a well-designed trade and industry policy and an innovative mechanism devised to ensure that education and training system output was aligned to the skills requirement of new industries (Ashton et al., 2002b).

In order to keep supply and demand of skills at near equilibrium, both South Korea and Taiwan provided skills through vocational education in the early 1960s which was progressively expanded while the state restricted access to tertiary education. As industry moved into higher value-added forms of production and therefore to increased demand for academically oriented, intellectual and problem solving skills, these states began to reduce vocational education and to expand higher education. During the same period, Singapore with a much smaller population than South Korea and with a greater range of industries, incorporated both general and vocational education into its educational structure with a series of reforms under strong state control (Ashton et al., 2002b).

While South Korea adopted an import substitution economic policy through its developmental trajectory, Singapore adopted an open door policy in dealing with multi-national corporations:

> This may make you conclude that Singapore's economic success proves that free trade and free market are the best for economic development until you also learn that almost all the land in Singapore is owned by the government. 85 percent of housing is supplied by the government-owned housing agency (The Housing Development Board) and 22 percent of national output is produced by state-owned enterprises (the international average is about 10 percent). All these go to show that there is no single type of economic theory that can explain the success of this combination of free market and socialism (Chang, 2014, p. 49).

Rodrik (2015) argues that 'our modern world is in many ways the product of industrialization'. Literature suggests that the manufacturing sector is the factor of industry that presents the greatest opportunities for continued growth, employment and reduction of poverty in Africa (United

Nations, 2011). The contribution of manufacturing to development can be viewed in three ways: it has forward and backward linkages affecting positively domestic investment, employment and output in the development process. It further has very strong linkage and spill-over effect (Rodrik, 2015; United Nations, 2011). The United Nations Department of Economics and Social Affairs (DESA) defines manufacturing as:

> the physical or chemical transformation of materials, substances or components into new products. The material, substances or components transformed are new materials that are products of agriculture, forestry fishing, mining or quarrying or products of other manufacturing activities. The substantial alteration, renovation or reconstruction of goods is generally considered to be manufacturing (United Nations, 2011, p. 5).

How then has Ghana's manufacturing sector evolved as a contributor to its industrialization agenda? The historical industrialization trajectory of Ghana can be segmented into three: the import-substitution regime between 1965 and 1983; the outwards liberalized industrialization strategy between 1984 and 2000; and private sector-led value-added processing for industrial development strategy from 2001 to date (Ackah C et al., 2016). From 1965 to 1983 the government pursued "development economics in progress", the dominant development economic theory at the time, with massive and extensive industrialization and modernization through import substitution in order to reduce the over-dependence on foreign goods (Seers, 1983).

The implementation of the Import Substitution Strategy involved "substantial government support as well as protection of domestic firms from foreign competition" (UNCTAD & UNIDO, 2011, p.

10). At the time the United Nations (2011) argued that African leaders were politically convinced that industrialization would hasten and transform Africa, create employment and increase incomes thereby alleviating poverty. The focal point of the strategy was to develop large scale capital intensive state owned manufacturing industries. Heavy investment was made to upgrade infrastructure and to provide such infrastructure where there was none, administration controls in the form of import tariffs were implemented and licensing was Introduced.

According to Ayeetey and Kanbur (2017), direct control of the activities of industry created excess capacity and inadequate linkages with other growth enhancing sectors, coupled, with external shocks. As a result, the overall aim of the policy was defeated. Another challenge according to United Nations (2011) is that African countries, including Ghana. lacked the technical, human capital needed to enhance industrialization.

There was a need to introduce appropriate domestic policies during the period from the mid-1970s to 1983 as the industrial sector of the economy as a whole suffered a severe worsening economic and financial downturn. Ayeetey & Kambur (2017) note that there was a decline in Ghana's export earnings, a decline in capital flows, financial aid and a lack of credit worthiness and therefore there was the need to change the strategy and to introduce a Structural Adjustment Programme (SAP).

The Structural Adjustment Programme phase can be sketched back to the early 1980s when the International Monitory Fund (IMF) and the World Bank, based on the findings of the Berg Report on the "*Accelerated Development in Sub-Saharan Africa: Agenda for Action",* published reports. (UNCTAD & UNIDO, 2011). These reports further argued that the poor performance of African economies was as a result of the import substitution regime policies and state direct control of the

market. The objective of the SAP was to allow “the invincible hand” to control market forces and to limit state intervention (Allais, 2020).

Killick (2010) noted that the liberal governments of Ghana at the time (The NLC and the Kuffour-led governments) also pursued/continued with some of Kwame Nkrumah's state interventionist policies but yet sought to draw a clear distinction between the two describing Kwame Nkrumah as a socialist, nationalist and Busia and Kuffour as liberals (Ayelazuno, 2012).

The International Monetary Fund (IMF) prescription for struggling developing economies at the time was to restructure the economy at almost all levels. A set of economic reforms was introduced to cure the shortcomings: a market-determined exchange rate with minimal interventions was introduced; price and exchange rate controls were removed; financial sector and interest rates were liberalized; import licensing systems were abolished; import tariffs and the taxation system were rationalized; a new investment code (PNDC Law, 1993) was promulgated; Ghana Investment Centre (GIC) was established and SOEs were privatized (Ackah C et al., 2016). There was a positive impact of this policy initially but later challenges resulted in sluggish growth and an assessment was therefore made to evaluate the SAP and to address the challenges.

Owoo and Page (2017) report that based on an evaluation of the SAP, a private-sector-led industrial production strategy in which science and technology would be central was introduced to stabilize the economy and to lay the foundation for sustainable, accelerated agro-industrial growth and job creation. The agro-industrial sector saw the implementation of new policy and strategies to accelerate the needed growth, development of commercially viable export and domestic market-oriented enterprises in the rural areas, improved agricultural marketing and enhanced access to

export markets among others (Newman, 2016). Some literature showed that the economy responded positively initially. But later challenges resulting from high cost of credit, unreliable power supply and rising fuel prices made domestic industries cut back on production with accompanying job losses (Ayeetey & Kambur, 2017). The struggles of Ghana's industrialization trajectories through various policy interventions over these years was not different to patterns of industrial development in Africa and the world in general.

Neoclassical economics views capital as the most important ingredient for growth (Reinert, 2006). Reinert argues that poor nations are unable to absorb such capital profitably due to the nature of their productive /industrial structures, and as a result interest payment on loans contracted often exceeds the rate of returns on investments made. Reinert (2006) further argues that investment in human capital made without matching the changes in the productive structure to produce demand for the skills acquired, will tend to encourage emigration. Thus in his view, poor countries are trapped in a vicious cycle with a lack of equivalence between supply and demand and an absence of increasing returns. Structural changes in the economy from low to high productive activities historically describe what has come to be known as economic development. It is the reason why sustained growth and provision of employment has been seen to be largely propelled by the manufacturing sector (Alexzander, 1967; Reinert, 2006; Rodrik, 2015; UNCTAD & UNIDO, 2011).

In many parts of the world, TVET systems were developed to meet the skills needs of industry in the development process. Allais (2020) argues that in sub-Saharan Africa the process, space and level of industrialization has contributed to undermining the formal TVET systems. She argues

that other undermining factors outside the formal TVET system are lack of economic development and the maintenance of labour markets as well as poor mass provision of education (Allais, 2020). The greatest returns for development have emanated from industrialization and this, most African countries began to promote in the early 1960s (Reinert, 2006). Even in more recent years. Reinert (2006) argues, African countries have demonstrated their renewed commitment to industrialization as evident in the "New Partnership for Africa's Development (NEPAD)" adopted by African leaders in 2001. All these fit into a broader agenda to diversify African economies, build resilience to shocks, and develop productive capacity for high and sustained economic growth, the creation of employment opportunities and substantial poverty reduction (United Nations Conference on Trade and Development & United Nations Industrial Development Organization, 2011).

For Amin 1972, Anievas and Nisancoglu 2015, cited in Allais (2020) Sub-Saharan African societies were prevented historically from industrializing due to decades of slave trade at the inception of capitalism. They further argue that emerging local industries which were focused on resource extraction and educational systems to serve these arrangements were destroyed by colonization. The term de-industrialization was used to refer to the experience mainly of advanced economies (early industrializers) whose manufacturing output share and income is on the decline (Rodrik, 2015). Rodrik uses the term "Premature deindustrialization" to describe

> countries whose manufacturing began to shrink (or is on course for shrinking) at levels of income that are a fraction of those at which the advanced economies started to de-industrialize. These developing countries are turning into service

> economies without having gone through proper experience of industrialization (Rodrik, 2015, p. 3)

Premature de-industrialization has potentially significant economic and political ramifications for economic growth and democratic failure (Rodrik, 2015). Premature deindustrialization is a factor in economic retardation for a developing country like Ghana as it has blocked off the main avenue of rapid economic convergence in low-income settings and therefore supply of skills.

Two theories with dramatically opposed perspectives have emerged in research and debates on Africa's development: the "internalists" approach which blames the development crises of Africa on "bad policies" and "poor governance" and the "internationalist" approach which blames the problems on international factors, particularly the global capitalist economy (Ayelazuno, 2012). Over the past 50 years, industrialization has declined as a result of "bad policies" and "poor governance" and international factors, particularly the global capitalist economy (Ayelazuno, 2012). In Ghana, the oil and gas industry is a recent add-on from 2010 to boost and reverse the downward trend of the performance of industry.

Challenges faced by Ghana's industrial development regimes point to employment instability, erratic job creation within the industrial sector, increased informality of jobs within the labour market and worsening employment conditions in the labour market (K. N. Otoo, 2019). According to the 2018 budget statement of Ghana, the structure of the economy is unchanged from recent years with a continued dominance of the service sector. In 2017, the share of the service sector in overall output in terms of growth was estimated at 55.9 percent while that of agriculture was estimated at 18.5 percent. The 25.6 percent industrial output was comprised of Mining and

Quarrying, Petroleum, Manufacturing, Electricity, Water and Sewage and Construction. Industry was estimated to grow at 17.7 percent with Petroleum contributing 69.2 percent of the growth, Manufacturing 3.1 percent, Mining and Quarrying 52.3 percent, Water and Sewage 2.1 percent, Electricity 6.7 percent (Government of Ghana, 2018). The weak performance of the industrial sector of the economy has negative implications for employment and for linkages between education and industry.

3.4 Knowledge, Learning Outcomes and Occupational Capacity

There is no simple relationship between credentials on the one hand, and knowledge and skills on the other. Employers without realizing that the skills, tasks and work are underpinned by knowledge, place emphasis on the tasks and processes of work: Policy makers seek ways to make providers of skills accountable, and providers want to know what they need to cover to meet good standards. This portrayal of interests may sound simplistic but it captures complex terrain in which different role-players are searching for common ground. The idea which emerged in the 1980s was that competence-based qualifications and curricula will create this common language (Allais et al., 2021, p. 80).

The belief that knowledge-based curricula do not prepare students well for the world of work, motivated the design of qualifications and curriculum in competence terms, specifying knowledge and skills was thought to be the best way of making the education field more explicit and transparent. Allais et al. (2021) argue that the anticipated outcome of this noble idea was not the case. What is considered as theoretical knowledge consists of broad classifications formed by one or more types of disciplinary knowledge, is context-dependent, and is concerned with general

applicability. Yet, work in practice require situational knowledge, complex as it may be (Allais et al., 2021).

Designing curriculum according to knowledge, skills and competence is problematic for the following reasons:

- The problem with the assumption, seen frequently in educational reforms, that a holistic judgement of competence can be reached from collections of specific observations.
- The problem of a competence or skills-based curriculum is that knowledge is selected on the basis of the skills it underpins and not the conceptual logic of the body of knowledge.
- If we say that we assess on the basis of what is observed but we in fact make judgement on bases that are not available to the person performing (as deliberation and principled judgement are not observable), the mode of curriculum and assessment will lead to what Bernstein calls 'invisible pedagogy' (Sadovnik, 1995).

Occupations have access to different kinds of 'know-how' which skilled workers encounter in their working lives. They may resort to task-skills to solve problems and exercise specific techniques but the process of selection, collection, and organisation of the task-skills, requires professional judgement based on diagnosis (Allais et al., 2021). Professional judgement is a central facet of 'know-how'. In exhibiting professional capacity, the goal of education and training providers among others in preparing people for work is to provide them with a kind of formal and practical education that will prepare, socialize them into making decisions, professing opinions

and judgements, overseeing their own work, in ways that could be justified by reference to a chain of reasoning that goes beyond the specific context (Allais et al., 2021).

It is increasingly accepted that improvement in productivity, competitiveness and social well-being depends not only on boosting skill supply but also ensuring that skills are utilized effectively inside the workplace (Payne, 2011). In broad terms, skills utilization points to the need for policies around productivity, economic development, work organization, employment relations and skills to pull together as part of a balanced and a coherent strategy for sustainable development (Payne, 2011). As affirmed by the Scottish Government:

> … making more effective use of skills is of fundamental importance in leading Scotland back to a higher level of productivity and sustainable growth. This encompasses many elements including how well learning is transferred to the workplace setting, job design, organizational ambition and workplace organization (Payne 2011 p 3).

Bozick, Gonzalez, Ogletree & Carew (2017) documented the knowledge and skills required by employers in the oil and gas industry in Ohio, Pennsylvania and West Virginia; assessed the extent to which colleges were positioned to provide employers with workers who have the appropriate knowledge and skills for high priority occupations; and identified collaborative strategies and practices. Core findings of their work include the following:

- Nearly a quarter of employees reported their companies had high-priority occupations that require long-term on-the-job training.

- More than half of employers have high-priority occupations that require at least 5 years of previous experience.
- Employers seek workers with cross-cutting knowledge areas and skills.
- Though employers desire basic-cross cutting employability skills such as time management, speaking and writing, most colleges in the region do not explicitly incorporate these into their oil and gas degree programmes.
- Though most colleges in the region report supporting students to get jobs in specific occupations within the industry, a few have stackable credential problems.
- Less than half of the courses aimed at future workers in the oil and gas industry use contextualized instruction.
- The majority of employers do not communicate results of workplace planning with colleges.
- Few employers provide deep or continual instructional curriculum support to colleges.
- Most employers (55%) do not provide any material or fiscal support to colleges for workplace development.

These findings are important as they relate to the core interest of the current study.

Gamble (2016) investigated how artisans and technicians become work ready, what levels of technical competence and communication competence will be required of employees, the kind of diagnostic and problem solving knowledge and skills workforces in the future will require of artisans and technicians. Her study took the changing nature of work as its central theme and sought to contribute to labour market intelligence by putting forward an evidence-based argument for how artisans and technicians of the future should be prepared for work. This section argues for

educational arrangements and holistic relationships among different social, economic, education and training actors and institutions for a smooth transition from education to the labour market. Strong and weak linkages between education and the labour market - categorized as "employment logic" and "education logic" - relate to a vocational pathway and to general education respectively. The section further argues, for an effective use of skills in relation to policies, economic development, work organization and employment relations. Making effective use of skills is as important as boosting skill supply and can lead to much higher productivity. I further argue for how the changing nature of work demands from would-be workers' problem solving knowledge and skills.

3.5 Occupations and Occupational Streams

Some researchers suggest that thinking more broadly about occupations and occupational streams is more beneficial than focusing narrowly on skills development (Wheelahan, 2010). They argue that the solution to the current divide between generalist qualifications as constituted in secondary and higher education qualifications on the one hand and job-specific competencies in TVET on the other is an intermediate position of focusing on 'vocations' and 'vocational streams' to shape the evolution of qualifications and skills in the future. Wheelahan and Buchanan (2015) argue that the labour market profoundly structures individuals' educational trajectories, including the transition from TVET in schools. Technical and vocational education and training qualifications based on competency-based training, which directly link qualifications to jobs, are too simplistic and narrow-focused and may aggravate skill mismatches.

Wheelahan and Buchanan (2015) describe vocations and vocational streams as follows:

> A vocation is a domain of practice performed by humans as economically productive beings. It encompasses the knowledge, skills and attributes they are required to use at work. A vocation emerges from fields of practice that share commonalities in knowledge and skills … Vocational streams refer to the structure of occupations and the way they are linked horizontally in related occupation at the same level and vertically in specialist or more senior occupations. They consist of linked occupations that share common practice, knowledge and skills and attributes that allow individuals to specialize within a broad field of practice or move laterally into related occupations. Qualifications that prepare people for the labour market using vocations and vocational streams prepare individuals for broad rather than narrow fields of practice (Wheelahan & Buchanan, 2015, p. 7).

Wheelahan and Buchanan (2015) argue that vocational streams can be used as a framework in the labour market to sketch the demand for qualifications and skills, and labour by encouraging the social partners (employers, unions, professional and occupational bodies and government) to collaborate to shape occupational pathways, build links between occupations and articulate demand for occupations (Wheelahan & Buchanan, 2015).

Keep & James (2012) raise a problem with England's current vocational qualification system under the competency-based model. They identify two interrelated policy issues: learning packages for students that are shallow and narrow; significant structural problems with the labour market that make it difficult for many vocational qualifications to generate any significant wage

premium or to support job progression. Young & Gamble (2006) believe that for the vocational route to succeed, the public must have faith in how knowledge will feature in conjunction with practical work experience to give vocational education a distinctive character. Furthermore, the ever-changing labour market dynamics call for new thinking and approaches within specific contexts.

The main point in this section is the need for an approach to vocational education and training and to employment that resolves the limitations of CBT by working with the concept of vocational streams at TVET institutions and the concept of occupational pathways in industrial and other occupational fields.

3.6 Competency-Based Training and Learning Outcomes

The modern-day movement of competency-based education and training began in the United States (Ford, 2014). The evolution of the model can be traced back to Australia's competency-based vocational model. The models that emerged in the 1980s and the 1990s represent the fifth generation of the competency-based training model (M. Brown et al., 1994).

Competency-based training has recently gained mainstream attention as a practical approach to resolving perceived gaps in vocational education and training. However, some of the problems with CBT are (i) employers do not always participate effectively; (ii) employers disagree on standards; (iii) employers do not always know what their skills needs are; (iv) Employers tend to list generic skills; (v) training providers find it difficult to design training programmes from occupational standards (Brockmann, Clarke, & Winch, 2011; Keep, 2015; Keep & James, 2012; Martin, 2017; Wolf, 2002).

It has been argued that competency-based training is problematic because it downplays the importance of generalized forms of knowledge that underpin it (Wheelahan, 2010). The Competence-Based Training (CBT) TVET system in Australia, for example, defines competency as:

> the application of specific knowledge, skills and attitudes needed to undertake a work role or task to the required standard in the workplace where learning outcomes are described as a demonstration of these (Wheelahan 2010 p. 127).

Wheelahan argues that CBT was introduced to increase private and public investment in training and to develop formal training for occupational areas where there were no existing qualifications but did not work well because, as defined by employers, the competency-based standards turned out to be people's highest point of performance. The low requirement and restrictive nature of vocational qualifications also led to employees not having the skills, knowledge and motivation to engage in further professional development. The definition of and terms used to qualify 'occupations' differ in different countries (e.g. England, France, Germany and the Netherlands). According to Brockmann et al (2011), in the English trades-based system, employer trade associations and trade unions were more fragmented and less well represented than was the case for their European counterparts when qualifications were being defined (Brockmann et al., 2011).

Occupational standards are, in theory, benchmarks for the standards required in specific areas of work to ensure that skills are developed to meet the needs of the industry (Allais, 2017). Allais et al., (2014) argue that in European countries such as Germany and Switzerland, occupational standards are associated with the vital provision of TVET and apprenticeships with a collective

understanding of competence among the stakeholders, guided by legal frameworks. The development of this collective understanding enables the building of bridges between employers and education providers. Classifying occupations depends on various factors, including perspectives and interests, power relations, technical knowledge, and division of labour within and across occupations (Shalem & Allais, 2018).

Young et al. (2006) argue that vocational programmes that rely on a standards-based method repudiate learners admission to the rules governing the production of knowledge by the scientific and professional communities. What body of knowledge is expected to be acquired by students in vocational training? One answer lies in the capabilities approach first developed by the Nobel Laureate in Economics Amartya Sen (2000) and philosopher Martha Nussbaum (2000) who argue that,

> A person's capability is their ability to do what they have reason to value, which is a combination of the opportunities that are available to them and the choices they make in pursuing those opportunities (Education International 2016: p 11).

Fuller (2019) argues that policymakers should consider reforming vocational education and apprenticeships to make these more appealing to both individuals and employers by constructing alternative routes to suitable quality employment and social mobility. This is in response to the inability of the labour market to absorb well-qualified graduates. Fuller (2019) further argues that it is crucial to examine the meaning of occupation and the strength and nature of the relationship between education, training and occupation.

In highlighting the opposing set of mutually reinforcing factors in investment in Training and Education and the pay-offs that accrue to learning, James and Keep (2012) argue that it is not enough just to reform the UK's National Vocational Qualification because the weak foundation of the qualification "perfected" over a century needs to critically examined. Power discriminations and inequalities in the labour market need to be addressed, particularly for women and the less educated who are limited to "bad jobs".

An IIPE-UNESCO Report (2020) on a case study of seven African countries, including Ghana, on a competency-based approach to technical and vocational education and training. notes that introducing the competency-based training approach in Ghana occurred in 2000 when the country was experiencing solid economic development and facing significant training requirements. The report further indicates that CBT programmes only involve a small percentage of TVET institutions, five training programmes, and mostly the first two levels of certification (Proficiency Level 1 and Level 2). CBT was introduced in the Higher Training Institutions (Polytechnics, most of which have become Technical Universities) in Ghana to provide graduates with appropriate knowledge and skills to efficiently perform workplace roles in industry and administration (Gyadu-Asiedu et al., 2020).

In their study, "Competency-based Training Approach to Teaching and Learning in Higher Technical Institutions in Ghana", Gyedu-Asiedu, Dzisi Asirifi and Boamaa (2020) argue that the introduction of CBT in higher technical institutions resulted from negative industry perceptions about TVET graduates fresh from these institutions. These perceptions are believed to be as a result of poor teaching and learning approaches adopted for various programmes in the various

training institutions; Lack of clear-cut, structured and workable hands-on training that empowers graduates from these institutions, together with many courses and methods of teaching and training that have left out practical aspects have caused problems (Gyadu-Asiedu et al., 2020).

To ensure a nationwide implementation of CBT education at higher levels:

> The Polytechnic law (PNDC 321 of 1992) was replaced by the Polytechnic law (Act 745) in 2007, and now Technical University Act, 2016 (Act 922), which provides for the establishment of Technical Universities; to provide for the conversion of Polytechnics to Technical Universities and to provide for related matters ….(Gyadu-Asiedu et al., 2020, p. 3)

The aims of the Technical University

> …. are to provide higher education in engineering, science and technology based disciplines, technical and vocational education and training, applied arts and related disciplines as the Council of the technical university may, in consultation with the National Council for Tertiary Education determine … (Gyadu-Asiedu et al., 2020, p. 3)

The current study explores the competence-based training approach because an attempt has been made to use it in Ghana to build a bridge between TVET and industry.

3.7 Conclusion

The chapter concludes by outlining what we know about the political economy of skills, the research gap and the proposed conceptual framework. The chapter notes that the relationship between education and work is vastly contested. Workers are likely to define skills differently from employers leading to skill mismatches. There is no simple relationship between credentials on the one hand and knowledge and skills on the other. Competency-based qualifications and curricula emerged to create a common language between employers and skills providers. Some researchers argue that the anticipated outcome of the design of qualifications and curriculum in competence terms, specifying knowledge and skills was not the case in resolving skills mismatches between skills providers and employers.

The complexities of skills demand of the Ghanaian oil and gas companies and those supplied by TVET institutions within a TVET system that is small and weak with structural, policy and institutional inadequacies are at the heart of this study. The World Bank, The ILO and COTVET argue that the TVET system in Ghana does not provide the appropriate skills to the oil and gas companies. What we do not know, however, are the institutional and structural constraints that inhibit TVET graduates from getting employed directly from school by the oil and gas companies apart from the perceived skills mismatch. What we do not also know is whether the relationship between TVET provision and the oil and gas industry concerning on-the-job training exists and the policy position of both the government and the industry.

The Ghanaian political economy of skills is characterized by: a small and weak TVET system, weak manufacturing and industrial base, and institutional, structural and policy inadequacies and

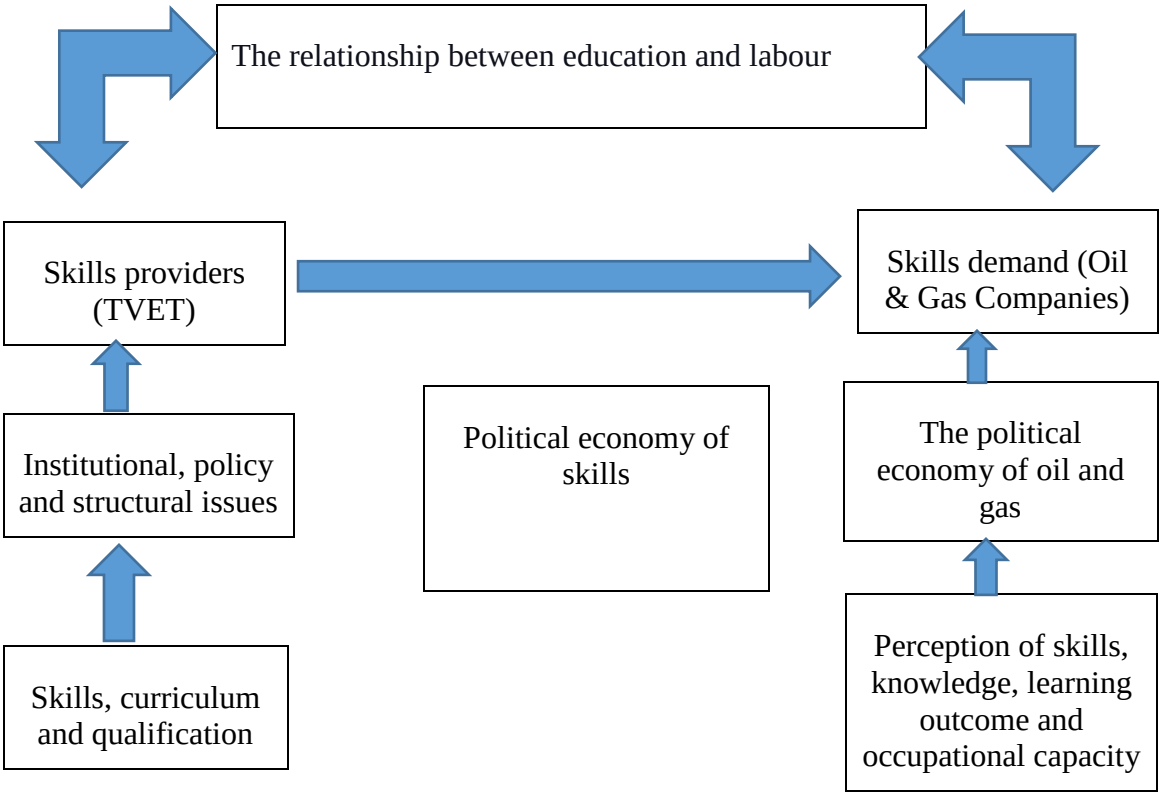
presents a unique challenge to linking TVET provision to work in the oil and gas sector. However, employers act rationally by selecting based on educational credentials. Similarly, job seekers respond rationally by investing in their human capital (Schultz, 1961)

Tutu (2013) identifies inadequate human resource capacity due to weak educational infrastructure, technological know-how and infrastructure base as challenges to local content and participation. There is adequate legislation - The Petroleum Local Content and Local Participation of petroleum activities are in place, in fulfilment of the promotion of Ghanaian nationals for jobs and recruitment, and training in the oil sector. This study provides the extent to which TVET provides mid-level technical occupations to the industry and the issue of international certification by the policy.

3.8 A conceptual framework for the study

The literature review presented in this chapter has established the relationships between education and work. In this study, I explore the relationship between TVETs as providers of mid-level skills and technical occupations and the occupational skills demands of the oil and gas upstream sub-sector. In connecting the literature review and my research questions, I proceeded to document the skills needs of the oil and gas industry from the perspective of all the stakeholders, the characteristics of any skills mismatches, the perception of the TVET educational system by employers, the relationships between education and skills providers and industry, the key reasons given by employers for not getting the required labour from the local labour market. The concepts of knowledge, learning outcomes and occupational capacity, occupations and occupational streams and competency-based training have been explored. Similarly, I rely on the following theories -

the relationship between education and labour (work); The human capital theory; Industrialization and skills development and the political economy of oil and gas as a context to relate to the relationships. I also rely on the political economy of the oil and gas industry and an overview of Ghana's educational system, particularly the TVET system. I, therefore, identify the above conceptual claims to provide the framework for the study and represented in the diagram.



CHAPTER FOUR

Methodology

4.0 Introduction

The chapter describes the research design and process. The research is based on a primarily qualitative and partly quantitative study for which data were gathered from interviews with representatives of organizations and institutions in Ghana that are involved in the relationship between TVET and the oil and gas exploration and production companies. The data are presented descriptively and analyzed thematically in order to address the study's main questions. What is behind the perceived skill mismatches between TVET qualifications and the upstream sub-sector of the oil companies; whether TVET institutions mandated by the government to supply core technical skills and occupations meet the employment and hiring criteria of the oil companies; the relationships between TVET providers and the industry concerning on-the-job training; and the government's reaction to the problem of the perceived skill mismatches.I collected data from representatives of three critical role-players: industry, TVET providers, and regulatory and intermediary bodies. In addition, I surveyed two exploration and production companies and conducted interviews. The survey aimed to get an insight into skilled work, occupations and qualifications of employees and the future of skilled work in Ghanaian oil companies. In addition, the interviews aimed to obtain information about fulfilling workforce needs, on-the-job training and how it is structured, and the company's engagement with education and training providers.

The study began with a desktop review which enabled me to develop an overview of employment numbers in the industry and an overview of Ghana's educational system. The survey enabled me to gain insight into mid-level skilled work, occupations and qualifications of employees and the future of skilled work in Ghanaian oil and gas companies. In addition, the interviews sought insights into fulfilling workforce needs, on-the-job training and its structure and the company's engagement with education and training providers in the category. Interviews were conducted with representatives of two oil companies. Further interviews were held with a representative of the Petroleum Commission as the sector's regulator and with a representative of Ghana National Petroleum Corporation (GNPC) as development partner of the oil companies Four TVET institutions with a major focus on the oil and gas industry and other stakeholders (Sector Trade Union, Ministry of Employment and Labour Relation, Ghana Education Service, Ghana Employers' Association, Association of Ghana Industries and Council for Technical and Vocational Education and Training (TVET)) were interviewed to investigate the relationship between skills demanded by the oil and gas industry and those supplied by TVET institutions.

This chapter presents a description of the research process. It provides information concerning the process used in undertaking this research and a justification for the use of the process. The chapter also describes the various stages of the research, including selecting participants, the data collection process, and data analysis. The chapter further discusses the role of the researcher in qualitative research with reference to flexibility. Finally, the chapter discusses validity and reliability in qualitative research and how these two requirements were met in the current study.

This study starts by first identifying skilled work and occupations and documenting the skills needs of the oil and gas industry.

The study began with a desk top review which enabled the researcher to develop an overview of employment numbers in the oil and gas industry (Managerial vs Core Technical Roles; Ghanaian vs Expatriate).

Discussion of the findings provide evidence to support the overall claim that beyond the supply of and demand for skills, economic, political, social and cultural institutions and arrangements shape both skills provision and the transition from education to the world of work. The chapter discusses the findings by synthesizing the responses of the three key role-players: industry, TVET providers, and regulatory and intermediary bodies and supports this synthesis with a desktop review in order to answer the research questions.

4.1 Research design

The study aims to document the skills needs of the oil and gas industry from the perspective of all the stakeholders, the characteristics of any skills mismatches, the perception of the TVET educational system by employers, the relationships between education and skills providers and industry, the key reasons given by employers for not getting the required labour from the local labour market.

A descriptive research design was adopted in this study because it is well-suited to answering the research questions appropriately and adequately. The strength of a descriptive case study method is that it allows for examining the phenomenon in depth, using various kinds of evidence obtained from interviews with those involved and analysis of documents (Yin, 2003). A descriptive case

study was chosen because the focus of the study is to describe and explain rather than predict. In addition, the case study allows for empirical enquiry of the phenomenon within its real-life context (Yin, 2003, p. 13).

4.2 The role of the researcher

Pitard (2017) argues that "if we think about our experiences in purely an intellectual way, we miss the opportunity of awareness, of understanding at a deeper level how this experience has impacted our being". Pitard (2017) argues that the practice of flexibility highlights the importance of declaring and taking responsibility for your positioning as a researcher. Therefore, I start by presenting my positioning and its influence on the study's aims. The positioning is the result of my experience in the field as a development economist, a unionist and a teacher.

Growing up in a rather tricky terrain and circumstances, I learned to challenge my ability and capabilities to attain the best in education and the occupation I desired. I ended up as a teacher in a private school for several years instead of the engineer I dreamt of being. I then moved on to join a trade union; as a trade unionist, I continued to pursue my dream, this time of being a development economist, and during all these years, I realized it is not a straightforward journey through the world of work. Inspired by the capability theory of Sen (2000) and the challenges the labour market poses in the transitioning from education to work, I was challenged to research the relationships between education and work that could enable me to understand the complexities of this relationship.

At the start of my PhD journey I read extensively about the TVET system in Ghana and imagined the opportunities offered by an emerging oil and gas industry in terms of employment related to

the skills produced by the TVET system. As a development economist, I share and I am motivated by the works of Braverman (1998) and Polanyi (1968) "Labour and Monopoly Capital: The Degradation of work in the twentieth century" and "The Great Transformation", respectively. The experience as a unionist brought me face-to-face with the reality of the relationship between employers and workers when I dealt with employment contracts and collective agreements both at enterprise and at national levels. As a teacher, my understanding of the relationship in the teaching field was one of "master-student". The study aims to provide insight into the relationship between demand for and supply of skills in the upstream subsector of Ghana's oil and gas industry.

4.3 Research paradigm

Thomas Kuhn popularized the concept of “paradigm” in the literature on research methodologies in his model of theory *The Structure of Scientific Revolutions (1962),* a paradigm as a disciplinary matrix.

> A scientific community consist, in this view, of the practitioners of a scientific specialty. To an extent unparalleled in most other fields, they have undergone similar educations and professional initiations; in the process, they have absorbed the same technical literature and drawn many of the same lessons from it (Kuhn & Hacking, 2012, p. 177).

Practitioners in a scientific community are bound by a comprehensive, consensual framework that prescribes rules, procedures and values informing science. Kuhn’s work implicitly argues that positivistic assumptions about the nature of reality are just particular human assumptions and

interpretations. Kuhn further explained that all human experience is fundamentally interpretivist and actively shaped by the mind and its categories (Kuhn & Hacking, 2012).

"Paradigm" translates into research methodological outlook, general orientation towards research such as positivism, interpretivism, postmodernism, Marxism. Positioning my research in terms of one of the paradigmatic labels relative to the key pillars of ontology, epistemology and methodology questions (Maykut & Morehouse, 1994)

- Ontological questions – What is the form and nature of reality? What can be known about reality?
- Epistemological questions – What is the nature of knowledge? What does research contribute to knowledge or how does knowledge accumulate? What is the role of values in inquiry?
- Methodological questions – How should the inquirer find out whatever she or he believes can be known? What are the researcher's epistemological and hermeneutical positions, personal, political and ethical choices?

This study situates in an interpretivist paradigm. The ontology postulates that the natural and social world (structures, practices, events and processes) have a reality independent of our knowledge of it (Stones 1996, Giddens 1979). Habermas argue:

> the positivist thesis of unified science, which assimilates all the sciences to a natural-scientific model, fails because of the intimate relationship between the social sciences and history and the fact that they are based on a situation-specific

> understanding of the meaning that can be explicated only hermeneutically … access to a symbolically pre-structured reality cannot be gained by observation alone (Habermas et al., 1988, p. 257).

Following the above critique of the positivist thesis, Giddens draws on the hermeneutic of Gadamer in his construction of the ontology of construction theory. In philosophical hermeneutics, human existence is hermeneutic – always interpreting and understanding the world (Habermas et al., 1988).

The epistemological stance adopted in this study is influenced by the understanding of reality to mean "reality is independent of our knowledge of it". The study adopts subjectivist epistemology and draws on hermeneutics.

There are some methodological implications flowing from the ontological and epistemological positions. The aim is to understand the complexities of the relationship between education and labour. The manner of going about the inquiry falls for a focus on a natural and localized setting, which is true of this study in that I focused on role-players in the relationship between technical and vocational education and training and the oil and gas companies in the upstream sector in management positions.

My response to the ontology, epistemological and methodological questions, therefore, leads me to conclude that my research is indeed substantially "qualitative" and partially "quantitative" in the sense of being a non-numerical examination but rather an interpretation of interviews and survey instrument administered to two oil and gas companies.

4.4 Data collection techniques

Several standard data collection techniques were available for this research. Appropriate choices under the circumstances for addressing the research questions were:

- A desktop analysis which enabled insight into the skills gap;
- A survey involving questionnaire administered to participants in two exploration and production oil and gas companies which aimed to provide empirical insight into skilled work, occupations and qualifications of employees and the future of skilled work
- Interviews to provide insight into fulfilling workforce needs, on-the-job training and the companies' engagement with education and training providers

The preferred method was also tactically adapted to take care of representatives' time constraints. All are in management positions and most worked from home due to COVID-19 restrictions.

Data were collected from two primary sources, surveys and interviews. In category one: A survey, by means of questionnaires administered to participants in two exploration and production companies with the questions answered by managers concerned with hiring of employees. (Table 5) The questionnaire asked participants to complete open-ended questions and rate how strongly they agreed with each statement; 1—identified skilled work, 2. occupations and qualifications of employees and 3—the future of skilled work in the company. In category two: three interviews with the two exploration and production companies and Ghana National Petroleum Corporation were conducted (Table 2). The interview questions solicited information from the companies on fulfilling workforce needs, on-the-job training and how it is structured, and the company's engagement with education and training providers.

In category three: four interviews with representatives of four TVET institutions were conducted. The interview questions solicited information from the TVET institutions on: 1 mechanisms of tracking past students in the oil and gas industry. 2 the kind of knowledge, skills and abilities the oil and gas companies expect students to have. 3 On-the-job training for students and 4 engagements with the oil and gas companies and other stakeholders (Table 1). In category four: five interviews with the Ministry of Employment and Labour Relation, Ghana Education Service, Association of Ghana Industries, Ghana Employers' Association and the General Transport, Petroleum and Chemical Workers' Union were conducted. The interview questions solicited information from them about the following:1. whether the organization has a say in the type of skills produced by TVET institutions and their level of involvement; 2 on-the-job training facilitation for TVET students; 3 engagements with the oil and gas companies and education and training providers. (Table 4). In category 5: two interviews were conducted with sector regulators – TVET sector regulator (COTVET) and upstream petroleum subsector (Petroleum Commission) (Table 5)

Table 4 Number of TVET Institutions Interviewed N=4

Table 4 Number of TVET Institutions Interviewed N=4	
Level of Education	Number of Institutions
TVET Institutes	2
TVET Universities	2

Table 5: Oil and Gas Companies Interviewed N=3

Table 5 Oil and gas Companies Interviewed n=3		
Company	Number	Role in the Study
Company 1	1	Object
Company 2	1	Object
Company 3	1	Catalyst

Table 6: Sector Regulators Interviewed N=2

Table 6 Sector Regulators Interviewed n=2		
Institution/Company	Sector	Number Interviewed
Regulator 1	TVET	1
Regulator 2	Upstream Oil and Gas	1

Table 7: Other Stakeholders Interviewed N=5

Table 7 Other Stakeholders Interviewed n= 5	
Institution	Number Interviewed
Ministry 1	1
Ministry 2	1

PS 1	1
PS 2	1
PS 3	1

Table 8: Upstream Companies Surveyed N=2

Table 8 Upstream Companies Surveyed n=2		
Company	Respondents	Number of Questionnaires
Company 1	Management representative with a role in hiring employees	2
Company 2	Management representative with a role in hiring employees	2

4.5 Targeted population

In this study, purposive sampling was adopted. For such sampling, the researcher identifies and selects individuals or groups of individuals that are knowledgeable about or have experience of a phenomenon of interest (Palinkas et al., 2015, p. 534). The rationale for choosing this approach was that the researcher sought knowledge about skills demand and supply, employment, qualifications and recruitment, which the participants would provide based on their experience and position. The researcher worked in conjunction with the Executive Director of COTVET during the research piloting in choosing participating TVET institutions, based on their roles in providing

unique skillsets for the oil and gas industry. There were fifteen participants in the study. Some participants worked from home due to COVID-19, especially officials from the oil and gas sector, while others participated in the study in person. In-person interviews were conducted and recorded in the respondents' offices where the participants were not in danger, and there was no intimidation or coercion. In addition, virtual meetings (ZOOM, Microsoft Teams) were set up for interviews with those working remotely.

I interviewed people from three categories: TVET providers and allied institutions, regulators and industry representatives. There were four TVET providers and allied institutions - a representative of Ministry 1; a representative of Ministry 2; industry associations (PS 1); employer associations (PS 2); and trade unions (PS3). For regulators, I interviewed a representative of the Petroleum Commission (Regulator 2) from industry and a representative of Regulator 1 as a regulator of TVET. The complete list of participants selected and interviewed is represented in Tables, 9 to 13. Biographical information about participants is provided in Appendix A.

Table 9: Industry Survey Respondents and Pseudonyms

Pseudonym	Company
Management Representative 1	Company 1a
Offshore Representative	Company 1b
Management Representative 2	Company 2

Table 10: Participants Interviewed in Oil and Gas Companies and Pseudonyms

Pseudonym	Company
Management Representative 1	Company 1
Management Representative 2	Company 2
Management Representative 3	Company 3
AOGC Representative	Regulator 2

Table 11: Participants Interviewed in TVET Institutions and Pseudonyms

Table 4.8 Participants Interviewed in TVET Institutions and Pseudonyms

Pseudonym	Institution	Title
TVET Representative 1	Takoradi Technical University (TTU)	Quality Assurance Dean
TVET Representative 2	Regional Maritime University (RMU)	Coordinating Dean
TVET Representative 3	Takoradi Technical Institute (TTI)	Principal
TVET Representative 4	Kikam Technical Institute (KimTech)	Assistant Principal

COTVET Representative	Coordinating Body	Deputy Director for and Acting Head of Project Planning Research Management

Table 12: Participants Interviewed in the Oil and Gas Companies and Pseudonyms

Pseudonym	Company
Management Representative 1	Company 1
Management Representative 2	Company 2
Management Representative 3	Company 3
AOGC Representative	Regulator 2

Table 13: Other Participants Interviewed and Pseudonyms

Pseudonym	Institution
GES Representative	Ministry 1
MELR Representative	Ministry 2
AGI Representative	PS 1
GEA Representative	PS 2

GTPCW Representative	PS 3

Below I provide a brief overview of the participating institutions and organizations to explain their significance to the study.

4.6 Technical and Vocational Education and Training providers

4.6.1 TVET institutions

The Four TVET institutions selected were institutions identified by government and policy to train students in technical skills for the oil and gas industry. All but one of the four are in the western region of Ghana where exploration and production occur.

4.6.2 Ghana Education Service

Under the Ministry of Education, Ghana Education Service creates an enabling environment for all educational institutions and management positions. The ICT division exclusively takes care of TVET training at the pre-tertiary level, the core mandate of the division.

4.6.3 Ministry of Employment and Labour Relations

The Ministry of Employment and Labour Relations' core mandate is to coordinate job creation interventions in the public and private sectors. The ministry also aims to ensure decent work standards and harmonious labour relations. In all these, it aims to make sure the relationship between employers and workers is cordial to support national development. Furthermore, the ministry promotes, and coordinates job creation interventions under departments and agencies specialized in skills training, given their mandate.

4.6.4 Ghana Transport, Petroleum and Chemical Workers' Union

General Transport, Petroleum and Chemical Workers' Union is a national union affiliated with the Trade Union Congress, Ghana, the most prominent Trade Union Federation in Ghana. Membership covers workers in transport, petroleum and chemical sectors. Specifically, in the oil and gas industry, it covers ENI, several organizations or companies and services sector that are operating upstream. However, most members in the upstream sector have either been laid-off or are on technical leave (leave with pay cuts) due to the COVID-19 pandemic. Currently, they have fewer than a thousand members in the upstream sub-sector from near two thousand before the pandemic.

4.6.5 Association of Ghana Industries

Association of Ghana Industries is a professional association with branches across the country with over two thousand companies having registered members with more than 60% of these being active. Membership is by companies. Membership covers about 23 different sectors in the Ghanaian economy. In manufacturing, about 75% of members are value addition. The rest are services. Their activities go beyond manufacturing. Services as part of AGI include; banks, insurance companies and advertising companies. Oil and gas became part of AGI in 2010. The association speaks for all businesses in Ghana. AGI is a typical advocacy organization and relates to government at different levels. Beyond policy advocacy, it provides business development services and also training.

4.6.6 Ghana Employers Association

The core mandate of GEA is to represent the interest of employers in the country. Representation in terms of interest means advocating for an enabling business environment for the private sector

and employers to thrive. There are some overlaps between AGI and GEA. Some members are part of AGI, others GEA, depending on their benefits. GEA has on several bodies at the national level which aim to look at TVET critically; it is part of COTVET and part of the National Council for Curriculum Assessment. It also has representation on the National Vocation Council for Females. These are critical bodies formed at the national level to look particularly at TVET and skills related to TVET structures.

4.7 Regulators

4.7.1 Sector industry regulator (Regulator 2)

The Petroleum Commission is a regulatory organization set up in 2013 by the government of Ghana purposely to regulate the upstream industry. The Regulator 2 manages and coordinates all the activities of the upstream sub-sector of the industry. It advises the Minister on issues concerning petroleum in the upstream sector. The government makes sure that the Ghanaian people to whom the resources belong have opportunities to participate in the oil and gas industry. The need for employment security of Ghanaians gave birth to the local content law, which the Commission operationalizes. The local content law is not a Ghanaian novelty, however. Even in advanced countries, such as Norway and Canada, most oil companies have this provision. The human resource side of the local content aims to ensure that Ghanaians who are competent are allowed to work before any expatriate is considered. Skill development is a priority; Accelerated Oil and Gas Capacity building (AOGC) aims to make sure that Ghanaians build skills and capacity to be considered for jobs and businesses in the industry. This arrangement is a response to the lack of available skills required by the International Oil Companies.

4.7.2 TVET regulator (Regulator 1)

The Council for Technical and Vocational Education and Training (COTVET), now Commission for Technical and Vocational Education and Training, designs the strategic plan for TVET transformations, coordinates and supervises all TVET activities across all formal and non-formal education and also provides for related matters. In addition, they formulate national policies and work towards rationalizing assessments and education in TVET. Furthermore, they lead the needs assessments and the skills gap analysis and audit of seven sectors, including energy (oil and gas).

4.8 Industry representatives

4.8.1 Company 1

Company 1is an exploration and production company. The company aims to move from exploration to total production, farming down some of the assets, making money available to finance new projects. The company established its presence in Ghana in 2006. The following year, it discovered the Jubilee field, 60km Offshore and the first oil flow was celebrated in 2010. The company has developed the oil field in partnership with Ghanaian and international companies.

4.8.2 Company 2

Company 2 is an exploration and production company. Offshore exploration has been developed in two phases: the development of the oil fields at Offshore Cape Three Point started in 2017, and that of non-associated gas fields started in 2018. OCTP has reserves of about 40 million cubic metres of non-associated gas and 500 million barrels of oil and is located 60km off the country's coast. Production is via a sub-sea link to the FPSO John Agyekum Kufour, the floating production, storage and offloading system.

4.8.3 Company 3

PNDC Law 64 established the Ghana National Petroleum Corporation in 1983 to support Ghana's objective of providing an adequate and reliable supply of petroleum products through developing the country's petroleum resources. Subsequently, the Petroleum Exploration and Production Law, 1984 provided the regulatory framework for exploring hydrocarbon resources. The Law establishes legal agreement between the state, GNPC and prospective investors in exploration and production operations. The corporation is a partner in all petroleum agreements in Ghana (Mckourage, 2021).

One of the core mandates of GNPC is to ensure the training of the people of Ghana and the development of their skills in all aspects of petroleum operations and to obtain the effective transfer to Ghana of' appropriate technology. It operates in two ways: 1 through the GNPC Foundation and 2 through the professional chair. The corporation does this by direct support in the form of curriculum development, teaching staff and development of lecturers in the area of energy at various universities.

For the credibility and reliability of this research relative to information and verifiability in the Skill Supply Category: TVET providers, six participants were interviewed at four TVET institutions, the Ghana Education Service and the Ministry of Employment and Labour Relations.

TVET Representative 1a's (TVET 1a) responsibility is to oversee accreditation, acquisition, and standards within the institution and its external regulators, ensuring that the university attains the total quality management required of higher education as an institution. It is his second-year in this position and his second term as well. **TVET Representative 1b (TVET 1b)** is based at the

Jubilee Technical Training Centre, a training centre set up for the training of technical staff for the oil and gas industry. He has been leading the development of a curriculum in petroleum engineering, process, mechanical engineering, and welding and fabrication. These two representatives were interviewed collaboratively.

TVET Representative 2 (TVET 2) has been in a senior management position for five years and also lectures in several courses at the university.

TVET Representative 3 (TVET 3)) is in a senior leadership position one of the technical institutes.

TVET Representative 4 (TVET 4) is a senior administrator responsible for a range of supervisory functions at the institute in which he is based.

GES Representative (Ministry 1) leads a division of the Ghana Education Service which focuses on TVET at the pre-tertiary level.

MELR Representative (Ministry 2) occupies a senior position in a ministry formulates policies related to employment and labour issues.

From the category of contributing and allied institutions to skills provision, three participants were interviewed:

GTPCW Representative (PS 3) is a senior union official with extensive experience as a trade unionist.

AGI Representative (PS 1) holds a senior position in the Association of Ghana Industries (A.G.I.).

GEA Representative (PS 2) is an advisor to the GEA and focuses on economic matters.

I interviewed two participants from the category of regulators:

The AOGC Representative (Regulator 2) is a consultant involved in in building capacity for the oil and gas industry. The AOGC department of the Petroleum Commission is responsible for building skills (mostly TVET skills) and the capacity of Ghanaians to be considered for employment in businesses in the industry.

COTVET Representative (Regulator 1) works in planning, research Management and evaluation. COTVET supports the Ministry of Education with policy formulation and inputs in policy designs as far as TVET and skills development are concerned.

One participant each from the industry category:

Management Representative 1 (Company 1) is involved in the end-to-end human resource process from hiring to retiring or resigning.

Management Representative 2 (Company 2) Plays a similar role at company 2.

Management Representative 3 (Company 3) is from the GNPC with responsibilities of the oversight of in-house training and employer-employee relations.

4.9 Secondary data

Secondary data sources include documents provided by participants that pertain to the study and from other literature sources.

1 Skills gap analysis and audit of seven sectors report: The study analyzed the skill gaps within the oil and gas sector. The Ministry of Education and Commission for Technical and Vocational Education and Training came together to investigate/research skill gaps and skill mismatches in terms of demand and supply in the upstream sub-sector sector of the industry. The analysis aimed

to ensure the majority of the Ghanains who have relevant skills, including technical and vocational skills for employment, are adequately linked to the industry (COTVET, 2021).

2 Local content and its implementation, challenges in Ghana's Upstream Oil and Gas Sector: The study analyzed the employment linkages to understand how the law impacts skills provision to the industry.

Here the study analyzed how middle-level skill jobs are accessed by TVET graduates in the upstream subsector of the oil and gas industry as a result of the implementation of the Local Content law.

4.10 Data collection

Data collection was from three primary sources during the fieldwork - On-site interviews, virtual meetings and retrieved questionnaires. The main aim of the survey was to get insights into middle level or intermediate level skill jobs/occupations in the company. I aimed to investigate middle-level or intermediate-level jobs/occupations, identify occupations and qualifications of skilled jobs, and the future of skilled workers in the company. The questionnaire was in three sections: section one identifying jobs described as skilled jobs at the mid-level or intermediate levels; the most important criteria against which those jobs are measured; the forms of knowledge and skills required in those jobs; and whether the way work (tools, technology, materials) is done in these jobs has changed over the last three years. Section two focused on identifying middle level and lower level skilled occupations and corresponding qualifications in the company. Finally, the third section investigated the future of skilled workers in the company by asking about how the different

types of knowledge and skills will be affected, how tools/materials/technology will affect work and how the company and workers intend to confront any challenges they face.

The main aim of the interview was to gain insights into the fulfillment of the company's workforce needs. For example, how on-the-job training is structured and the nature of engagement with education and training providers and other institutions in providing the required skills for industry. The interview further aimed to find out the following: high-demand occupations the company is looking for; knowledge, skills and abilities the company expects new hires to have; in what ways the company determines if an applicant has those KSAs; if the company has job descriptions; if the company has a specific test for applicants and the type of questions asked at interviews with new applicants. Lastly, the interview aimed to determine if there are internal processes that the company goes through to determine what KSAs a specific job requires.

The second part of the interview aimed to determine if the company offers on-the-job training and how it is structured. In further probing the question, options such as student internship; partnership with any education provider; apprenticeship being paid while under training; paid school opportunities (tuition reimbursement) were investigated.

The third part of the interview investigated the company’s work with education and training providers. First, does the company collaborate or partner with any local education provider? In probing this further, the interviewee was asked to provide the following: local education and training providers the company typically interacts with; how the company interacts or engages with them. Probing further, whether in, for example curriculum development, employees guest lecture in a class, internships, offering students tours of company facilities, sharing data on

workforce needs with the school, interviewing their graduates. Furthermore, what the collaboration process looks like (meetings, student-employee interactions, planning and implementation of programmes was investigated (Bozick et al., 2017).

The main aim of the interview with education and training institution representatives was to understand the company's position and perspectives on the following: knowledge, skills and abilities expected of graduates, on-the-job training, engagement and collaboration by training institutions and industry. The objective was to find out the following: if they have records or can track their past students in the oil and gas industry; the high-demand occupations that the oil and gas companies are looking for; knowledge, skills and abilities (KSAs) the company expect graduates to have—probing further to unpack KSAs – content knowledge, performance skills, abilities and workplace competences. The interview further probed to identify the role the head of the institution and management play in determining the required skills needed by industry, particularly the oil and gas industry. Some of the questions posed to the interviewees were as follows: How well do you think the industry (oil and gas) is contributing/developing skilling up the talent in those occupations? Is the institution successful in turning out graduates who readily find jobs to fill the high-demand occupations in the oil and gas industry?

The second part of the interview probed whether the oil and gas companies offer students from TVET institutions on-the-job training and if they do, how it is structured. Finally, the third part of the interview explored how TVET institutions work with the oil and gas companies. Questions posed: 1 Which local oil and gas companies do the institution typically interact with? 2 How does the institution interact or engage with them? 3. What is the nature of the collaboration process?

The main aim of the interview in the case of Ghana Education Service, the Ministry of Employment and Labour Relations and the Union was to get an insight into their respective roles in helping shape the ability of TVET institutions to meet the requirements of the industry. In achieving this objective, the interview sought information under three main sub-headings: fulfilling workforce needs, on-the-job training and stakeholder engagements.

The main aim of the interview in the category of regulators, Regulator 1 and Petroleum Regulator 2 was to get an insight into their respective roles in coordinating TVET skills and the local content law in supply and demand of skills. Key questions put to the TVET coordinator included: How does the institution get involved in resolving skills mismatches between education and training providers (TVET graduates) and the oil and gas industry? How well are current education and training providers contributing to developing skills in occupations relevant to the oil and gas industry? In what ways does COTVET interact or engage with stakeholders?

Further questions to the COTVET representative included: How does the commission guarantee the right skills to the oil companies? 2 What internal processes does the commission go through with other stakeholders to determine the kind of Knowledge, Skills and Abilities a specific job requires in the oil and gas industry? *The interview* further aimed to find out more about the commission's work with education and training providers.

On the part of the regulator 2, the interview sought information on the high-demand occupations the companies are looking for; What knowledge, skills and abilities (KSAs) do they expect new hires in the oil companies to have? Then, in probing further, the researcher asked the respondent

to “unpack” each KSA, e.g. Asked, can you give me specific examples of what you mean by …… or what you mean by ……. which jobs require what kind of knowledge, skill or ability.

The researcher further probed to find out how on-the-job training offered by the companies is structured, how it is provided and if there was any mechanism to monitor it. The questions also investigated the commission’s work with education and training providers.

Primary data collection began on 19th October 2020 and ended on 4th May 2021. Contact phone numbers at the front gates of the oil companies were the first point of call in order to gain access to management, as almost all were working from home. Permission was sought from the companies. The researcher gained permission from the companies to conduct interviews. Depending on the availability of respondents interviewed, face-face or virtual interviews were arranged. Hard copies of questionnaires were delivered at the front gate of the office of one of the oil companies as requested. The ethical protocols were followed strictly to the letter. Respondents willingly signed the participant consent sheet and allowed the interviews to be recorded. Three questionnaires out of four from two oil companies were recovered and subsequently interviews were granted through their respective HR departments and with regulator 2 and company 3. In all, a total of fifteen respondents participated in interviews.

4.11 Data analysis

Chapter Six discusses the findings that provide evidence to support the overall claim that beyond the supply of and demand for skills, economic, political, social and cultural institutions and arrangements shape both skills provision and the transition from education to the world of work. The chapter discusses the findings by synthesizing the responses of the three key role-players:

industry, TVET providers, and regulatory and intermediary bodies and supports this synthesis with a desktop review in order to answer the research questions.

For the analysis and discussion aims to make the data meaningful and to answer the research questions (Sharan & Merriam, 2009). Sharan and Merrian (2009, p. 165) state that:

> rigor in qualitative research derives from the researcher's presence, the interaction between researcher and participants, the triangulation of data, the interpretation of perception, and detailed, thick description.

According to Cohen et al., (2002), the most appropriate way of presenting data analysis from a case study is through a descriptive narrative. Chronologically, issues are raised throughout and the emerging issues are amalgamated across the different role-players (Cohen et al., 2002). The researcher needs to keep in mind the risk of combining data and interpretations (which is unavoidable) and of being over-selective, unrepresentative and unfair to the situation at hand in the choice of data and interpretations put on them (Cohen et al., 2002). This I have attempted to do throughout my analysis.

For analyzing the data, I built an analytical framework from the literature reviewed and, in doing so, analyzed the data with the key concepts raised in the literature in order to discuss the findings in relation to the research questions. "Data analysis is a process that requires astute questioning, a relentless search for answers, active observation and accurate recall (Saldaña, 2009). My analytical lens was on the concept of skills and its definition in the relationship between education and work;

a holistic approach to thinking about linking education to work; industrialization and skills in general and in Ghana – the issue of skill is essential because it is seen as key for industrial development and industrial development as key to development in general; the concept of education to work transitions – the relationship between an educational programme and its destination in the labour market; the concept of Competency-Based Education and Training – a significant approach to resolving skills gaps in vocational discourse in CBT but one that has its critics.; the concept of occupations and occupational streams – more helpful in resolving the linear relationship between education and work as propounded by human capital theory; the political economy of oil and gas in Ghana – the local content law and its contribution to employment of the local population.. Finally, the conceptual framework I drew from the literature review enabling the beginning of a coding system for thematic content analysis to address the research questions.

The transcripts were checked for errors and repetitions before I analyzed the interview data. The analysis was done manually by identifying consistent themes and interconnections emerging from the data. The researcher then developed codes for labelling sections of the text. For the survey instrument to support the interviews, descriptive data was generated. The researcher used structural coding to identify the companies 'skills needs. By contrast, thematic coding was adopted in the interviews by labelling common themes that appeared across the interviews.

Memos were developed to record evolving insights and emerging patterns. Finally, the researcher cross-examined the emerging themes, summarized and drew conclusions. The researcher adopted structural coding, which involves as question-based code, and applied it to the retrieved questionnaires as follows:

Table 14 Coding data from questionnaire

Code	Description	Category	Sub-Category
1	Skill jobs in the company	Category 1 The most important criteria against which you measure the kind of skill jobs	
		Category 2 The forms of skills and knowledge required in this job	Sub-category 2 The kind of diagnostic and problem solving applied to the skill jobs
		Category 3 What has changed in the way work is done in this category of jobs in the last five years	Sub-category 3 Has the tools or technology used in this job changed over the last five years Has materials used in this job changed over the last five years
		Category 4	Sub-category 4

		What are the kind of things that could go wrong in this job	How risk is minimized
2	Identifying occupations and qualifications of skills jobs	Category 1 Types of middle-level and occupations Category 2 Types of occupations lower than middle-level occupations Category 3 Types of occupations higher that middle-level occupations	
3	Future of mid-level skill jobs	Category 1	

Will middle-level skilled jobs still exist in 10-20 years	
Category 2 Form of knowledge and skill that will be required in 10-20 years	Sub-category 2 Best diagnostic and problem solving skill that will be required in this type of job in 10-20 years
Category 3 Will the way work is done change in 10-20 years	Sub-category 3 What tool or technology will be used in this type of job in 10-20 years
	Sub-category 3 How will staff learn to use the new tools and technology
	Sub-category 3 What materials will be used in this type of job in the next 10-20 years
	Category 3

	How will staff learn to work with new materials

Interviews were thematically coded and categorized into three: Industry (companies); TVET institutions; other institutions.

Table 15 Coding data from interviews - Industry

Code	Description
1	High-demand occupations the company is looking for
2	Knowledge and skills expected of new hires
3	Ways the company determines if an applicant or new hires has that knowledge
4	Qualification and entry level of job applicant
5	Internal processes that the company goes through to determine KSA to specific job requirement
6	Success in finding people to employ in high-demand occupations with the required skills
7	On-the-job training
8	Company engagement with education and training institutions (TVET)

Table 16: Coding data from interviews - TVET institutions

Code	Description
1	Occupations/Courses TVET Institutions turned out for the oil and gas industry

2	Tracking mechanisms of past students in the oil and gas industry
3	High-demand occupations the oil and gas industry is looking for
4	Knowledge, Skills and abilities expected of students to meet industry demand
5	Internal processes the institution go through to determine Knowledge, skills and abilities required by the industry
6	How industry is skilling up knowledge, skills and abilities in the institution
7	How successful trained graduates take advantage of high-demand occupations in the oil and gas industry
8	On-the-job training for students
9	Institution's engagement with the oil and gas companies

Table 17: Coding data from interviews - Other institutions/organizations

Code	Description
1	Level of involvement in skills produced by TVET institutions
2	Level of involvement in resolving skill mismatches
3	Skilling up of TVET skills to meet critical technical needs of industry
4	Recommendations on on-the-job training by industry
5	Level of engagement with TVET institutions and other stakeholders

Table 18: Coding data from interviews - Regulators

Code	Description
1	Level of involvement in skills produced by TVET institutions
2	High-demand occupations the oil and gas companies are looking for
3	Knowledge, skills and abilities expected of students to meet the demand of industry
4	Level of involvement in resolving skill mismatches
5	Skilling up of TVET skills to meet critical technical needs of industry
6	On-the-job training opportunities for TVET students

4.12 Ethical considerations

Before commencing the study, ethical clearance was obtained from Wits Human Research Ethics Committee (non-medical) on 13th May 2020, Protocol Number H20/03/02. When inviting participants, the purpose of the research was clearly explained. All participants duly granted permission for recorded interviews. Management Representatives 1, 2, 3, Company Representatives 1a and 1b, and AOGC Representatives are all from the industry. TVET Representative 1,2,3,4, COTVET Representative from TVET institutions; GES Representative, MELR Representative, AGI Representative, GEA Representative and GTPCW Representative represent a range of other stakeholders. All participants were informed that they would not receive any direct benefit from participating in this study. There were no disadvantages or penalties for

not participating, and they were free to withdraw at any time or not answer any question if they did not want to. Participants were guaranteed confidentiality and anonymity as neither their names nor identity are divulged in any publication or report. Given how readily identifiable most institutions in the sample are, and hence the potential individuals in certain roles, the assurance of participants of anonymity was a challenge at the first instance. For example, I had to accept an undertaken from company 3 to sign a confidentiality agreement and declaration dated 19/04/2021. Participants from government institutions were particularly assured that the researcher will protect their identity in the report and subsequent publications to allay their fears. Participants from the TVET institutions were more confident to give information freely as they believe the research could improve the deficiencies of the institutions in relation to employability of their students. Other stakeholders: government ministries and the private sector representatives do delegate the respective department that has the information requested by the researcher. They were similarly assured that the researcher would be using a pseudonym to represent their participation in the final research report.

The data collected are analyzed and documented only in this thesis. The research findings will be used only for academic purposes, including possible books, journal articles, and conference proceedings. All research data will be kept securely in a locked cabinet or password protected computer folder and will be destroyed five years after completion of the project.

CHAPTER FIVE

Findings

5.0 Introduction

The chapter presents findings in relation to the three categories of role-players: industry: TVET providers, and regulatory and intermediary bodies, supported by a desktop review of documents submitted by representatives and from reports. The main finding is that while there is a widespread perception of a mismatch between skills required in the Ghanaian oil and gas industry and skills supplied by the country's TVET sector, in reality the key issue to be addressed is a structural dislocation that policy reforms have not addressed to date, despite efforts to do so, making it impossible for the TVET providers to provide skilled workers to the oil and gas industry. The chapter establishes the following: (i) mid-level technical jobs will change, but skilled workers can learn new work methods by training or through management of the change process; (ii) artisanal or middle-level skills work will shift upwards to a higher level of knowledge and skill at the technical level (from the survey); (iii) while TVET provision aims to develop appropriate qualifications based on labour market analysis and including industry players, the TVET sector is still not doing well enough in helping TVET graduates find employment in the exploration and production oil industry: (iv) hiring decisions by the exploration and production oil and gas companies are based on three main features: competence, a university degree and work experience tied to professional certification; (v) collaboration between stakeholders is not optimal as TVET providers are not directly linked to the oil companies structurally but rather through the Petroleum Commission. Perhaps the most important finding is that the lack of power and institutional capacity of the TVET institutions to offer professional certificates prevents graduate from these

institutions from being employed by the exploration and production oil and gas companies in Ghana.

The chapter begins with findings from the desktop review which allowed the researcher to develop an overview of the classification of occupations on the ISCO-18, ISCED, Ghana Educational Levels and Qualifications of Professionals, Technicians and Associate Professionals in the oil and gas sector. This is followed by findings from data collected from the upstream sub-sector of the oil and gas companies through a survey instrument and interviews. Oil exploration and production activities take place in the Western Region of Ghana. Exploration and production activities are offshore, hosted by Floating Production Storage and Offloading (FPSOs) systems operated by lead companies in the sector. This chapter is divided into three main sections; oil and gas companies, skills supply institutions, and other related institutions.

5.1 Desktop analysis

The study began with a desktop review which enabled the researcher to develop an overview of the classification of occupations on the ISCO-18, ISCED, Ghana Educational Levels and qualifications of Professionals, Technicians and Associate Professionals in the oil and gas sector. The review was essential for identifying the middle-level professional occupations and credentials required by the industry. The desktop review further explored the employment status by origin in compliance with the Local Content Law. Tables 19 & 20 presents an overview of the findings.

5.1.1 Classification of occupations: professionals, technicians and associate professionals in the oil and gas industry

The classification is relevant to this study in many respects: to determine the context of TVET qualifications and technical professionals' qualifications against ISCO-08 and ISCED skill Levels; To relate professional credentials to the National TVET Qualifications Framework.

Table 19: Classification of Occupations: Professionals, Technicians and Associate Professionals in the Oil and Gas Industry

Classification of Occupations (ISCO-08),Ghana Educational Levels and qualifications: Professionals, Technicians and Associate Professionals in the Oil and Gas Sector					
SN	**Major Groups**	**ISCO-08 Skill Level**	**ISCED Level**	**GES**	**NTVETQF**
2	Professionals	4th	6 to 7	BA/BSc	Level 6 Bachelor/ (Professional Technical)
3	Technicians & Associate Professionals	3rd	5	HND	Level 5 HND

Source: COTVET - Skills Gap Analysis and Audit of Seven Sectors

Tables 19 situates middle-level occupations and qualifications in the oil and gas industry. Technicians and Associate professionals' entry-level points at certificate (1 & 2) and HND levels on Ghana Education Service qualification, Level 5 and the third Level on ISCED and ISCO-08 Levels, respectively, are associated with TVET qualifications. Qualifications as Technical

Professionals, identified as middle-level occupations, are the minimum credential required by the oil and gas companies – Level 6 Bachelor/Professional Technical on NTVETQF and at corresponding Level 6-7 and 4th Level on the ISCED and ISCO-08, respectively.

5.1.2 Employment in the upstream sub-sector of the oil and gas sector by classification: 2010-2020

Table 20 provides a comparative analysis of employment in managerial and core technical roles in the upstream oil and gas sub-sector between 2010 and 2020. Fifty-nine per cent of those employed in core technical roles are Ghanaians. The percentage employed in the technical roles is well short of the estimated 90 per cent of the stipulated employment opportunities for Ghanaians within ten years of commencement of oil production. Contrary to NTVETQF based on CBT, the sector still lacks qualified Ghanaians to participate in the available job opportunities in the industry.

Table 20: Employment in the upstream sub-sector of the oil and gas industry by classification - 2010-2020

Level of Employment	Ghanaian (%)	Expatriate (%)
Management Roles	75	25
Core Technical Roles	59	41

Source: Discov Sustain 2021

Suleman & Zaato (2021) argue from data collected in 2019 that there is a lot more to do to address the employment gap in the core technical roles in the industry. Suleman & Zaato (2021) recommend local training in core technical skills (Drilling, Engineering, Geosciences and

Technical Management) and monitoring, experience building, and localising core technical positions.

5.2 Findings from survey - industry perspective

The survey aimed to capture "present" and "future" dimensions of Technical and Vocational Education and Training graduates' qualifications and to compare these with the job specifications required by the exploration and production oil and gas companies. Technical and Vocational Education and Training graduate work refers to skilled work at the middle-level or intermediate level of employment.

5.2.1 Descriptive overview of the kinds of technical/skilled jobs in the oil and gas Sector

Table 21 Skilled jobs and corresponding grades in the exploration and production oil and gas companies

Skilled jobs in the exploration and production oil and gas companies and their corresponding grades		
Company	**Mid-level Skilled job**	**Grade**
Company 1	HR Officer	3
	General Service Officer	3
	HSE Officer	3
	Plant Superintendent	5
	Plant Operator	3
Company 2	Reservoir Engineer	7
	Plant Interface Engineer	7
	Sub-Sea Engineer	7
	Project Engineer	7
	Senior Reservoir Engineer	8
	Graduate Reservoir Engineer	5

Middle or intermediate level jobs in the oil and gas sector are between grade 3 and grade 9. In company 1, an example of a grade 5 level job is that of plant superintendent. Below this grade is the General Services office, HSE Officer, and HR Officer, all at grade 3. In company 2, a technical job at a higher level of skills 8 & 9 is equivalent to offshore Team Leader and Senior Reservoir Engineer. Lower grades in this company at level 7 include Drilling Engineer, Production Operations, Project Engineer, Subsea Engineer, Project Interface Engineer and Reservoir Engineer. Graduate Reservoir Engineer and Graduate Operations Engineer are also below grade 8

Technical occupations span from Plant Operator at job level 3 to Offshore Team Leader at job level 9. Reservoir Engineer, Project Interface Engineer, Subsea Engineer, Project Engineer, Production Operations, Drilling Engineer Project, Plant Superintendent, HR Officer, General Services Officer and HSE Officer at different job grades are all in the category of middle-level technical jobs identified by respondents.

5.2.2 Most important criteria for employment in intermediate or middle level occupations in the oil and gas industry

When interviewing applicants for intermediate or middle level employment, the oil and gas companies require the following: training and related experience, a minimum of a Bachelor's degree and excellent analytical skills, and communication skills (both written and oral. – "It is not enough to only have a good degree; we expect our employees to have business skills to enable them to hit the ground running"). A reason given for the requirement of a minimum of a Bachelor's degree for all technical occupations from level 3was that "A good degree is an indication that one can absorb information and learn quickly on the job. It is also an indication to the employer that

one may have some transferrable skills relevant in the workplace." The emphasis on excellent analytical skills is because these "…allow us to evaluate each candidate's problem-solving ability." According to one of the management representative, excellent communication skills (both written and oral) are needed because "being able to communicate effectively increases efficiency in the quality of work an employee does."

5.2.3 Types of knowledge and skills required in intermediate and middle-level employment

Respondents' answers to the question "What forms of knowledge and skills are required in middle-level or intermediate jobs in the company?" were formal knowledge (scientific laws and principles gained through study), situated or practical knowledge (gained through on-job experience), knowledge of rules and procedures (as specified in company manuals), proficiency in Microsoft Office Suite applications. In terms of rating in ascending order, hand dexterity or manual skills were considered the least important. High in this ranking are diagnostic and reasoning skills and planning, organizing and time management skills, ability to handle multiple tasks simultaneously, and communication skills.

5.2.3.1 Kinds of diagnostics and problem solving knowledge and skills applied to intermediate or mid-level occupations

When the question was posed, "Which of the following kinds of diagnostics and problem-solving skills apply to skilled jobs in your company" Industry representatives 1 and 2 had varied views on whether these are often or very often relevant. Overall, the following was considered necessary to these categories of jobs: diagnostic and problem solving skills, as part of routine work or maintenance, standardized diagnostics and problem solving, as specified in operations manuals or

through using diagnostic tools; working out solutions to unknown or novel problems through practical experimentation with essential tools and materials; drawing on the experience of similar or related problems and then making drawings or sketches before tackling the problems practically; drawing on formal scientific principles/theories to diagnose and solve problems mentally or 'virtually' before proceeding with identified solutions;, using Google and the internet to find solutions used by others experiencing the same kind of problem;, bringing new problems to a team meeting for joint diagnostics and problem-solving.

5.2.4 Changes in ways of working over the last five years

There has been a change in the work requirements of middle and intermediate jobs over the last five years. Industry respondents explained that either skilled workers learn the new work methods by training or through a management of change process, and the re-issue of procedures with updates approved by management. Resolving the problem of technological change could also be done by joining societies to stay abreast with the latest technology and any new developments, and by attending conferences and workshops.

According to the industry respondents, changes are due to tools and technology updates but the changes are not fundamental. For example, industry respondent 2 gave as an example of a change "Kanepi software has replaced the use of Excel Spreadsheet in generating Daily Production Reports over the last five years".

While skilled workers can adopt procedures and policy changes based on changes to the operation of the FPSO, when such changes occur, re-training is required.

When asked whether they had anything else to say about the future of skilled workers in the company, offshore representative 1b stated:

> Research is always ongoing in various universities on oil and gas companies to find solutions to current challenges. These new solutions are sometimes improvements to current ways of working or are novel ideas patented and proposed by companies. There is no sure way to determine which breakthrough will change which part of the vast oil and gas industry. Some areas of research are advances in Drill Bit and DrillString Technology and Advances in FPSO technologies (Pumps, compressors, gas turbine technologies, valves), to mention a few. Some advancements are also a result of incidents or accidents in the industry-leading to new regulations (e.g. BP Macondo blowout, Exxon Valdez Oil Spill, North Sea Piper Alpha Incident). In addition, the use of software and technology (automation) will become more prevalent in the next 10-20years. These changes will reduce the number of manual calculations and interventions.

5.2.5 The kinds of problems that can occur in the oil and gas industry

In responding to the question about what kinds of problems skilled workers could experience on the job, industry representatives were unanimous.

> Loss of primary containment (release of hydrocarbons from pipework, gas release) leading to pollution of the sea, explosion, loss of property & assets as a

result of fire, injuries to personnel, accidents leading to disability or potential fatality, wrong analysis of data, failure of types of equipment.

In response to how to reduce risk in the company, the following were offered:

First, assess the risk (with mitigations in place), and reduce the risk to ALARP (as low as reasonably practicable). Secondly, adhere to temporary working instructions through control of work (permit to work system) and carry out the incident investigation to prevent a recurrence. Furthermore, strict adherence to safety protocols and practices, proper verification of all data, routine maintenance culture, and having standardized operating procedures and risk and assurance principles are necessary.

5.2.6 Summary of risk and risk mitigation in the oil and gas industry

Risk	Response/Mitigation
1 Loss of primary containment (release of hydrocarbons from pipework, gas release) leading to pollution of the sea	First assess the risk (with mitigations in place)
	Reduce the risk to ALARP (as low as reasonably practicable)
2 Explosion	

3 Loss of property & assets as a result of fire	Adhere to temporary working instructions through control of work (permit to work system)
4 Injuries to personnel	Carry out Incident investigation to prevent a recurrence
5 Accidents leading to disability or potential fatality	Strict adherence to safety protocols & practices
6 Wrong analysis of data	Proper verification of all data
7 Failure of types of equipment	Routine maintenance culture
	Having standardized operating procedures

5.3 Findings from interviews – industry perspective

Findings from the interviews enabled insight into the classifications of occupations in the oil and gas industry. It also allowed the researcher to engage participants in probing further to elicit detailed information.

5.3.1 Employment categories and numbers in each category

Company	**Number of Employees**	**Category of jobs/occupations**
Management Representative 1	Direct employees 282 as at November 2020	Direct jobs are made up of: a Petrochemicals b Support Petrochemicals is made up of drillers, petroleum engineers, reservoir engineers, production technologist, geologist, production operations and sub-team disciplines. Support services is made up of finance, legal, external affairs and human resource.

		Respondent said by their operations regime, the FPSO is operated by a third party – MODEC. 'The third party provide us with the technicians, operators and all of that'
Management Representative 2	1 Direct employee (Expatriates and Nationals) 200 2 Indirect (Contractors and auxiliary services) 500	Direct jobs are made up of a Technical b Support Technical - which is geological is made up of drilling aspect and project development aspect and agency. Support - is procurement, insurance, finance and commercial and negotiation.

In 2020 direct jobs in both companies were approximately 300; made up of jobs in technical and support services. In addition, the industry creates more job opportunities in its value chain (contractors and auxiliary services) (Management representatives 1 & 2).

5.3.2 Occupations and qualifications required for employment in a skilled job

As is typical of oil companies, similar occupations or jobs exist in both companies. management representative 1 classified employment in the sector into direct and support staff, in other words, those performing petrochemical roles were referred to as technical or direct staff. Drillers, petroleum engineers, reservoir engineers, production technologists, and geologists make up the technical staff category. Management representative 2 classified occupation categories into

production operations and sub-team disciplines as technical. This category of occupations is supported by finance, commercial and negotiation, legal, external affairs and human resources.

Middle-Level occupations listed by Management representative 1 included reservoir engineer, subsea engineer, operations engineer, drilling engineer and senior accountant. A minimum of a bachelor's degree is required with preference given to holder of a master's degree. A bachelor’s degree is also required for lower-level occupations like graduate reservoir engineer, graduate engineer and finance analyst. Team assistants require a minimum of a diploma qualification.

5.3.3 The future of skilled work in the companies

In the next 10-20 years, skilled middle-level jobs will still exist in the companies. Management respondent1b argues that "these category workers play a key role within the company and transition with experience to higher levels or roles within the company" Management respondent 1a further stated that:

> Artisanal or middle-level skilled work of this kind will shift upwards to a higher level of knowledge and skill at the technician level in as much as AI and automation technologies will affect the majority of skilled jobs across all job level. It is a reality that automation will only change the nature of work rather than displace most workers.

The forms of knowledge will not vary much from what currently exists. However, dexterity or manual skills will become less significant. Diagnostic and reasoning skills, planning, organizing and time management skills, reading, writing and calculation skills and social and teamwork skills will become more significant in the next 10-20 years. Technological knowledge and skills,

innovative skills, and emotional intelligence will become more relevant in the future, according to one respondent.

The types of diagnostic and problem-solving skills will be much more demanding in the next 10-20 years with the exception of using Google and the internet to find solutions. While a lot will change in how work is done, skilled workers will learn the new work methods through formal training, manuals and procedures. Management representative 1b said: "The use of software and technology (automation) will become more prevalent in the next 10-20years, reducing the number of manual calculations and interventions."

When asked what tools or technology will be used in this job, or type of job, in the next 10 – 20 years, HR Representative 1b said tools and technology that will be used in this category of the job would include Process Engineering software, instrumentation which is a new and more sophisticated instrument that can be monitored and controlled more remotely (with higher reliability), automation of mechanical tasks like greasing, seal top-ups, reservoir management software and integrated systems. He further stated that the Well Engineer must brace himself or herself to know more about rock measurements during drilling and more sophisticated well drill strings and measurement tools. Workers learn through formal training, on the job training and monitoring from manufacturers of the tools and technology, new procedures (SOPs) and manuals.

Tools and types of knowledge required in this category of jobs in the next 10-20 years include the following, according to Management respondent 1b: AI tools (Seismic testers), new laws, rules and regulations from host governments, industry bodies (IOGP – International Association of Oil and Gas Producers).

However, all three respondents said staff generally learn to work with new tools and types of knowledge through on-the-job training and self-education by reading new rules/regulations/laws. Further answers solicited from Management respondent 1b suggest research is always ongoing in various universities and within oil and gas companies to find solutions to current challenges. These new solutions sometimes impact on and improve current ways of working. They include novel ideas patented and proposed by companies. Management representative 1a suggested that in as much as jobs will be lost with the advent of new technology and AI, the majority of skilled workers will be maintained, and a new work culture will be established.

5.3.4 High-demand occupations needed by the oil and gas industry

Demand for employees in mid-level occupations depends on the development phase. For example, Management respondent 2 explained that the company operates in different ways at different times. He said, "Currently, production is over; we are doing mostly maintenance work. So at the moment, the high phase (development phase), where usually there is demand, is where the project begins." In reviewing employment over the last seven years he explained as follows:

> In the beginning, almost seven years ago, we tried to find expertise in the development and production area. However, unfortunately, this is where we struggled, so obviously, we have to go through capacity building structure by relying on seconded staff from GNPC because we are such a big company. However, the company does have the capability of developing staff internally.

When asked from which institutions the companies hire young graduates, Management representative 2 said it is a combination of some from the technical institutes/universities, some from KNUST, some who have Masters degrees in the oil and gas fields. She elaborated as follows:

> For a geologist, specifically, it has to be a geological degree, someone who comes from an institution which offers a geological degree. For the drilling aspect, employment is a mix. The company can consider people from a wide-ranging area of disciplines from any basic engineering, mechanical, electrical engineering, mainly in the engineering field.

In responding to the question of the company's high-demand occupations, Management representative 1 stated that they are looking for production operations people as the company is still in the production phase. She emphasized the need for people who can operate the FPSO, production superintendents, and production engineers: "Those are the skills we are looking for and Ghanaians in particular for years and we never give up". When confronted with whether welding is a critical technical occupation for the company she stated:

> We do not hire directly for all those low-level roles; we subcontract. We have a fabrication yard, which is fully subcontracted in Takoradi. We have no day-to-day involvement at all. We give specifications, and they work and deliver. If we come in at all, our engineers come in to conduct quality assurance to see that whatever they have done meets our needs.

The new hires are generally from technical institutes/universities and regular universities. For a geologist, it has to be a geological degree. Someone who comes from an institution that offers a

geological degree – for drilling aspects and for production, it is possible to have people from a wide-ranging area of disciplines from any basic engineering mechanical, electrical engineering, mostly the engineering field. "I think of a few engineering disciplines that we have also taken on. Most of the engineers come from the technical institutes/universities, TVET 1"

5.3.5 How successful have companies been in filling vacancies

Somewhat surprisingly Management respondent 1 stated that the company does not have a problem finding young graduates. It relies heavily on its own assessment process that measures attitude and aptitude and cognitive capacity. In addition, prospective candidates are trained on the job after they are employed; this training is complemented by online courses when employees are first appointed.

Contrary to Management representative 1, Management representative 2 said finding people with expertise in the production area to fill vacancies was challenging at the initial stages. This problem led the company to go through capacity building education and training to develop staff at that stage.

5.3.6 Hiring decisions made by the companies

Management respondent 2 said that they hire graduates in terms of disciplines. If a prospective candidate is applying for a geophysical position, he or she must have a geophysics degree. Applicants for any engineering position should have a degree. The company trains new hires when it comes to technical knowledge as the technical knowledge acquired in the local institutions does not necessarily match their requirements. Outside technical knowledge, critical thinking, pro-activeness, organizational knowledge (understanding of how to work in an organization, including

simple things like drafting memos are expected of new hires. Problem-solving skills and a high level of tacit knowledge are required.

Answering the same question, Management respondent 1 stated that the educational system in Ghana is largely theoretical.

> The university gives graduates theoretical knowledge, so when they come to the workplace, you take your time to make them understand the structures of what they learnt in the university to give everyone a level playing field. Because we do know for a fact that those Ghanaians who were trained outside have a better experience because they have more practical experience than what we offer in the Ghanaian university.

A first degree in a specific discipline is an entry requirement for new employment. There is an internal process within the companies to determine what knowledge, skills and abilities are required for a specific job. As an internal process through which the right skills are determined for meeting the formal job requirements, Management representative 1 explained that there is a competency framework that covers each discipline within a professional 'family' of disciplines. The framework indicates the type of knowledge, skills, abilities and the level at which these are needed. Management representative 2 emphasized; "For each professional family, we have defined the skillset and knowledge-base that is needed and which applies to each recruitment process that we undertake"

In response to a further question, Management representative 2 explained that:

> There are two categories—young graduates and older adults who have experience. For young graduates, we test aptitude in terms of problem-solving, numeracy and literacy. Specific scenarios come into play and revolve around probability and what they will be doing in terms of their jobs. For example, when we provide a problem-solving case, it might have revolved around, let us say, a contract engineer. It might be a procurement problem, e.g. if you develop a contract, what are you supposed to do in a particular instance to see how people or individuals react. That is, we ask for responses to specific job-related problems.

Traditionally, the focus of TVET provision in Ghana has been on a lower level of qualification than is required by the oil and gas exploration and production companies. Consequently, the initial rollout of CTB by TVET providers was at a lower level of qualification than was required once oil was discovered in commercial quantities.

5.3.7 On-the-job training

From the perspective of Management representative 1, the company's on-the-job training philosophy is based on the 70-20-10 principle. That is (70%) of the training is gotten on the job and then (20%) through coaching, mentoring, workshops, professional association and (10%) in the classroom.

Management representative 2 stated that on-the-job training from a career path point of view takes different forms: shadowing and cross-posting. Shadowing is a way to understudy somebody to gain experience within the role and also the role above yours to develop your set of skills. Cross-

posting involves an employee swapping posts with a colleague from another country. The aim is to study the different circumstances and problems of that country.

Management representative 2 further explained that they have National Service, apprenticeship for individuals through the Company 3 and Regulator 2, and even individuals who \approach the company directly. However, these apprenticeships do not necessarily lead to direct employment in the sector.

5.3.8 Engagement, collaborations and partnering with local education providers

The two companies engage, collaborate and partner with local TVET institutions in different forms and at different levels. However, Management representative 1 stated that they collaborate and engage only when approached. This respondent also gave examples of individuals who come to the company to do their MSc project work. 'We used to collaborate with the University of Mines and Technology, but that no longer exists. We give scholarships to the University of Ghana and KNUST to brilliant students studying engineering.'

When asked about their collaboration with the technical universities and institutes. Management representative 1 said that the company funds them through their social performance scheme. 'We trained their lecturers in the past, taking them on courses, and every year we give funding to them.' Surprisingly, the respondent also said: "But the people who study there will be the ones who will go and work in the fabrication yard and with the spare parts contractors. So the people that we hire are those who come directly from the university."

When Management respondent 1 was asked whether the company's objective was to give institutions funding and absorb the product directly, the respondent said:

> No, but we expect their product to find work in the oil and gas industry. Through our local content support, all these companies I talked about, Tullow supported them to be able to be at a level that the oil and gas will expect them to be in order to win contracts as third party contractors

Management representative 2 concurred that the company has collaborated with TVET and other learning institutions.

> …We have had a few educational programmes in the Western Region where we trained teachers, like train the trainer, to undertake specific courses within those regions, primarily vocational and technical. We have also engaged some of the technical institutions like the TVET 2 and a few others to develop the lecturers' expertise. They had the opportunity to undertake some lessons with lecturers from Italy and a few other places. Their skills and expertise were emphasized and enhanced in geology and engineering. We have had that in the past. The last one we had was in 2018 concerning curriculum development as one aspect of expertise enhancement.

As a result of COVID-19 in 2020, the company had not had any such collaborations with any higher learning institution. The respondent further noted that at the moment, they are not recruiting because the project is streamlined and they do not require a recruitment drive yet.

When asked whether they have any collaborations with the technical institutions, Management representative 3 said they have not had any direct collaborations but had a joint partnership with

C to set up a training unit in Takoradi where the technical schools could go and have practical training. The respondent emphasized:

> When we took them through proper vocational training in electrical, mechanical, and production fields, we did that. We set up a joint institution there with our jubilee partners then. Then we sent teachers from Cape Coast University to Aberdeen, Scotland to be certified as NVTI trainers and all of that so that those from the technical schools get the opportunity to go there. The jubilee partners heavily supported them. Furthermore, when the term of the MoU (Memorandum of Understanding) ended, we handed it over to Cape Coast University to continue with it.

5.4 Technical and Vocational Training Institutions

Interviews with representatives from these institutions provided information about the following: brief background to the institution; the kind of courses the institution offers and in which occupations; records of past students working in the oil and gas industry; on-the-job training for students in the oil and gas industry; engagement and collaborations (if any) with oil and gas companies and other institutions; high-demand occupations the oil and gas companies are looking to the institution to provide.

5.4.1 Courses for the oil and gas industry offered by TVET institutions

TVET institutions that offer oil and gas courses are limited and concentrated in locations where exploration and production occur. The technical universities in this area of specialization offer

most engineering courses, and technician courses, while the technical institutes focus on technician courses supported by engineering for the oil and gas industry.

This section presents a brief historical background of these institutions and their courses.

5.4.2 TVET 1

HISTORICAL BACKGROUND AND COURSES OFFERED

TVET 1's current student population is 15,000. Historically, it had an engineering focus to support the railway and harbour operations in Takoradi. Its mandate was to produce engineering components required for engineering services within the railway and harbour services when it was established as a Technical Institute in 1954. In 1993, the institution was upgraded to tertiary polytechnic status. In 2016 and amended in 2018, it was offered tertiary technical university status. Although the university focuses on engineering, its niche is oil and gas.

The Engineering Faculty includes the following fields:

Mechanical,

Electrical and

Civil as their major areas.

Branches under these fields include:

Process Engineering,

Instrumentation Engineering, and

Health and Safety that cuts across all industries.

All the courses offered by the university are tailored to oil and gas.

5.4.3 TVET 2

HISTORICAL BACKGROUND AND COURSES OFFERED

The current student population of TVET 2 is 2,000+. The University was formerly called the Ghana Nautical College, was established by the government of Ghana and was founded in 1958 to train seafarers. The college was upgraded to the Regional Maritime Academy in 1983 and managed by the sitting Ministers of Transport of Ghana, Cameroon, Sierra Leone, Liberia and Gambia. Then in 2007, it was upgraded to become a university. The Regional Maritime University focuses on Marine Engineering Mechanics, Refrigeration Technicians and Welding for the oil and gas industry. Their welding workshop was rehabilitated and upgraded by MODEC, a partner to Tullow, to meet the standard of training for the industry. They currently have two faculties: Maritime Studies and Engineering and Applied Sciences Faculties and the School of Graduate Studies.

The following departments fall under the Maritime Studies Faculty:

Transport Department,

Nautical Studies

Maritime Safety and Security Center

Under Engineering and Applied Sciences Faculty: (BSc & Diploma)

Marine Engineering Department,

ICT and

Marine Electrical Electronics Department (MSc program in Renewable Engineering)

MSc programs which include Environmental and Bio-Processing Engineering programs,

Units of Applied Sciences not fully Departments:

Physics and Nautical Causes

School of Graduate Studies (MA Port and Shipment Administration)

It is only the department of electrical science; they does not have any master's programme yet

5.4.4 TVET 3

HISTORICAL BACKGROUND AND COURSES OFFERED

With a current student population of 4,243, TVET 3 is one of the technical institutions identified to train the potential workforce for the oil and gas industry. Courses and programmes geared toward the oil and gas industry out of the many other programs offered by the University include:

Mechanical engineering,

Welding and fabrication,

Plumbing and

Gas fitting technology.

Other courses include:

Building construction technology,

Business studies (accounting option) and information technology option Business studies keyboarding option,

Computer hardware technology,

Digital design technology,

Electrical engineering technology,

Electronics engineering technology,

Fashion designing technology,

Hospitality and catering management,

Information technology,

Mechanical engineering technology,

Motor vehicle engineering technology,

Plumbing and gas fitting technology,

Refrigeration and air condition,

Small engine repairs,

Software development and

Welding and fabrication technology

5.4.5 TVET 4

HISTORICAL BACKGROUND AND COURSES OFFERED

TVET 4, with a current student population of 1,646, was founded in 1963. It is a technical institution and therefore runs technical programms under Ghana Education Service. The institution offers:

- Welding and Fabrication Technology
- Electronics Engineering,
- Computer Technology,
- Plumbing and Gas Fitting Technology,
- Wood Construction Technology,
- Building Construction Technology.

Accreditation has been sought to run oil and gas capacity building programmes in mechanical engineering, plumbing, and gas fitting.

5.4.6 Records and tracking the employment of past students in the oil and gas industry

TVET representative 2 from TVET 2 said that the university does not keep records of its past students in the oil and gas industry. However, the institution has a fair idea of their past students in welding, electrical science, marine engineering and electronic engineering in the industry. ‘We are not directly linked with the oil and gas industry even though we have some relationship’, the respondent stated.

TVET representative 1 from TVET 1 explained that the institution has a tracking mechanism in place. The respondent outlined two models available to them to track their past students. First, the Tracer Study Model uses an industrial attachment supervision format. They deploy all their students on industrial training attachments. Students do semesters out for Competency-Based programmes and at the end of the year for all Masters, Bachelors, Higher National Diplomas and Diploma programmes. Secondly, the institution offers the supervisors the opportunity to help the industrial liaison office and the Career Guidance Centre in the same process to acquire some information in the field in which the graduates are situated.

TVET representatives 3 & 4 from TVET 3 and TVET 4 respectively, were not aware of any system for monitoring their past students but could account for their transition to the world of work satisfactorily, particularly to welding. When asked whether the institution has records of past students in the oil and gas industry, TVET representative 3 gave a positive account of how their graduate students transition to the world of work but was not sure of the numbers. The respondent said, ‘We have a department down there called oil and gas department, we have all the facilities on the rig there and some of the companies bring their workers to be trained.

The tertiary TVET institutions developed better mechanisms in tracking their graduates in employment in the oil and gas industry than the pre-tertiary ones, knowing that their students don't qualify in the first place to work in the industry at that level.

5.4.7 High-demand occupations in which the oil and gas sector is looking to employ personnel

TVET representative 2 considers engineering, electrical electronics, port and shipping administration, welding, and navigation as high-demand occupations in which the sector is looking to employ suitably qualified workers. TVET Representative 1 stated that the industry is currently looking for technicians that can produce oil on the FPSO; Process, Mechanical, Instrumentation, Electrical, Health and Safety and Process specialists to work in the control room with hand tools and for Mechanical Engineers to maintain pumps and valves that are part of the production phase. For TVET representatives, the most important are the welding and fabrication occupations together with gas fitting technology, and mechanical engineering. TVET representative 4 did not offer any direct response to this question but said;

> what we offer as a course under the Ghana Education Service cannot take these kids that far. The education we offer at this level is woefully inadequate to get products to the oil field because the course content of certificate II intermediate is such that it just gives the basics. To be able to get employed, the student needs to go beyond the basics.

The TVET institutions under review are aware that mid-level occupations are in high demand by the oil and gas companies. The pre-tertiary institutions however, agree that they fall short of the

technical requirements, both in qualification and experience in meeting the demand of the oil and gas companies. Similarly, all the role-players and researchers argue that mid-level skill are not only in high demand but cannot be sort in the local labour market.

5.4.8 Knowledge, skills and abilities expected of graduates by the oil and gas industry

According to TVET representative 2 the government has acquired equipment and upgraded the institution's existing infrastructure in order to scale up the knowledge, skills, and abilities of students to help meet the industry's demands. Unfortunately, TVET 2 does not yet have a comprehensive understanding of industry requirements. Current understanding is fragmented. For example, the industry wants prospective graduates from the institution to have teamwork abilities, be able to hand over to the next shift, monitor, control and shut down safely, noted TVET Representative 1. The industry expects students to have underpinning knowledge, the concept behind every action, followed by performance skills. The internal mechanism by which the institution determines students' knowledge, skills, and abilities is by what TVET representative 1 calls 'the internal verifiers', Internal Party Assurance and the External Quality Assurance. These verifiers are used in the middle and at the and end of training, respectively, to ensure that skills acquired meet industry specifications or requirements. The institution also has industrial mentors who interact with the trainers and the students. The respondent further reiterated the point:

> Some of our students were among the first that worked on the FPSO Kwame Nkrumah. Some of them did their first degrees in other universities, but after their programme, they were brought to TVET 1 to be trained to have the competency to work in the oil and gas industry. The same institution has trained

> the first female to work on the FPSO, although that female graduated as a petroleum engineer from UmaT. Some of the lecturers were sponsored by the industry to become certified instructors in order to lead the development of curriculum in petroleum engineering, process, mechanical engineering, and welding and fabrication in the institution. This process further built the capacity of the institution to train for industrial competence.

TVET representatives 3 & 4 explained that their institutions have not had enough collaborations with the oil and gas industry to determine the appropriate skills expected of their students. The credentials they turn out are certificates 1&2 in welding but 'the companies need the American Bureau of Welders certification and the Canadian certification regarding welding.'

The technical institutes do not have any internal mechanism for determining the knowledge, skills, and abilities the oil and gas industry wants. "When we teach, we do not match what industry needs; we are just going the way the public second cycle technical institutions teach."

TVET representative 4 notes that:

> the petroleum commission, in recent times, have gotten two of our past students to Canada to go and train there and be certificated at the Canadian Welding Bureau Certificate, which is needed in the oil fields.

Though the understanding of the knowledge, skills and ability demanded by the oil and gas companies is fragmented, the TVET universities have better control of what the oil and gas sector want through their internal verifiers, internal party assurance and external quality assurance

mechanisms. These mechanisms are, however, absent in the pre-tertiary TVET institutions on the back of government policy defining their status.

5.4.9 The role of oil and gas companies in supporting skills development at technical institutions

TVET representative 2 described how the institution's welding centre was built and financed by Company 1 and MODEC to help narrow gap between demand and supply of skilled workers. The institution sometimes gets information from the oil companies about what they require but this is not always well-aligned with the numbers of, for example, welder being trained at the institution at a particular time.

For TVET representative 1, the recommendation of the Jubilee partners to locate rig duplicates (a copy of the rig offshore for learners to have practical experience) in TVET 1 to give them what they want in return, is a step in the right direction. The development of the certification manuals and training that is approved by the industry's external verifiers, with an industry approved curricula for certification being part of this package, is a further positive development.

According to TVET representative 3, the industry has upgraded the oil and gas department of the institution with the requisite tools and infrastructure to raise the teaching of skills to industry standard. However, TVET representative 4 argues that the institution is yet to have such magnitude of development:

> I cannot cite examples of any capacity building training for the workers. However, I have heard about their presence in other institutions like TVET 3 to

> give workers, people who are already on the staff, the capacity building training to make them more ready to meet the challenges of the job.

Investment in skills development by the oil and gas companies in the TVET sector is enormous. The TVET universities have benefited more in these developments to the extent that certification and training manuals and industry-approved curricula for certification are supported.

5.4.10 On-the-job training opportunities offered by oil and gas companies for students from technical institutions

TVET representative 2 stated that the institution does not have any formal memorandum of understanding with the oil and gas companies in this respect. Individuals find their way to the companies to undertake internships, although such internships are not always available. However, TVET representative 1 explained that the institution trains new hire students brought to them by the companies for competency development. The companies also have industrial mentors who require the institution to be at the workshops (industry). The respondent further explained:

> when we say the student is competent, he has also signed out that he is competent. He will have no problem working with that particular person or division in the industry. For instance, the industry recruits people from other universities, e.g. KNUST or any other institution; some even come from Nigeria and other places outside the country. When they recruit them to work with, they bring them here for competency development. Students from this institution meet their expectations almost all the time. The industry sponsors many of the guys brought in here by the industry for training.

TVET representatives 3 & 4 stated that their respective institutions only have access to these companies through the Regulator 2 and the Company 3.

The company regulator regulates internships offered by oil and gas companies that do not necessarily lead to eventual employment. Similarly, the TVET institutions do not have a formal memorandum of understanding with the oil and gas companies on on-the-job training as part of the skills development process.

5.4.11 Engagement, collaboration and partnering with oil and gas companies

According to TVET representative 2, the institutions have collaborated with the oil companies at the institutional level but such collaborations are not well structured. “We have collaborated with Company 1 in the deeper sense but also interact with other companies as well” When asked in what ways the institution interacts with them, the respondent explained that, for example, a company called Fendercare and an engineering company supporting the oil and gas do not own any of the wells, but they support companies. “Fendercare, for example, rehabilitated and refurnished our I.C.T. lab with new computers” The institution collaborates with the Petroleum Commission more than with individual companies, the respondent noted.

With reference to collaboration, TVET representative 1 confirmed extensive collaboration with MODEC, Company 1 and Nyinson (Jubilee partners). In the initial stages, the institution benefited from expatriates as guest lecturers in class. The respondent argued that workforce data from the companies are centralized at the Regulator 2 and accessible by the institution. There is further collaboration through a Board that interacts with external industries. (PS 1., PS 2), university local union are part of our governing board). TVET respondent 4 said the institution has had some

engagement meetings with Ghana Gas and Company 2 but this engagement has yielded no tangible results. The respondent, for example, lamented:

> The companies come, we will discuss beautiful proposals, but we do not see them here at the end of the day. So, we have had some engagements for now, but it has not yielded any results. We have had engagements with Ghana gas. For Company 2, we visited them, but they did not give us the audience.

TVET representative 3 said the institution collaborates with the companies only through the Regulator 2 and company 3. As a result, the respondent argued that these two institutions virtually control the upstream subsector.

Technical and vocational education and training institutions collaborate, engage and partner with the oil and gas companies. The process through industry and the TVET regulators brings together third-party players in skills provision to the oil and gas sector. The university's local union find expression as a board member that engages industry.

5.5 Involvement of other institutions in the relationship between demand for and supply of skills

This section examines the roles the Representative of AGI (PS 1), Ghana Employers Association (PS 2), General Transport, Petroleum and Chemical Workers Union (PS 3) and the Ministry 2 play in contributing to skills provision by TVET institutions. How they engage and collaborate influences the type of skills TVET institutions produce for industry and how the TVET institutions provide skilled workers for occupations in the oil and gas industry.

5.5.1 Association of Ghana Industries (PS 1)

The AGI Representative stated that engagement with the government takes the form of annual budgetary inputs in preparing the national annual budget. The Association further engages with the government on members' concerns regarding industrial development in that particular year; policy and position papers prepared by the Association and the government depending on the issue at stake.

The Association serves on several government boards by law: Export Promotion Authority, Ghana Shippers Authority, all the technical universities, formerly termed polytechnics and the Regulator 2. The Association also serves in committees within the Ministry of Foreign Affairs, Ministry of Trade and Industry, Ministry of Finance, Ministry of Energy and several others, all to influence policy. In addition, the Association influences training and skills development through its representation on the COTVET Board and sector skills bodies.

The AGI Representative explained that the Association influences skills development through its involvement in curriculum development as a member of the Regulator 1 and Ministry 1 boards. PS 1 gets its members involved in the process. The respondent further explained, "I know of a skills gap analysis which is a huge document they developed. We are doing other policies with global policy makers in reducing the skill mismatches" The respondent noted that skills mismatches have always been there. The skills mismatches have led employers in the oil and gas industry to hire labour from outside the country, especially for the core technical occupations.

The PS 1, as a member of the local content committee, aims to address skills mismatches. The local content committee aims to ensure that skills are developed locally, but more importantly, to

push the companies to employ people locally to help reduce unemployment. Companies have to submit their annual plans and then their plans for engaging locals as far as possible every year. The government, through the Regulator 2, wants to see whether the country is improving in replacing foreign employees. The respondent explained:

> What we have done in the case of the oil and gas industry is that even when we rely on foreign experts, we have a programme developing locals by having them understudying the expatriates. With time the state should be able to allow the locals to work. This is what we should be pushing for.

The AGI representative stated that "The educational system is theoretical and lacks the facilities to make it very practical". The industry has made a great deal of effort, aided by the government, to improve facilities in some technical institutions. For example, Company 1 has invested about one million dollars in the TVET 1 for practical training at the institution. The competency-based training policy adopted by Regulator 1 is also helpful in complementing the investment by industry in developing skills. The respondent further noted:

> The industry is not growing that fast, and it becomes a challenge to get the attachments for students who come out in their numbers each year. Sometimes they go to the wrong places, which does not help, but generally speaking, I think it is a good curriculum.

5.5.2 General Transport, Petroleum and Chemical Workers Union (PS 3)

The PS 3 Representative stated that the union does not have any direct collaboration with other stakeholders but only with the oil companies whose workers they organize. The respondent emphasized that they do not have members in other oil and gas companies because they either sold their oil block or folded due to the pandemic. The union primarily negotiates workers' service conditions to guard against exploitation by the employer as guaranteed in the Ghanaian Labour Act. The respondent emphasized:

> We are a trade union. So we must negotiate and negotiate very well for the worker. So as part of the negotiations, we do not only look at what workers take home but the service and conditions that require that the worker is not disadvantaged.

As a national union, the union's influence is at the level of contribution to the local content policy but the union does not get directly involved in training. Priority is given to promoting locals to occupy certain job categories in the oil and gas industry. It is the duty of the government, the union and other stakeholders to ensure that its citizens get employment in the sector. The PS 3 Respondent further stated: "We are keenly observing and monitoring to ensure that the law is enforced to the letter even though it has its difficulties, admittedly."

The GTPCW representative explained that training is ongoing for the oil and gas industry at the University of Cape Coast, KNUST, and TVET institutions. Therefore, the union does not think there should still be conversations about skills mismatches in the oil and gas sector. The respondent further stated, "In training, I think institutions have turned out many of our citizens to take

advantage of the job opportunities in the industry." The union believes most jobs require technicians who can do the job and not graduates. The industry itself is training many more technicians to take up the jobs. The respondent argued that most of the graduates lack the technical know-how and have to be further trained on the job.

5.5.3 Ghana Employers Association (PS 2)

5.5.3.1 Engagement, collaboration, partnering with government, the oil and gas industry and other stakeholders

The GEA representative explained that the Association collaborates with various tertiary institutions. The Association does this through workshops and stakeholder meetings to deliberate on issues of work and technology advancement in general. Offering students tours to industrial bases and using professionals from the industry to act as guest lecturers are two of their current ways of improving the skill-sets of employees in the oil and gas industry.

The GEA representatives explained that the Association at the national level sits on several Boards whose aim is to improve skills for industry. For example, the Association is on the Boards of Regulator 1, the National Council for Curriculum Assessment (NCCA) and the National Vocation Council for Females.

PS 2 participates in the sector skills body of the International Labour Organization (ILO). PS 2 started with construction and agriculture, and now it is dealing with oil and gas to be followed by manufacturing. The sector skills body will determine and recommend what skills are in high demand and the skills-sets students require. The respondent explained the following view:

> Because day in and out, people believe that those who did not qualify well in the tertiary institutions typically resort to the TVET system. That in itself also affects the employer's valuation of the product that the TVET training institution brings out, so it may not necessarily be a structural problem of the nature of skills that they have, but it usually has to do with an ideological perspective where people believe that it is the 'gunk' that is there so nothing good will come out of the system.

The Association influences the structuring and formulating of curricula for TVET related skills for the country through its representations. The Association is also making a case for compulsory industrial attachment for students at the end of every long vacation. The recommendation is part of the National Employment Policy with the Ministry of Employment and Labour related to fitting workers' skills to employers' needs.

5.5.4 Ministry 2

The MELR representative explained that the Ministry engages with employer associations and organized labour. Through the PS 2, they link up with the private sector and with PS 1 depending on the issues under discussion. The respondent stated: "I do not remember partnering with any oil and gas company directly. Because of our set-up, we work in a tripartite arrangement."

The Ministry operates more in the broader policy framework that brings all these stakeholders together to deal with subject matter. The respondent expressed the view that:

> we should have a way of creating some platform to engage the sector directly to get to know some of the nitty-gritty of what needs to support the sector**.** If that

> is lacking, though you are in the loop of collaboration, you may not necessarily get to know many happenings in that sector.

The MELR representative insisted that it is not their mandate to develop the curriculum of the TVET institutions. Theirs is to give policy guidelines to the Accreditation Board based on market surveys of the skills demanded by industry. The Accreditation Board has to determine the kind of skills provided by TVET. The Ministry identified the existence of skills mismatches in the oil and gas industry as the skills demanded were not those traditionally produced by educational institutions. The respondent stated that the Ministry also identified the cost implication to the government in developing the skills required by the oil and gas industry. For example, the respondent noted the need for skills in underwater welding:

> It is a huge opportunity that is there. The government has not invested much in that. Private sector companies are trying to do something, but the private sector is into profit, so they will not go into it when the venture is not profitable. So we need the government side to support young graduates who have the interest to be underwater welders but do not have the money; then the government should support those persons to be able to acquire the skills.

The MELR representative was unsure how the entire education and training field were providing knowledge and skills for the oil and gas industry but could only speak for the National Vocational Training Institute. ‘When it comes to the technical skills required by the oil and gas industry, people have studied internally and externally to acquire skills on their own in this area. The

respondent explained that it is a problem of how government can position itself to invest in those areas of skills training for the industry.

The respondent further stated that some private sector companies provide training for management and for occupational safety and health. However, there is a lot more to be done in terms of technical skills in high demand by the industry.

Collaboration role by the private sector: Association of Ghana Industries, Ghana Employers' Association and Ghana Transport, Petroleum and Chemical Workers Union are critical to skills provision to the oil and gas companies. Similarly, government ministries and departments are preoccupied with the policy framework guiding skills provision and development.

5.6 Sector regulators

This section examines how the sector regulators (Regulator 1 and 2) understand and are involved in issues of skills supply by TVET institutions; high-demand occupations in the oil industry knowledge, skills and abilities expected of would-be employees to meet industry demand; level of involvement in resolving skills mismatches; developing TVET institute to meet critical needs of industry; on-the-job training opportunities for TVET students and engagement with education and training providers and other stakeholders.

5.6.1 Regulator 1

For Regulator 1, the concept of mismatch became apparent after the organization had assessed TVET programmes, equipment and tools and then the industry's expectations. "We started pushing out lots of information about mismatches, and over time it became tunes for almost everyone", the Regulator's representative stated. With the aim of matching supply to demand, the council needed

to use standards and the standard used was determined by industry. The industry training advisory committee came together with experts to determine the standards. The system now has a sector skills body in place to deal with the industry's skill needs and anticipated skill needs.

The Regulator's representative stated that the mandate of the Commission makes it imperative to coordinate all activities of TVET institutions, public and private, formal and informal and related matters. At the curriculum development level, the Commission works closely with industry to determine the occupational standards used to generate the curriculum for the various TVET institutions. The Commission has played a critical role in designing the strategic plan for TVET transformation, which was introduced in 2018.

At the policy level, the Regulator's representative claimed that the Commission has rationalized assessment by ensuring that a National TVET Qualifications Framework is developed so that all qualifications and certifications should emanate from this framework through the use of a competency-based approach which sets the standards for training.

The respondent further explained:

> We just finished developing skills for the industry project that AFDP supported, and now we are looking forward to starting the jobs and skills project that has approval from parliament. We are working on the Ghana TVET report; this is a first in the field. The only country I know that has been working on it is Germany.

In responding to the qualifications framework, the respondent explained that the Commission came up with a policy that recognizes people's prior knowledge and prior learning as part of the framework. In furtherance of its aim, the Commission is harmonizing and leveraging accrediting institutions across the country that will become the hub of assessment. For example, on the advice of the Commission, the government is upgrading workshops at TVET institutions by replacing obsolete equipment to meet current industry standards.

The Regulator's representative noted that the first high-skills occupation that comes to mind is underwater welding. This occupation is always needed, but people with this skill are not readily available. "Welding has always been taught in the schools but the courses do not go deeply into some of the heavy metals the oil and gas industry use. So hardly will you get any technical institution going through welding and using that technology and assessing competence in its use"

The respondent gave a brief account of the skills required in the industry and explained that until Ghana found oil in commercial quantities, nobody talked about the skills required by the oil and gas sector. The few people who had the required skills were those working in the GNPC and TOR, and those who came from that field of expertise either travelled out or worked in the few secretariats. The respondent mentioned TVET 2 and TVET 4 and some institutions around the Jubilee area as examples of institutions that are privileged to be provided with workshops of the standard required to upscale students' practical knowledge.

According to the Regulator's representative the most significant breakthrough in resolving skill mismatches is the accomplishment of the needs assessments and the skills gap analysis and audit of seven sectors, including energy which, embraces oil and gas.

The skills gap analysis gave a great deal of information on the challenges of skills provision for the oil and gas industry and the regulator has offered to engage more with industry players to develop training programmes that the industry requires. The respondent stated, "Over time, we want to make sure that there will be nothing like a mismatch, we would have closed the gap completely and the people will be very skilled to do things that they are trained to do."

The Regulator's representative discussed "on-the-job training as an internship and on-the-job training as a form of skilling-up after recruitment". On-the-job training as an internship is a good thing but a disincentive to the employer because it comes with a cost, so if everybody recruited has to be trained to start, then there is a problem. However, if on the job training is upskilling, it is a good thing. Hence, there is a need to look at it from two different sides. The commission guides prospective recruits through a recruitment process that enables them to use their existing skills when they are employed. However, because of changing technologies and new ways of doing things, the companies then need to offer professional development opportunities to upskill their employees.

Regulator 1 has a coordination and collaboration role. The Commission has an MoU with several institutions - PS 1 and international partners. It does not have the same with the PS 2 directly but rather works indirectly through PS 1 and the Private Enterprises Federation (PEF). In addition, it has inter-ministerial collaborations with government institutions for development projects. The respondent stated that all the institutions that have something to do with TVET make a conscious effort to engage them regularly.

5.6.2 Regulator 2

The AOGC Representative's response to the question 'Do you get involved in skills demand and supply to these oil and gas companies' was an affirmative. The Commission is concerned with the human resource side of local content, ensuring that Ghanaians who are competent are given opportunities to work before expatriates are considered. The Commission is also concerned with the oil business itself, including small-scale businesses involved in oil and gas upstream, for instance, procurement. The third one is with contracts: to whom should contracts be awarded? The respondent gave several reasons why the LI is problematic. In the first place, Ghanaians did not have the required skills at the time of the oil finds, and if they had any of the relevant skills these were mostly lower-level TVET skills.

A skills development setup is in place in the oil and gas industry, and the AOGC department participates in this so that Ghanaians will build skills and capacity to be considered for opportunities in a range of jobs. The respondent explained;

> When you talk about engineering and other high-level ones, Ghanaians have them. We have high-level Ghanaians who can do tax accounting or management of oil resources and finance. Those were not problematic; what were problematic were the engineering role, the vocational role, and the technical role; some of them may be welding, scalp folding, mechanical technician, and electrical instrumentation technician. Those are the people the industry requires, and those are the skills we do not have in Ghana.

The respondent explained that aim of the department was to deal with the technical skills deficit so that Ghanaians could take up jobs in the sector. In the absence of these skills, the respondent further explained:

> As we speak, most of these jobs are handled by foreigners. We give visas and work permits to these expatriates. The IOCs need to justify that there are no Ghanaians to occupy that role. Once it is justified, we give them a letter to go to immigration to bring all the skills they need. Furthermore, the way to justify is to advertise and interview local Ghanaians and see whether they have the expertise and experience for that particular job. We supervise it. We ensure that they are doing the right thing to see the type of skill they need for a particular vocation before it is approved for a foreigner to come in with a work permit to occupy that role.

The Regulator 2 ensures that Ghanaians who meet the requirement are not unduly denied employment in the sector. Ghanaians can be given priority if they have the same certification as foreign applicants. “If a Ghanaian has a South African Institute of Welding certification and an English man has the British version, the Ghanaian will be given priority to be employed”, the respondent explained.

The AOGC representative stated Ghana has many theoretically trained engineers but what they lack is a professional certification that the companies rely on to employ them. There are two ways for Ghanaians to acquire this: individuals may acquire international certification outside the

country or a centre must be built in Ghana for this purpose. The latter is a more difficult option because of the expense involved.

The industry needs skill sets in terms of professional areas, such as, instrumentation - knowledge to put wires together, practical hands-on experience. Potential employees are required to have skills, experience and certification. Asked whether TVET institutions produce these skills, the AOGC respondent was categorical, “they don’t” The respondent went on to explain;

> I will say Ghana has a lot of theoretically trained engineers, but as a component of engineering practice, and that is why professional practice is essential, you need to have certification. Certification is given to you based on the practical knowledge of the theory you have learned.

The respondent explained further, using ‘professional welding’ as an example.

> Suppose one wants to weld in the Ghanaian oil industry, you not only require local training as a welder. You have to acquire a certification of American welding certification or Canadian Welding Bureau certification or international IW welding certification. That will be given to you by going through some practical training and some set of modules, programmes and conferences. The process takes a long time to acquire. The South Africans have one, so you can also have South African welding certification. So any person that has one form of this certification would be able to work in the oil and gas industry.

The difficulty for TVET graduates is the requirements (certified teachers, prescribed models of programmes, required facilities and equipment) that have to be in place for Ghana to become a member of the international institute of welding. The facilities and equipment have to be upgraded regularly for the centre to continue to hold that certificate. The oil companies will accept a certificate from such a centre in Ghana, but Ghana does not have it.

When the AOGC representative was asked about the commission's role in assisting students in acquiring international certificates, *t*he respondent said the commission only intervenes from time to time and cited two ways of acquiring the certificate; one by the individuals going for training (vocational and practical) outside Ghana. For example, the respondent estimated the cost of taking five Ghanaian welders to Alberta for nine months to get the CWB (Canadian Welding Bureau) welders' certification to be $45,000 per person at the Northern Alberta Institute of Technology, a centre recognized for training technicians. In his view “The best way is to build our own centre of excellence" as the government cannot sponsor Ghanaians in sufficient numbers to resolve the current skills mismatch.

When the respondent was asked about his assessment of current training and education providers (TVET) contributing to high level skills, he agreed that there had been progress but lack of professional certification capabilities remains a key problem. The respondent cited the Technical Universities having the same challenge, their students undergo the requisite education with BSc, Diploma, very competently but they do not have professional certification. He emphasized, ‘No technician works without a certificate, not an academic certificate but a professional certificate.’

From the regulator's perspective, on-the-job training does not lead to certification. The companies do such training in two ways; a formal university training programme during vacation or through an internship. However, the oil and gas companies do not employ the candidate permanently after such an internship or national service unless they first acquire professional certification.

The AOGC representative stated that collaboration between the sector and training institutions is now more substantial than in the past. For example, the Petroleum Commission recently met the VCs and the managements of ten (10) TVET institutions to schedule a training programme for their teachers or instructors to be certified instructors because none of them are qualified as certified instructors.

> The process is ongoing and the selected few will be flown to Canada for a year to become certified teachers. Recently, the TVET institutions have benefited from such a package, five students being the beneficiaries. So we are doing all this stakeholder thing, but the numbers are just a drop in the ocean," said the AOGC Representative.

5.7 The persistence of skills mismatches

This section seeks to understand why skills mismatches remain despite the government's efforts and the efforts of the institutions and policy makers.

The AOGC representative noted that three entities are “playing the game now” and went further to explain as follows:

> One will think that the companies that need these technical skills to utilize in their operations should train them. The other is that the government and the people of Ghana are Ghanaians, and the Ghana government is responsible for their well-being, so why wouldn't the government take up the responsibility for footing the cost of training to get jobs that are politically and policy-wise good. So why wouldn't the government do that? The third school of thought is that people believe that this is a capitalist environment; individuals should fund themselves and go to school, pay their fees and acquire the requisite certification.

One suggestion has been to divide the cost into three: individual, government, and company. The answer is funding, but where the funding is to come from is the biggest question yet to be answered.

However, the AGI representative suggested that firstly the skills need of the oil and gas industry must be investigated and secondly the resource needs of institutions tasked with developing these skills need to be identified and attended to. If these steps are not followed, the skills mismatch problem will continue. Finally, there must be proper linkage between the companies and the students who have been trained.

The view of the Regulator 1's Representative is that young people with the potential to be employed as skilled workers in the oil and gas industry need to know what opportunities are available to them:

> ..people have the passion, but they do not know how to get into it, but if the information is out there for everybody to know very well, then you know that

> this is what I need to become an expert in engineering, then, of course, it is more feasible

However, this statement was somewhat contradicted by his further observation that what is needed is “certificate” training, given by experts. that is aligned with the requirement of the industry, so that once a person has this certificate they can be part of the industry.

Other suggestions from industry players were as follows: Management representative 2 suggested that generally, there should be an intermediary between graduation employment (structures of incorporation of young graduates) and "job centres" as in the UK. This intermediary should be in partnership with an organization or some recruitment structure; at least to makes it easier for the student to understand the requirements of employment in particular occupations. It could become a mechanism for helping to obtain jobs after graduation. The respondent noted:

> Unfortunately, in Ghana, we do not have anything like that, so usually, when young graduates come out of the university, they are left to fend for themselves. Very few opportunities and lots of graduates, and it becomes very difficult.

Technical and Vocational Education and Traning institutions offer technical and engineering courses relevant to the exploration and production of oil and gas companies. The findings suggest that the TVET institutions are cognizant of the skills and knowledge requirements of the oil and gas companies and therefore modify the various course content. In addition, strategic relationships are developing through policy and direct government interventions which are resulting in improved education and training at TVET institutions and facilities.

The persistence of the perceived skill mismatches has been attributed to the very demanding cost of certification training. Who bears the cost? Is it the oil companies who need the skills or is it the responsibility of the government or the individual, like any student in higher education? The challenge persists because the answer is not straightforward, leaving students to bear the brunt of the cost of certification training after graduating from technical institutions.

5.8 Summary

The findings indicate that direct, skilled jobs in both oil and gas companies as of 2020 were approximately 300; mainly in technical and support services. The industry creates more job opportunities in the contractors and auxiliary services category than do the two companies in their value chain. The review shows that the supply of mid-level staff by the TVET institutions to the two oil and gas companies is limited. However, the TVET institutions supply skilled workers to the other value chain sectors. Interestingly, while it is anticipated that AI and automation technologies will affect the majority of skilled jobs across all job levels, in reality this change will only affect the nature of work rather than displace most workers.

In the developmental model approach to skills development, Ashton et al. (2002a) argue that the "Tiger" societies had no alternative but to adopt Japanese-type industrial policies and devise ways of upgrading the labour force's skills in integrated industries to avoid shortages. However, the findings of this study suggest that Ghana did not plan for the mid-level skills required by the oil and gas exploration companies ahead of time. I argue that the inability of the exploration and production oil and gas companies to find people from the local labour market is because the mid-level skills the industry requires were not traditional skills produced by TVET institutions in Ghana. Therefore, Ghana did not plan for those skills ahead of time and cannot meet the

institutional and structural requirements of skills provision upfront, especially in regard to professional certification.

The IIPE-UNESCO (2020) report indicates that CBT programmes at in their initial stages only involving a small percentage of TVET institutions, five training programmes, and mostly at the first two levels of certification (Proficiency Level 1 and Level 2). This qualification is inadequate as a requirement for the exploration and production work of oil and gas companies.

However, the TVET institutions do offer technical and engineering courses relevant to the exploration and production of oil and gas companies and are cognizant of the skills and knowledge requirements of the oil and gas companies which has resulted in the modification of various courses. The key problem remains the inability of the TVET institutions to offer professionally certified courses

CHAPTER SIX

Discussion of findings

6.0 Introduction

The findings indicate that **w**hile there is a widespread perception of mismatch between the skills development provided by TVET institutions and the skills required by the oil and gas industry, there is a structural dislocation that policy reforms have not addressed to date despite efforts to do so, making it impossible for the TVET providers to provide sufficiently skilled Ghanaian workers to the oil and gas industry in the required numbers. The chapter discusses six sub-findings that led to this overall main finding.

This chapter begins with a discussion of findings from literature, policy documents and reports about the phenomenon (perceived skills mismatch). This is followed by a discussion of the key findings from the data collected and analysed. The chapter does this by exploring the perspectives of three sets of critically important role-players: industry, TVET providers, and regulatory and intermediary bodies. Between industry and TVET are the regulators whose critical role, facilitates the transition of TVET graduates into the oil companies. They include industry's regulatory body (Regulator 2) and the TVET regulatory body (Regulator 1) intermediary and employer associations are comprised of PS 1, PS 2, and PS 3.

6.1 Overall key finding and discussion of this finding

While there is a widespread perception of a skills mismatch between what is offered by the TVET sector and what is required by the oil and gas industry, findings from this case study suggest that there is a structural dislocation that has not been addressed by policy reforms to-date, despite

efforts to do so, making it impossible for the TVET providers to provide skilled workers to the oil and gas industry. There are six key sets of sub-findings that led me to this conclusion:

1. Regulator 1 states that all the appropriate structures to meet the industry's requirements have been put in place. The commission also claims that it has developed appropriate qualifications based on labour market analysis and industry player contributions. Industry representatives agree that they have contributed to policy documents, but state that implementation challenges still exist.

2. Two TVET institutes have the specific task of providing skilled workers to the oil and gas industry and are formally mandated to do so by the Ghanaian government. However, findings from this research show that all formal TVET provision does not supply sufficient professionally qualified technicians to the industry. The TVET providers do train technicians, but they cannot meet the entry requirement for the oil and gas sector because these technicians are neither professionally certificated nor sufficiently trained to respond to the high risk nature of occupations in the oil and gas industry. Thus, there is not a pipeline of qualified applicants for technical positions from the TVET institutes to the oil companies. Both institute representatives and industry representatives stated that the institute qualifications (Certificate II) are inadequate for the oil and gas industry.

3. It is intended that two technical universities provide the oil and gas industry with the skill workers required. They offer bachelor's degrees in engineering and Higher National Diplomas in engineering. Representatives from these universities argue that their

qualifications prepare their students for work in the oil and gas industry. However, the industry will not employ them because they do not meet the professional requirements.

4. The government's response has been to sponsor individuals to obtain professional certification outside the country. This action is costly and benefits individuals and not TVET provision within Ghana.

5. There is no on-going relationship between the TVET providers and the oil and gas industry regarding on-the-job training and work experience. The industry has internship programmes, but there is no direct link between these and what TVET providers offer.

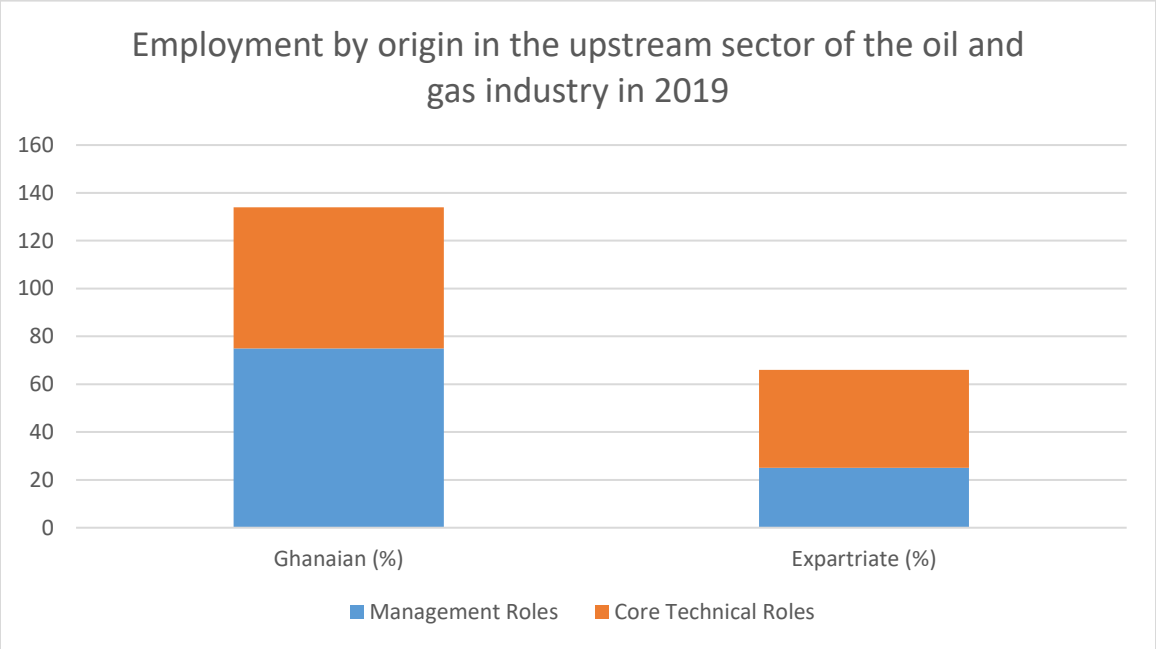
6. The Companies' hiring decisions are based primarily on standardized qualifications from world-recognized institutions of excellence to minimize the risks in middle-level occupations within the industry.

This section focuses on the perceived mismatch between skilled workers turned out by TVET institutions and industry demands from key role players. Despite the efforts by government and the relevant institutions and policies, the mismatch continues.

6.1.1 Employment in the upstream sub-sector of the oil and gas industry by classification – 2010 -2020

Figure 4 below illustrates employment in managerial and technical roles in the oil and gas industry.

Figure 5 Employment in the oil and gas industry - Locals vs Expatriates



The presentation of data collected in 2019 in relation to Ghana's local content policy and its implementation in the upstream sub-sector of the oil and gas industry 019, in Figure 4 indicates that there is a lot more to do in order to increase the percentage of Ghanaians employed in core technical roles in the industry. Suleman & Zaato (2021) recommend local training in core technical skills and also in the areas of monitoring and experience building in order to localize both core technical and managerial positions. The account of Ackah & Mohammed (2018) in comparing the employment figures with the local content goals supports the data collected for this study as these researchers also found low numbers of Ghanaian technical staff, particularly engineers and technicians of various types . However, Ackah and Mohammed (2018) found that the Ghanaian target for management and staff had been met.

6.1.2 Classifications of core technical occupations

Core technical occupations (professionals, technicians and associate professionals) are classified according to their skill levels in the Table 21.

Table 22 Classification of occupations: professionals, technicians and associate professionals in the oil and gas industry

Classification of Occupations (ISCO-08),Ghana Educational Levels and qualifications: Professionals, Technicians and Associate Professionals in the Oil and Gas Sector					
SN	**Major Groups**	**ISCO-08 Skill Level**	**ISCED Level**	**GES**	**NTVETQF**
2	Professionals	4th	6 to 7	BA/BSc	Level 6 Bachelor/ (Professional Technical)
3	Technicians & Associate Professionals	3rd	5	HND	Level 5 HND

Source: COTVET - Skills Gap Analysis and Audit of Seven Sectors

The table provides information on middle-level occupations and qualifications in the oil and gas industry in Ghana. Technicians and associate professionals' entry-level point at certificate and HND levels is different from that of bachelor's degree /professionally qualified technicians. While the industry's minimum entry qualification is a bachelor's degree or equivalent for technical

professionals, students from the technical institutes (technicians and associate professionals) do not qualify for employment opportunities despite these institutions being accredited as training institutions responsible for supplying skill workers to the oil and gas industry.

6.1.3 Efforts by industry, TVET providers and government regulatory bodies to address the problem of the perceived skills mismatch

The AGI representative explained that the Association influences skills provided by TVET institutions through their involvement in curriculum development with both Regulator 1 and the Ghana Education Service Boards. The Association also gets its members involved in the process. The respondent further noted that:

> I know of a skills gap analysis report that a considerable number of stakeholders developed together. In addition, stakeholders are involved with further policy making to reduce the skill mismatches.

The respondent further noted that PS 1 is a member of the local content committee. The local content committee aims to ensure the development of skills locally. Companies have to submit annual plans and then their further plans for engaging locals every year. The government, through the Regulator 2, wants to see whether there is improvement in replacing foreign employees with local ones. The respondent explained:

> What we have done in the case of the oil and gas industry is that even when the companies depend on foreign experts, the AOGC and its partners have a program to develop locals by having them understudy the expatriates. With time employment should be fully localized. This is what we should be pushing for.

The GEA representative noted that the Association aims to influence the structuring and formulating of TVET related skills throughout the country. In furtherance of this objective, the Association is making a case for compulsory industrial attachment for students at the end of every long vacation. The representative stated that the input is part of the National Employment Policy with the Ministry 2 which aims to fit employers' needs.

However, the MELR representative admitted that the government has not done much to address the skills deficit, especially in fields such as underwater welding, which has great potential to employ locals. The respondent noted:

> It is a huge opportunity that is there. However, unfortunately, the government has not invested much in that. Private sector companies are trying to do something, but the private sector is into profit, so they will not go into it when the venture is not profitable. The ministry needs the government side to support young graduates who have the interest to be underwater welders, but do not have the money; then the government should support those persons to acquire the skills.

Management representative 3 explained that the company gets involved directly by sponsoring individual students to acquire professional certification outside Ghana. And also through the local content law through AOGC and other departments of Regulator 2.

TVET respondent 1 admitted that the university had seen tremendous investment in upgrading facilities. "The institution initially had amateur labs but these were upgraded for process

engineering, instrumentation and all these came from Aberdeen. The institution had the rig replicate also commissioned as part of the package."

While the private sector role-players admit that they have contributed to identifying the skill mismatches between TVET skills and the skill demand by the oil and gas sector, they have equally contributed to resolving the problem through the local content committee. Industry and the responsible ministries argue that they have improved TVET skill provision to the oil and gas sector. Government regulators are the lead policy initiators in collaboration with other stakeholders in resolving the perceived skill mismatches.

6.2 Key finding COTVET/industry – Appropriate qualifications developed

Regulator 1 argues that the commission has all the appropriate structures to ensure that the industry's requirements are met. The commission argues that it has developed appropriate qualifications based on labour market analysis and industry players. Industry representatives agree that they have contributed to policy documents, but implementation challenges exist.

Qualification systems have an explicit system of qualification levels based on public appreciation of the status, entry points and the demand for qualifications backed by quality assurance systems (Giles & Coles, 2013).

The COTVET representative noted:

> With the concept of matching supply of TVET skills to the demands of the oil and gas companies, the Commission needed to use standards and the standards used were determined by industry. The industry training advisory committee came together with experts to determine the standards to be achieved or not achieved. As a result, the system now has a sector skills body to deal with the industry skills needs and anticipated skill needs.

The findings suggest Regulator 1, in collaboration with industry players has developed the appropriate curricula and qualification framework. The findings show a close collaboration between industry, TVET institutions, Ministries responsible for skills development and employment, and sector skills bodies to develop the standards and the appropriate qualifications. Nevertheless, there is a negative perception about TVET by some employers. The Ghana Employers Association noted that:

> Because day in and out, people believe that those who did not qualify well in the tertiary institutions typically resort to the TVET system. That in itself also affects the employer's valuation of the product that the TVET training institution brings out, so it may not necessarily be a structural problem of the nature of skills that they have, but it usually has to do with an ideological perspective where people believe that it is the 'gunk' that is there so nothing good will come out of the system.

A skills development department at the Regulator 2 guarantees Ghanaian participation in the oil and gas industry. However, such participation is easier in some occupations than in others. The representative stated:

> We have high-level Ghanaians who can do tax accounting or management of oil resources and finance. Those are not problematic; what is problematic is the engineering role, the vocational role, and the technical role. We need welders, scalp folders, mechanical technicians and electrical instrumentation technicians. These are the people the industry requires, and these are the skills we do not have in Ghana.

At the policy level, the COTVET representative stated that the Commission had rationalized assessment and by doing that had taken a bold step towards ensuring that all qualifications emanate from the National TVET Qualifications Framework through the use of a competency-based approach which sets the standards for training.

The respondent further explained:

> We just finished developing skills for the industry project that AFDP supported, and now we are looking forward to starting the jobs and skills project that has approval from parliament. We are working on the Ghana TVET report; this is the first development of its kind. The only country that I know that has been working on it is Germany.

While the finding suggests the appropriate qualifications based on labour market analysis to ensure that skills provision meets industry requirements, institutional inadequacies prevent TVET graduates from the required employment criteria of the oil industry.

6.2.1 What industry has done to 'skill up' critical technical skills in the TVET institutions

Management representative 2 stated that the company has collaborated with TVET institutions and other higher education institutions. The representative noted:

> We have had a few educational programmes in the Western Region where we trained teachers - like train the trainer - to undertake specific courses within those Regions, primarily vocational and technical aspects. We have also engaged some of the technical institutions like the TVET 2 and a few others to develop the lecturers' expertise. They had the opportunity to undertake some lessons with lecturers from Italy, I think, and a few other places. Their skills and expertise were emphasized and enhanced in geology and engineering. We have had that in the past. The last one we had was in 2018 concerning curriculum development as one aspect and expertise enhancement.

When asked whether they have any collaborations with the technical institutions, Management representative 3 said they had no direct collaborations. However, they had a joint partnership with Company 1 to set up a training unit in Takoradi where technical school students could go and have practical training. The respondent emphasized:

> The company took them through proper vocational training in electrical, mechanical, and production. The company set up a joint institution there with our Jubilee partners. The company sent teachers from the Cape Coast University to Aberdeen Scotland, and I think to be certified as NVTI trainers and all of that so that those from the technical schools get the opportunity to go there. The Jubilee Partners heavily supported them. Moreover, when the term of the MoU (Memorandum of Understanding) ended, we had to hand it over to Cape Coast University to continue with it.

The oil companies provide industry experts as guest lecturers, develop lecturers' expertise and set up a joint institution by the Jubilee partners to skill-up critical TVET skills. The oil and gas companies do this by collaborations with the government, the private sector and the TVET institutions through government regulators.

6.2.2 Discussion

Rigby and Sanchis (2006) argue that workers are likely to define skills differently from employers. Regulator 1 agrees with other role-players that they collaborate with the industry through its sector skills bodies to develop the appropriate curricula and qualifications based on standards. This position, the role-players argue, resolves the perceived skill mismatch between TVET skills and the skills needs of the oil companies. Allais (2021) argued that there is no simple answer to the relationship between credentials, knowledge and skills. The position of Allais (2021) is collaborated by Sadovnik (1995) that designing a curriculum according to skills and competence is

problematic. Competency-based qualification and curriculum emerged to create a common language hence the competency-based training curriculum in TVET 1 & 2. This attempt though laudable, could not transition TVET graduates in these institutions into the oil and gas companies.

6.3 Key finding about what TVET institutions offer and why these do not satisfy industry requirements

Two TVET institutes are mandated to provide skills to the oil and gas industry. However, the findings show that all formal TVET qualifications provided by TVET institutes do not result in the supply of appropriately qualified technicians to the industry. The TVET providers do train technicians, but they cannot meet the professional certification entry requirement for the oil and gas sector which includes knowledge and skills related to high risk occupations. So there are no pipelines between TVET institutes and the oil and gas industry. Both institute representatives and the industry representatives stated that the institute qualifications (Certificate II) are inadequate for the industry. Industry requires an international professional certification for all mid-level technical jobs; none of the Ghanaian TVET providers can offer this certification.

In meeting the skills demands of the industry, competency-based training (CBT) was introduced in technical institutions to provide direct linkage to industry skills. The introduction of CBT was more evident in the technical universities than the technical institutes. Therefore, the interviews reflect the responses of the two types of institution in relation to the courses they offer to students

who want to work in the oil and gas industry. The technical universities in this area of specialization offer most engineering courses and also technician courses. The focus of the technical institutes is on technical courses for the oil and gas industry. TVET 3's specialization areas are mechanical engineering, welding and fabrication, plumbing and gas fitting technology. TVET 4 focuses on welding and fabrication technology for the oil and gas industry.

In response to the question of how successful the institutions have been in supplying technicians to the oil companies, TVET representative 4 states:

> What the institute offers as a course under the Ministry 1 cannot take these students that far. The education we offer at this level is woefully inadequate to get products to the oil field because the course contents of the certificate II intermediate is such that it just gives you the basics. He added that it would be best if the student went beyond the basics to get employed by the oil and gas companies.

TVET representatives 3 & 4 explained that the credentials they turned out are certificates I & II in welding, for example and do not meet the oil and gas companies' knowledge and skills requirements. The institution does not have any internal mechanism for determining the knowledge, skills, and abilities the oil and gas industry requires. The responses from the TVET institute staff confirm that the institutes are not on the CBT programme, unlike the technical universities.

Apart from the TVET 1 who reported the ability of the institutions to track its past students in the industry, the other TVET institutions do not have such mechanisms in place but have a fair idea about the few past students working in the industry. TVET representative 2 noted, “we do not have direct link with the oil and gas companies even though we have some relationship.”

TVET representative 1 explained that:

> Two models are available to us in tracking our past students of the institution. First, the Tracer Study Model uses an industrial attachment supervision format. The institution deploys all its students on industrial training attachments. Students do semesters out for competency-based programmes and at the end of the year for all Masters, Bachelors, Higher National Diplomas and Diploma programmes. Secondly, the institution offers the supervisors the opportunity to help the industrial liaison office and the Career and Guidance Centre in the same process to acquire some information on the field as to where the graduates are located.

TVET representatives 3 & 4 were not aware of any structure for monitoring their past students but could count on their students' transition to the world of work satisfactorily, particularly for welders.

Industry representatives explained: “We trained their lecturers in the past, taking them on courses, and every year we give funding to them.' Of interest is this further observation "but the people who study in the technical institutes will be the ones who will go and work in the fabrication yard

and with the spare parts contractors. The people that we hire are those who come directly from the university."

6.3.1 International professional certification

The issue of international professional certification is of major importance. There is no institution in Ghana that awards internationally recognized professional certification for professional technicians. The industry needs these in several professional areas; for example, instrumentation - knowledge to put the wires together, and practical hand-on experience. Employees are required to have skills, experience and certification. When an industry regulator was asked whether TVET institutions produce these skills, the respondent was categorical, “they do not” The respondent went on to explain:

> I will say Ghana has a lot of theoretically trained engineers, but as a component of engineering practice, and that is why professional practice is essential, one needs to have certification. So certification is given to technicians based on the practical knowledge of the theory they have learned.

The respondent further explained, using ‘professional welding’ to elaborate his point:

> If one wants to weld in the Ghanaian oil industry, one must be a welder by training. However, one has to have certification of American welding certification or Canadian Welding Bureau certification or international welding (IW) certification. The professional certificate is issued by going through some practical training and some set of modules, programmes and conferences, which

> takes a long time to acquire. The South Africans have one, so one can also have South African welding certification. So any person that has some of these certifications would be able to work in the oil and gas industry.

The difficulty for TVET graduates is the requirement (certified teachers, prescribed models of programmes, required facilities and equipment) that has to be in place for Ghana to become a member of the international institute of welding. The facilities and equipment have to be regularly upgraded for the centre to continue to hold that certificate. The oil companies will accept a certificate from such a centre in Ghana, but Ghana does not have it.

For example, the industry role-players and, in particular, the Regulator 2 argue that Ghanaian universities give graduates theoretical knowledge and not professional knowledge and certification. The industry requires an international professional certification for all mid-level technical jobs; none of the Ghanaian TVET providers can offer this certification. A combination of training and related experience, and educational credentials gives the professional certification required by the industry. For example, the Canadian Welding Bureau (CWB) offer professional certification where CWB independently verifies all elements of welding operation on an ongoing basis. At its core, CWB certification requires that: welding must be done by a competent individual, welding operations must be overseen by competent, qualified individuals and must follow proven qualified welding procedures.

6.3.2 Discussion

Context analysis reveals findings related to critical role-players in the relationship between TVET skills provision and the oil and gas upstream sub-sector of the oil and gas industry. TVET

representatives 3 & 4 argue that Certificates (I & II do not meet the oil and gas knowledge and skills requirements. However, TVET 1 & 2 agree that the credentials, skills and knowledge of graduates from their institution meet the minimum entry qualification (Bachelor's degree or equivalent for technical professionals) of the oil and gas companies. Contrary to the position of the TVET institutions, the industry regulator argues in support of international professional certification for technicians as a requirement for employment in the oil and gas industry. The industry position is collaborated by cwbgroup (2022) that made a case for the international welding certification system in welding. The group argues that the certification requires three essential elements of focus: the welding personnel, supervisory personnel and welding procedures to provide an additional level of confidence and assurance for weld quality and knowledge level of fabricators against the requirement of the standards

6.4 Key finding about what two technical universities provide and why the industry does not employ their graduates

Two technical universities aim to provide the oil and gas industry with mid-level skills for technical occupations. They offer bachelor's degrees in engineering and higher national diplomas in engineering. Representatives from these universities argue that their qualifications prepare their students for work in the oil and gas industry. However, the industry will not employ them because they lack professional certificates required by the oil companies.

The technical universities offer courses in high-demand mid-level occupations the oil and gas companies are looking for in their employees. The Technical Universities in this area of specialization offer most engineering courses and, in addition, technician courses; TVET 2 focuses on marine engineering mechanics, refrigeration technicians and welding for the oil and gas industry. The other technical university's focus is on engineering, electrical electronics, port and shipping administration, welders, and navigation. TVET representative 1 noted that the industry is currently looking for technicians that can produce oil on the FPSO; process, mechanical, instrumentation, electrical and health and safety specialists. Process specialists work in the control room with hand tools as mechanical engineers and maintain pumps and valves concerning the production phase. The most important one is welding and fabrication.

The internal mechanism by which the institution determines students' knowledge, skills, and abilities is by what TVET representative 1 calls the internal verifiers (internal quality assurance) and also external quality assurance. The verification occurs in the middle and at the end of training, respectively, to ensure that skills acquired meet industry specifications or requirements. In addition, the institution also has what they call industrial mentors who also interact with the trainers and the students. The respondent further emphasized that the institutions can boast of certified instructors who lead in the development of the curriculum in petroleum engineering, process, mechanical engineering, and welding and fabrication in the institution. The presence of certified instructors has further built the capacity of the institutions to train students for industrial competence.

According to TVET representative 2, the government has acquired equipment and upgraded the institution's existing infrastructure in order to 'skill up' the knowledge, skills, and abilities of students to help meet the industry's demands for skills. Management representatives I and 2 argue that the most important criteria by which middle-level skill jobs are measured in the companies are met. However, the AOGC representative emphasized that professional certification for training and relevant experience in this category of jobs is vital in the industry.

> A good degree is an indication that one can absorb information and learn quickly on the job. It is also an indication to the employer that one may have some transferrable skills relevant to the workplace (Management representatives 1&2).

"It is not enough to only have a good degree. We expect our employees to have business skills to enable them to hit the ground running" (Management representative 1&2). Employees also need excellent

analytical skills as these "Allow(s) the company to evaluate each candidate's problem-solving ability". They also need excellent communication skills (both written and oral): "Being able to communicate effectively increases efficiency in the quality of work an employee does" (Management representatives 1&2).

While the TVET providers noted that much more effective collaboration between stakeholders, especially the oil companies, is needed, the industry regulator explained that all will come to nothing if acquiring professional certification is not feasible for graduates in the country.

The AOGC representative explained:

> Suppose one wants to weld in the Ghanaian oil industry, you not only require local training as a welder. You have to acquire a certification of American welding certification or Canadian Welding Bureau certification or international IW welding certification. That will be given to you by going through some practical training and some set of modules, programmes and conferences. The process takes a long time to acquire. The South Africans have one, so you can also have South African welding certification. So any person that has some of this certification would be able to work in the oil and gas industry.

When the representative of the regulator of the upstream sub-sector of the oil and gas industry was asked about his assessment of current training and education providers (TVET) contributing to knowledge and skills development, he agreed that there had been progress but lack of professional certification capability in Ghana remains a key problem. The Respondent cited the Technical Universities having the same challenge, their students undergo the requisite education with BSc, Diploma, very competently but they do not acquire professional certification. He emphasized, 'No technician works without a certificate, not an academic certificate but a professional certificate.'

In response to his assessment of education and training providers (TVET) contributing to provision of the skills required by industry, the AOGC representative argued that "you can do all, but once you do not have certification, you have not done much" The representative reemphasized that technical universities face the same challenge. In further explanation to this, the industry regulator noted:

> The TVET institutions will train graduates, and they are very competent, but they do not have certification. They will give them a certificate BSc or diploma, but when they come out from the TVET institutions, they need a professional certificate. It is like an accountant who does not have CA or ICA. Even when they graduate from the university with a BSc in accounting, no one will employ them; they must complete the professional programme for professional certification. No technician works without a certificate in the sub-sector, not an academic certificate but a professional certificate.

6.4.1 Discussion

The oil and gas companies argue that graduates from Ghanaian TVET institutions lack professional practice and the institutional framework as part of TVET provision to supply skills to the industry. The findings further suggest incomplete institutional arrangements leading to professional certification that allows for direct employment of the students. Bills (2003) argue that the human capital theory specifies that at any given level of skill supply among job seekers, the hiring principles used by employers are consequential from processes of technological change, workplace organization and enhanced managerial efficiencies. The findings suggest that qualifications concerning hiring decisions by the oil companies are due to the risky nature of mid-level skills occupations in off-shore oil companies.

6.5 Key finding about government's current way of addressing professional certification and the limitations of this response

The government's response has been to sponsor individuals to obtain professional certification outside Ghana. This response is costly and benefits individuals only and not TVET provision in Ghana.

The government's response to the problem has been to sponsor individual students to obtain professional certification. In addition, a few of the instructors at the technical institutions have been sponsored to obtain international qualifications as certified instructors. This action is an expensive venture for government and benefits only individuals in terms of professional certification, though it can be argued that certified instructors are able to pass on their knowledge and skills to numerous students. From the regulator's point of view, the AOGC representative noted that the collaboration between the sector and skills training institutions is much stronger than in the past. The Regulator 2 has worked with the VCs and the managements of ten (10) TVET institutions to schedule a training programme for their teachers or instructors to be certified instructors because none of them were qualified as certified instructors. As stated by the AOGC representative:

> The process is ongoing and the selected few will be flown to Canada for a year to become certified teachers. The TVET institutions have benefited from such a package in the recent past, five students being the beneficiaries. So we are doing

> all this stakeholder kind of thing, but then the numbers are just a drop in the ocean.

The government, through the AOGC, as reported by the AOGC representative, emphasizes the role it plays in assisting students to acquire the international certificate. "We had done that recently when we took five Ghanaians, welders, to Alberta for nine months to get the certificate. The certificate is called CBI (Canadian Bureau of welders' certification); these were welders already, so we needed welders. So we took five at the cost of $45,000 per person to the Northern Alberta Institute of Technology. That is a centre recognized for training technicians. They came back recently, and this was publicized on TV."

The government's effort cannot be said to be commensurate with the anticipated practical experience students need in addition to the theory learnt in the classroom. The oil companies cannot offer that directly to students from these technical institutions because of the cost implications, the regulator emphasized.

6.5.1 Discussion

Tutu (2013) identifies inadequate human resource capacity due to weak educational infrastructure, technological know-how and infrastructure base as challenges to local content and participation in Ghana. ILO (2012) argues for the need to decrease reliance on expatriate workers, but the difficulty of empowering local workers through policy persists. The Petroleum Commission is determined to establish the Ghana Welding Bureau (GWB). The body will be an autonomous professional institution and non-Governmental to empower Ghanaian artisans to take over the local content of the petroleum sector (Isaac, 2022). The institution will be essential in achieving the global

competitiveness required for Ghanaian skills for certification and standards. The proposed institution (GWB) is to be affiliated with an international welding body (Korina et al., 2019). As argued by Isaac (2022), the proposed intended policy of the government of Ghana is to avoid the cost of funding such a professional institution and students directly.

The comprehensive employment of skills for East Africa in the oil and gas sector (E4D/SOGA), a model to address skills deficiencies in the local labour market in four East African countries (Uganda, Kenya, Tanzania and Mozambique), could be a point of reference to the Ghanaian context (Korina et al. 2019). The German Corporation for International Cooperation (GIZ) integrated approach model to employment promotion in the oil and gas sector is another example of the supply and demand side of the labour market. And the use of active labour market policies and instruments to leverage to access employment (Korina et al., 2019).

6.6 Key finding about the lack of relationship between TVET providers and industry on-the-job training

There is no relationship between the TVET providers and industry in terms of on-the-job training and work experience. Industry has internship programmes, but there is no relationship between these and what the TVET providers offer.

From the industry perspective, Management representative 1 explained that on-the-job training offered by the oil companies has a training philosophy based on the 70-20-10 principle. That is (70%) of the training is obtained on the job and then (20%) through coaching, mentoring,

workshops, professional association and (10%) in the classroom. Management representative 2 stated that on-the-job training from a career path point of view takes different forms: shadowing, coaching and cross-posting. Shadowing is a way to understudy somebody (to gain experience within the role and also within the role above you to develop your set of skills). Cross-posting involves exchanging a position with a colleague from another country. The aim is to understudy the different circumstances and problems of that country. Management representative 2 further noted that the company has National Service and apprenticeships for individuals through the Company 3 and the Regulator 2, and that the company even assists individuals who apply personally. However, none of this assistance leads to direct employment in the sector.

The industry regulator explained that on-the-job training is recognized as a good thing by the oil companies. The companies look at it from two perspectives; training before recruitment and training after recruitment. On-the-job training is offered after recruitment as professional career development because due to changing technologies and new ways of doing things, employees need to keep abreast of changes. The TVET Institutions, sector regulators and other stakeholders all appreciate how the oil companies organize on-the-job training.

6.7 Key finding about what companies require in terms of applicants' qualifications

Companies' hiring decisions are based on applicants having standardized qualifications from world-recognized institutions of excellence to match the requirements of high risk middle-level occupations in the industry.

6.7.1 High-demand occupations required by the oil and gas exploration and production companies

From the companies' perspective, high-demand occupations at the middle level of skills require employees to be able to contribute to exploration and production operations. In the exploration and production phase, Management respondent 1 noted they …

> looked for production operations people as the company was in the production phase. So people who can operate the FPSO - Production superintendents and production engineers- are the skills we are looking for and Ghanaians in particular for years, and we never give up.

Management representative 2 reiterated the point made by Management representative 1 but added, "at the moment, production is over; we are just basically doing maintenance work" The respondent recalled:

> We tried to find expertise in the development and production area almost seven years ago. However, unfortunately, this is where we struggled, so obviously, we have to go through a capacity building process because we are such a big company that we can develop staff internally.

When asked whether welding is a critical technical occupation for the company the respondent explained:

> We do not hire directly for all those low-level roles; we subcontract. We have a fabrication yard, and it is entirely subcontracted, so we have no day-to-day involvement. We give specifications, and they work and deliver. If we come in at all, our engineers come in to conduct quality assurance to see what they have done that meets our standards and needs.

From the perspective of education and training providers, high-demand occupations needed by the industry, according to TVET representative 2, include engineering, electrical electronics, port and shipping administration, welding and navigation. TVET representative 1 stated that the industry is currently looking for technicians that can produce oil on the FPSO - process, mechanical, instrumentation, electrical and health and safety employees. Process specialists work in the control room with hand tools, mechanical engineers maintain pumps and valves associated with the production phase. The most important needs are in the areas of welding and fabrication. TVET representative 3 emphasized welding and fabrication, gas fitting technology, and mechanical engineering. TVET representative 4 did not offer any direct response to this question but said;

> What we offer as a course under the Ministry 1 cannot take these students that far. The education we offer at this level is woefully inadequate to get products to the oil field because the course content of the certificate II intermediate is such that it just gives one the basics. It would be best if one went beyond the basics to get employed.

The AOGC representative agreed with TVET representative 1 and explained that the high mid-level occupations the oil and gas industry is looking for are the in technical professional areas like a mechanical technician, instrumentation technician, electrical technician, process engineer, welder and scalp folder The COTVET representative commented that 'technical occupations are always needed, but we do not always have many people with the required skills."

Employers evaluating job candidates look for educational credentials and job experience (B. Bills, 2003). The oil and gas companies apply the following criteria in making their employment decisions: a minimum of a Bachelor's degree and excellent analytical skills, and communication skills (both written and oral. "It is not enough to only have a good degree, in addition, we expect our employees to have business skills to enable them to hit the ground running". A minimum of a bachelor's degree is required for all technical occupations. "A good degree is an indication that one can absorb information and learn quickly on the job. It is also an indication to the employer that one may have some transferrable skills relevant in the workplace". Excellent analytical skills are required in relation to problem-solving. Excellent communication skills (both written and oral) are also a prerequisite: "Being able to communicate effectively increases efficiency in the quality of work an employee does" (Management representatives 1 & 2)

A first degree in a specific discipline is an entry requirement for new hires. There is an internal process within the companies to determine what knowledge, skills and abilities are required for a specific job. With reference to the internal process through which the right skills are determined for the formal job requirements, Management representative 1 explained that there is a competency framework that covers each discipline within a professional family. The framework indicates the

type of knowledge, skills, abilities and the level at which these are needed. HR representative 2 emphasized; “For each professional family, we have the skillset and knowledge-base that needs to be defined for each professional family and which applies to each recruitment process that we undertake”

In response to a further question, Management representative 2 explained that:

> There are two categories—young graduates and older adults who have experience. For young graduates, we test aptitude in terms of problem-solving, numeracy and a bit of literacy. Specific scenarios come into play and revolve around probability and what they will be doing in terms of their jobs. For example, when we provide a problem-solving case, it might have revolved around, let us say, a contract engineer. It might be a procurement problem, e.g. if you develop a contract, what are you supposed to do in a particular instance to see how people or individuals react. That is, specific job-related problems.

In responding to the question of risk factors in this category of jobs, both industry representatives gave the same descriptions:

> Loss of primary containment (release of hydrocarbons from pipework, gas release) leading to pollution of the sea, explosion, loss of property & assets as a result of fire, injuries to personnel, accidents leading to disability or potential fatality, wrong analysis of data, failure of types of equipment.

In response to how to reduce risks in the company, the following were offered:

> First, assess the risk (with mitigations in place), and reduce the risk to ALARP (as low as reasonably practicable). Secondly, adhere to temporary working instructions through control of work (permit to work system) and carry out the incident investigation to prevent a recurrence. Furthermore, strict adherence to safety protocols and practices, proper verification of all data, routine maintenance culture, and having standardized operating procedures and risk and assurance principles are necessary.

Though there are on-going changes in the way work is done by this category of skilled workers, industry respondents say changes are due to tools and technology updates but t are not fundamental. Skilled workers are able to adapt procedures and policy changes based on changes to the operation of the FPSO. However, when changes occur, some re-training is likely to be required.

Management respondent 2 noted that the company hires employees with a first degree in a specific discipline. For example, if one is applying for a geology based position, the degree major should be in geology. If a person is applying for a geophysical position, he or she should have a geophysics degree. To apply for any engineering position, the applicant must have a degree. “The company trains new hires when it comes to technical knowledge as the technical knowledge acquired in the local institutions does not match our requirements”. Outside technical knowledge, critical thinking, pro-activeness, organizational knowledge and skills, lading understanding of how to work in an organization including simple things like drafting memos (organizational culture) are expected of new hires. Problem-solving and a high level of tacit knowledge are required.

Answering the same question, Management respondent 1 noted that the educational system in Ghana emphasizes the theoretical:

> The university gives graduates theoretical knowledge, so when they come to the workplace, we take our time to make them understand the practical application of what they learnt in the university. We aim to give everyone a level playing field because we know that those Ghanaians trained outside have a better experience because they have more practical knowledge and skills than we offer in the Ghanaian university.

There is an internal process within the companies to determine what knowledge, skills and abilities the company looks for, for a specific job. Management representative 1 explained that there is a competency framework that covers each discipline of a professional family. The framework states the specific knowledge, skill, abilities and the required level of these. Management representative 2 emphasized;

> For each professional family, we have the skillset and knowledge-base that need to be defined for each professional family which is applied to each recruitment process that we undertake.

Companies' hiring decisions are characterized by standardized qualifications from world-recognized institutions of excellence to match the risky nature of middle-level occupations. In playing their watchdog role, the AOGC representative explained:

> As we speak, most of these jobs are handled by foreigners. We give visas and work permits to these expatriates. The IOCs need to justify that there are no Ghanaians to occupy that role. Once it is justified, we give them a letter to go to immigration to bring all the skills they need. Moreover, the way to justify is to advertise and interview local Ghanaians and see whether they have the expertise and experience for that particular job. We supervise it, and we ensure that they are doing the right thing, to see the type of skill they need for a particular vocation before it is approved for a foreigner to come in with a work permit to occupy that role.

The Regulator 2 ensures that Ghanaians who meet the requirement are not unduly denied employment in the sector.

The Commission has attempted to align TVET qualifications to the industry by introducing competency-based training. The COTVET representative noted that:

> The Commission has rationalized assessment, and by doing that, the Commission has taken a bold step by ensuring that all qualifications emanate from the National TVET Qualifications Framework through a competency-based approach.

The Commission has an MoU with several institutions and makes conscious efforts to engage them - PS 1, International Partners, PS 2, and Private Enterprises Federation (PEF). In addition, it has

inter-ministerial collaborations with government institutions (Ministry 2), in shaping TVET curricula.

6.7.2 The problem of TVET graduates not being able to meet industry employment requirements

Economically, the difficulty for TVET graduates is the standard requirements of the oil companies (certified teachers, prescribed models of programmes, required facilities and equipment for training). For example, an institution with each of these characteristics must be in place for Ghana to become a member of the International Institute of Welding and this is what Ghana lacks. Moreover, this requirement puts a financial burden on professional technicians as they have to individually bear the cost of acquiring such certificates outside the country.

While the industry collaborates with skills providers at different levels, there is not an effective connection between demand and supply. TVET representative 2 commented on the effectiveness of the information flow between the industry and the institution;

> The Local content law to us is not well aligned to give the institution an estimated number of potential employees (e.g. welders) that the company needs at a particular time in order for the institution to train this number.

Technical occupations identified by industry representatives in particular and TVET institutions are core occupations in the employment structure of the companies. Therefore, they are appropriately classified as “technical” or “petrochemical” and support services.

6.8 Stakeholders' vision for skills provision for the Ghanaian oil and gas industry

This section presents the thinking of the different role-players. All stakeholders responded to the question, "***In an ideal world, how should employers, education and training providers and other stakeholders collaborate to ensure the oil and gas companies get employees with the appropriate skills?"***

6.8.1 Industry perspective

The AGI respondent explained that in resolving the perceived skills mismatch, the starting point needs to be the skills needs of the companies which can be ascertained by conducting a skill needs assessment. Secondly, a list of institutions that can develop these skills should be identified. Once skills gaps are identified, the required resources need to be made available to fill the gaps. The respondent further noted:

> We then generate interest so that they can develop programs or develop the necessary capacities and provide the tools for the institutions that have already been identified or for new ones to be developed; we provide the facilities. Then we do the actual training, which is not the end of it.

There must be a proper linkage between the companies and the students regarding on-the-job training. Therefore, the respondent concluded that some credit hours must be allocated to the students for training on the job to pick up the practical knowledge and develop skills for the industry.

The responsible institutions could be government-related or private. There is nothing wrong with the private sector providing these skills on a commercial basis. However, a compromise agreement could be established for individuals benefiting from the training to pay fees. When the institution develops a person's skills, the person becomes so marketable that he or she will be willing to pay for the training.

The perception that companies want to bring in workers from outside Ghana may not be accurate. The local labour force lacks some of the skills companies need. However, if local people can become skilled they cost less because the cost of maintaining expatriates is much higher than it is for locals. This is because of the cost of flights every year to go abroad to visit their families, their relocation cost, and other associated costs and generally because employees are paid less in Ghana than in Europe or the USA. So, when the company brings somebody from outside, they are likely to spend more money than the if the employ locals, so they would readily employ locals if they have the requisite knowledge and skills.

The AOGC representative raised questions about funding. Who is responsible for training prospective employees? The respondent identified three entities who could be responsible for funding: (i) the companies that need these technical skills to utilize in their operations; (ii) the government as it is responsible for Ghanaians' well-being; (iii) in a capitalist environment individual should fund themselves and acquire their certification.

Management representative 3 believes that Ghana's oil and gas industry is in its infancy and in that respect, the company is still building capacity so most of the time it tends to look externally for people with the required skills. According to him:

> To get the individual to compete with global partners in the energy sector, we need to send them abroad so we can also have a similar experience. Ghana is still relatively new. We do not have established institutions for all the certifications we require. However, we still have an excellent educational system that gives us a strong solid foundation to employ and build on.

Management representative 2 sees the solution in a strong collaboration between the technical institutions and the industry. However, the respondent argues, “most of our institutions are not that focused. They are only focused on the student passing out and fending for themselves” The respondent suggests there should be a channel from graduation to employment. It should be in partnership with an organization or some recruitment structure. This will make it easier for the student to understand the requirements for getting to work, and could become a mechanism for preparing to obtain jobs after graduation.

6.8.2 Technical and Vocational Education and Training perspective

The COTVET representative sees the solution in awareness creation and information flow. The respondent thinks people should be made aware of opportunities in the oil and gas sector. Sometimes interested people have difficulty identifying which aspects of employment opportunities are open and how they can enter employment. The respondent further suggests:

> If there is much information on opportunities available, the entry points, how one can come in, and knowing the system is open to all, not just to foreigners but to every qualified Ghanaian.

People have the passion, but they do not know how to get into the industry, but if the information is out there for everybody to access, then one knows that this is what one needs to become employable as an engineer. So the respondent's primary concern is to let people know about the current opportunities and the associated skills requirements.

TVET representative 2 recommends strengthening the law that mandates the Petroleum Commission to develop skills for the industry. "What we need is a law that will empower the Regulator 2 to make sure that any person on board a rig has specific certificate of competency from the technical institutions. It becomes mandatory, but if the law is not there, everybody can twist it or do whatever they like," When the respondent was asked about the existence of such clauses in the local content law he replied that there are implementation challenges. "Who is regulating the law or who is implementing the law, I do not know."

TVET representative 4 supports more realistic collaborations between the oil companies and the TVET institutions. Presently, this is not the case. "We need to improve collaboration; most of the oil companies are within our neighborhood, but we barely communicate" Through collaborations, we will get to identify our needs and where we can have some synergies for the benefit of everyone." The respondent explained further:

> When arrangements are in place, we should make an effort to execute them because most of our issues end up on the drawing board. For example, one of the petroleum commission chiefs visited the institution to give a hint that the school would turn into a petroleum institute. Once the minister left office, that plan was still on the drawing board.

The institution's curriculum has remained the same and has not adjusted to the CBT concept. Unfortunately, this also affects the quality of students turned out in relation to the skills requirements of oil companies.

TVET representative 1 explained that in solving the problem of perceived skills mismatches, TVET institutions have strengthened the competency-based training regime. In doing that, collaborations between the industry and the institutions will have to be strengthened as well. The respondent further noted:

> Many institutions' training programmes have to be fully sponsored by the industry or the government. A lack of sponsorship leads to skills mismatches. There should be a line of progression for the students because the labour market is diverse, and a student may not get the job for which he or she is trained. In that case, the student becomes unemployed.

6.8.3 Perspective of the responsible ministries in regard to skills provision

The Ministry 1 representative recognized the industry's enormous role, "the industry decides everything."

> We deal a lot with the industry regarding the generation of occupational standards; that is, the beginning of curriculum development. The ministry brings them on board to generate standards that they feel they want the learner to exhibit in the world of work.

The ministry thinks this could lead to TVET skills matching the skills required by the industry but much funding will be needed to implement the various aspects of the project.

The MELR representative sees skills development as an integral part of economic development planning. With reference to a medium to long term national human resource development framework, the respondent asked the following questions:

> If Ghana is going into oil and gas production, questions like who does the production? How many people do we need in the production process? And for how many years? What are the skillsets required for the production process? And then what type of training or human capacity development interventions do we need? If they do not have the people, what do we do for people to acquire those skills?

If such a framework can be developed it will be possible to bridge the gap between the skills and knowledge required by the industry and skills and knowledge supplied by the appropriate institutions. The private sector is not willing to invest in training because training comes at a cost and they are not sure of a good return. Already the companies are suffering from high production costs, and the cost of doing business in Ghana is high. Therefore, the companies expect the training institutions to bear the cost of training**.**

The respondent proposed a public pool that all private institutions contribute to for training and for the money to be used to train people they need. By doing this, the fear of poaching will be eliminated.

6.9 Discussion of findings

Chapters five and six have reported findings from in-depth interviews with stakeholders and two exploration and production oil and gas companies in Ghana. It highlighted skilled work, middle-level occupations in the companies as: reservoir engineer, subsea engineer, operations engineer, drilling engineer, or senior accountant. The criteria against which middle or intermediate level skill jobs are measured relate to knowledge, skills and practical experience and the most important criteria and employment requirement of job seekers is a relevant degree. Similarly, training leading to certification and other relevant analytical and communication skills are all considered essential. The types of knowledge and skills ranked by the oil and gas industry from the most important to the least important, are diagnostic and reasoning skills, ability to handle multiple tasks, social and teamwork skills: formal knowledge, knowledge of rules of the organization,

In terms of the future of middle and intermediate level jobs, the skills required in the industry are traditional ones. Moreover, this situation will probably remain the same despite technological advancement. Workers will learn new work methods through on-the-job training or through a management of the change process. Workers in these categories play a key role within the company and transition with experience to higher levels.

High demand occupations looked for by the companies are all in technical professional fields such as mechanical technicians, instrumentation technicians, electrical technicians, process engineers, welders and scalp folders. Other technical professionals include basic mechanical, and electrical engineers. While companies do not necessarily have a problem finding graduates, they rely heavily on their assessment process that measures good attitude and aptitude and cognitive capacity. The

regulator of the sub-sector said Ghana has many theoretically trained engineers but what they lack is a professional certification that the companies require in order to employ them. As an alternative to acquiring this certification outside Ghana, a purpose-built centre could be developed in Ghana to train certified skilled workers. However, the requirements and standards are high and costly.

New hires and employees require technical knowledge such as critical thinking, pro-activeness, and understanding of how to work in an organization, including office tasks such as drafting memos. They must be able to solve problems and must have a high level of tacit knowledge as well. The companies recognize that newly trained graduates from Ghanaian universities have general and specialized theoretical knowledge but do not have hands-on experience. As a result, the education is good but very theoretical: "We mostly take new hires through another two years of training to cement their knowledge."

On-the-job training is heavily relied on by the companies to overcome the deficiencies of the supply side of skills. The companies have a similar training philosophy based on the 70-20-10 principle. That is (70%) of the training is gotten on the job and then (20%) through coaching, mentoring, workshops, professional association and (10%) in the classroom.

The companies engage, collaborate and partner with local educational institutions in different forms and at different levels. The engagements include scholarships to students studying engineering and funding through social performance schemes to the technical universities and institutes oriented towards oil and gas. The collaboration between the upstream sub-sector of the oil and gas industry and training institutions is healthier than it used to be. The Petroleum Commission has met the VCs and the managements of ten (10) TVET institutions and enabled

some staff to go to UK for a training programme for their teachers or instructors so that they can become certified instructors because none of them qualifies as certified instructors.

Two technical universities and two technical institutes were under review. The universities' degree of collaboration with the oil companies was much higher than the institutes. Ghana Education Service, Ministry of Employment and Labour Relations, General Transport, Petroleum and Chemical Workers Union all had collaborations in different forms and at different levels, contributing to policy and sub-committees within the Ministry of Employment and Labour Relations.

The claim by COTVET (2021) of lack of core technical skills, qualifications and prior experience by TVET graduates can only be partially correct. The findings show that on-the-job training provision by oil and gas companies in Ghana is not part of the TVET provision. The assurance by Isaac (2022) of confidence in knowledge level against the required standards remains a challenge to the employment of TVET graduates in the oil and gas sector. Findings show that the technical universities provide the core technical skills based on a competency-based curriculum but fail to get employed by the oil and gas companies due to professional certificates (COTVET representative).

6.10 Conclusion

The chapter has discussed the findings in line with the research questions by first considering whether the perceived skills mismatch between mid-level skills turned out by TVET institutions and skills demanded by the upstream oil and gas sub-sector is the case. It subsequently discussed the sub-findings that led to the overall finding. The findings demonstrate that the perceived skills

mismatch results from institutional dislocation. Having satisfied almost all the conditions necessary for acquiring the mid-level skills required by the industry, the problem lies in the failure of the TVET sector to offer courses leading to professional certification as required by the oil and gas industry. The government's reaction to solving the problem has been to sponsor individuals to obtain professional qualifications. However, this action of government is expensive and benefits only individuals.

The chapter also explored the relationship between the TVET institutions and the oil companies in on-the-job training. The chapter established that on-the-job training is recognized as a good thing by the oil companies but only offered after recruitment because the would-be employee has the skills and the requisite qualifications to be hired.

CHAPTER SEVEN

7.0 Conclusion

This study has drawn strongly on the political economy of skills literature and the relationship between education and work literature. This thesis began with an overview of the Ghanaian educational system in general and of the TVET system in particular. The educational system has undergone several reforms including reforms in the technical and vocational education and training sector. What is important to note is that TVET system is small. Formal TVET offers only 10 per cent of vocational skills training in Ghana; most workers receive skills through apprenticeships. Ghana's educational reform goals have primarily been influenced by globalization and the development agenda of successive governments. The reforms over the years have considered TVET as an essential component of the educational system but to date have achieved little to improve and enlarge it.

The oil and gas industry has many challenges in keeping up with technological advancement. The professional skills and competencies required by the oil and gas sector are in a continuous process due to widespread digitization. The oil and gas companies recognize the constant change in work operations due to tools and technology updates. For example, Kanepi software replaced Excel Spreadsheets in generating daily production reports.

The knowledge and skills required in work and education can be conceptualized in different ways. While TVET representatives interviewed for this study believe they produce graduates with the right skills and knowledge for the oil and gas industry, industry representatives perceive TVET training as theoretical. Even if graduates are employed in core technical occupations, they have to

be further trained. Industry representatives argue that students from the pre-tertiary TVET institutions could find jobs at the fabrication workshops operated by third parties in the industry and with contractors but not with the exploration and production companies because they do not have the knowledge and skills associated with professional certification.

Collaborations between TVET institutions and the oil and gas companies, on one hand, and between other stakeholders on the other, occur at different levels, directly or indirectly. The institutions collaborate at the policy level, institutional level, committee and sub-committee levels – sector skills bodies, local content committee, and COTVET Board to ensure certification aligns with CBT and with industry. These collaborations to some extent meet their intended purpose of properly linking education to work, but the question of lack of training to meet the requirements of professional certification remains.

Skills are necessary because they are critical to industrial development and industrial development is key to development in general. However, the study argues that as much as skills and their modes of acquisition are essential to development, other economic and social factors must be considered for education policy to stimulate economic growth.

While there is a widespread perception of a skills mismatch between the education and training offered in the TVET sector and the employment requirements of the oil and gas industry, the findings suggest that the main issue is a structural dislocation that has not been addressed by policy reforms to date, despite efforts to do so, making it impossible for the TVET providers to supply mid-level skilled workers to the exploration and production oil and gas companies. TVET provision in Ghana does not have both the power and the appropriate institutional arrangements to

issue professional certificates to mid-level skilled technicians from TVET institutions even though the certification manuals and training development has been industry approved by the internal verifiers, internal party assurance and the external quality assurance and in addition, TVET universities competency and skills are based on the training manuals.

The empirical contribution of this study is a textured explanation (political economy analysis) of why TVET graduates with core technical occupational competence do not get employed directly by the oil companies. The government's reaction has been to sponsor individuals to obtain professional certification outside Ghana. As previously stated, this response is very costly and benefits individuals and not TVET provision within Ghana.

Allais & Nathan (2014) argue that studies of the transition from education to work attempt to describe the relationship between an educational programme and its destination, with its attending institutional arrangements that include labour market arrangements and information and advice systems, curriculum content and qualification systems. Allais et al. (2021, p. 90) argue; "How regulated the labour market is, and the extent of the coordination between key social actors (government, unions and employers) in the labour market determines the functioning of qualifications as a symbolic rhetoric of competence or a substantive indicator of the nature of the occupational work involved in the field of practice."

The findings suggest that the relationship between skills providers and the oil and gas companies regarding collaborations is acceptable with reference to 'work experience' opportunities as part of the curricula offered by various institutions in the TVET sector. Similarly, the progress made between crucial stakeholders in supplying the required skills to the oil and gas companies is

encouraging. In addition, the institutional framework to deliver on qualifications and the curriculum seem adequate at two levels: TVET Universities run CBT and produce BA/BSc Technical Professionals on the ISCO-08 occupational classification equivalent to Level 6 (Professional Technical) NTVETQF. TVET Institutes offer the Ghana Education Service curriculum and produce Technicians and Associate Professionals at Level 5 (HND) on the NTVETQF (Table 14). However, the institutional framework and a range of resources for the TVET institutions to offer professional certification are lacking.

I argue that institutions and their appropriateness are of greater importance than thinking more broadly beyond "occupations and occupational practice" in linking mid-level skilled graduates to work in the upstream sub-sector of Ghana's oil and gas industry. For example, exploration and production oil and gas companies offer technical employment in high risk occupations that require highly professional people with internationally accepted certified qualifications as a foundation for further training (on-the-job training), given that the risks associated with such occupations can have dire consequences for the marine environment and require technical professionals to be able to drive exploration, production and maintenance processes (5.2.6).

7.1 Limitations

The application and the retrieval process of the survey instrument were challenging. The oil and gas companies were difficult to access as the companies were observing lockdown in response to the government's response to the pandemic. Eventually, out of four questionnaires applied, three were recovered, two from Company 1 and one from Company 2. The full complement would have given the researcher more detailed information on the two companies.

There is a requirement within the Plan of Development (POD) that training budgets are to develop locals' or Ghanaians' skills. Beyond that, Company 2, Vitol Ghana, and Company 3 are also required by the LI to support skills for the industry. In addition, the local content law requires internal staff development to create and develop nationals to certain levels of position within the organization. Several attempts by the researcher to seek permission from Vitol Ghana to be part of the research were unsuccessful. Having an interview with Vitol Ghana together with Company 2 and Company 3 may have given a deeper insight into employment issues in the sector.

7.2 Validity and reliability

Sharan and Merriam (2009) state that validity and reliability can be approached by carefully paying attention to how a study is conceptualization and to how the data are collected, analyzed and interpreted. Internal validity in all research hinges on the meaning of reality (Sharan & Merriam, 2009).

Data collection was undertaken during the pandemic (COVID-19), when most workers worked from home. The timing of the research could thus have affected the reliability of the findings. In addition, it is mostly accepted that case study findings are not likely to be generalizable to other settings. However, such generalizability was not the intention of this study which aimed to investigate what could be done to overcome challenges related to supply and demand of scarce technical skills in the |Ghanaian exploration and production oil and gas industry.

7.3 Recommendations

The limitations of this research are set out above. What the study does offer, however, are the findings which confirm the structural and economic factors that obstruct graduates from both pre-

tertiary and tertiary TVET institutions from being employed by the exploration and production of oil and gas companies in Ghana. However, the research did not consider third-party operators like the fabrication yard. Those low-level roles are equally essential and are not hired directly by the upstream oil and gas companies but subcontracted to third-party companies. The upstream oil and gas companies are not involved directly in these their-party contractors. The oil companies give specifications to these third-party contractors to deliver. The engineers of the oil companies only come in to conduct quality assurance to inspect the deliveries if they meet the needs and specifications of the companies of the upstream companies.

The rationale for suggested further research will be to explore the relationship between TVETs as providers of mid-level skills and technical occupations and the occupational skills demands of the oil and gas third-party contractors of the upstream oil and gas sector in Ghana.

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APPENDICES

Appendix A: demography of respondents

No	Respondents' ID	Date interviewed	Gender	Institution	Credentials	Responsibility
1	Management representative	19 12 2020	F	Company 1	HRBP	Head of HR function - from hiring to retiring or resignation
2	Management representative	X	M	Company 1	*Offshore Team Lead*	Operations
3	Management representative	21 05 2021	M	Company 2	*HR Officer*	HR function
4	AOGC representative	18 01 2021	M	Regulator 2	Consultant AOGC (Accelerated Oil and Gas Capacity Building)	Building capacity for the oil and gas industry particularly the upstream sub-sector.
5	Management representative	04 05 2021	F	Company 3	Manager HR	In-house training & hiring
6	TVET representative 1	22/10/2020	M	TVET 1	Senior management	See to accreditation, acquisition, standards within the institution and its external regulators

7	TVET representative 3	04 11 2020	M	TVET 3	Senior leadership	Management of the institute
8	TVET representative 4	03 11 2020	M	TVET 4	Senior administrator	Performs all functions of a principal except signing checks
9	TVET representative 2	17 12 2020	M	TVET 2	Management/Lecturer	Coordinate the work of the Deans
10	COTVET representative	02 11 2020	M	Regulator 1	Senior management and acting head Project Planning, Research Management and Evaluation	Support the Ministry with policy formulation and inputs in policy designs as far as TVET and skills development is concerned
11	GES representative	12 11 2020	M	Ministry 1	Senior position for the division of GES	The division is solely to take care of TVET training at the pre-tertiary level
12	MELR representative	13 11 2020	M	Ministry 2	Senior position of a Ministry	Support the ministry to formulate policies about employment and labour issues
13	AGI representative	19 10 2020	M	PS 1	Senior position	Speak for all businesses in Ghana

14	GEA representative	01 12 2020	M	PS 2	A Research Officer and an Economist	Undertake all research in the business environment that is of key interest to the employer
15	GTPCW representative	18 11 2020	M	PS 3	Senior union official	In-charge of operations for the National Union

Appendix B: Employer interview protocol

Introduction

We would like to understand a bit about your organization and your role;

1. What is your position in the company? What are your roles and responsibilities? How long have you been in your current position?
2. Could you share some information about the workplace at your company?
   a. Number of employees?
   b. Employed in what kind of jobs/occupations?
   c. Where located geographically?

Fulfilling workforce needs

3. What are the high-demand occupations that your company is looking for?
4. What knowledge, skills and abilities (KSAs) do you expect new hires in your company to have?

PROBE

   a. *Content knowledge*
   b. *Performance skills*
   c. *Abilities*
   d. *Workplace competencies/soft skills*

PROBE

Ask respondent to "unpack" each KSAs eg. Ask can you give me specific examples by what you mean by ……. or what do you mean by ……. which jobs require what kind of knowledge, skill or ability.

5. In what ways does your company determine if an applicant or new employee has those KSAs?

a. Are there any specific types of credentials or licensing your company seek in new employees?
b. Does your company have job descriptions that list these requirements? (Evident)
c. Do you require applicants to take any type of test (drug or ability test)?
d. Any kind of question you ask in the interview

6. What internal processes if any does your company go through in order to determine what KSAs a specific job requirement?
7. What is the relationship between your company, Vitol Ghana and GNPC in the field of work and how does that relationship contribute to making sure local Education and Training providers (especially TVET) meet your skill demands?

PROBE

What role do HR/hiring managers or other employees have in determining the required skills? What about government regulations eg Health and Safety regulations?

8. How well do you think current education and training providers are Contributing/developing skilling up the talent in those occupations and skills?
   a. Do you have any concerns regarding students mastering the skills that are been taught? In what ways?
9. Are you having success in finding people to fill your high-demand occupations or with those key skills?

On-the-job training

10. Do your company offer on-the-job training opportunities? (obtain details on how programmes are structured, who is targeted population (new, hired, incumbent workers, students etc)
    a. Student internship (before someone is hired)
    b. Partnership with any education provider?
    c. Apprenticeship (being paid while trained up)
    d. Paid schooling opportunities (tuition reimbursement)
    e. Others

Company's engagement with education and training providers

I will like to find out more about your company/organizations work with education and training providers. First does your company collaborate, partner or interact with any local education provider?

(If NO then to Q14) if YES ask Q10 through Q13)

11. Which local education and training providers does your company typically interact with?
12. In what ways does your company interact or engage with them?
    (list out all the ways with all the institutions. Eg. Curriculum development, your employees gust lecturing in a class, internships, offering students tours of your facility, sharing data on workforce needs with the school, interviewing their graduates)
13. What does the collaboration process look-like? (ie meetings, student-employer interactions, planning and implementation of programmes)
14. To date what are some of the positive and negative experiences your company has had?

15. In an idea world how should employers and education/training providers collaborate to ensure that your company get the right type of employees?
16. What forms of skills and knowledge will be required in the next 10 – 20 years in your company?

Appendix C: TVET interview guide

Introduction

We would like to understand a bit about your institution and your role;

1 What is your position in the institution? What are your roles and responsibilities? How long have you been in your current position?
2 Could you share some information about the institution?

d. Number of students?
e. What kind of causes do your institution offer to your students?
f. In which particular occupations?

Fulfilling workforce needs

3 Do you have records of your past students in the oil and gas industry? If yes, at what levels of qualifications?
4 How many of your past students are employed in the oil and gas sector?
5 What are the high-demand occupations that the oil and gas companies are looking for?
6 What knowledge, skills and abilities (KSAs) do they expect your graduates to have?

PROBE

e. Content knowledge
f. Performance skills
g. Abilities
h. Workplace competencies/soft skills

PROBE

Ask respondents to "unpack" each KSAs eg. Ask can you give me specific examples by what you mean by ……. or what do you mean by ……. which jobs require what kind of knowledge, skill or ability.

e. In what ways does your institution determine the kind of KSAs the oil companies need?

7 What internal processes if any does your institution go through in order to determine what KSAs a specific job requirement?

PROBE

What role do the Head of the institution and management play in determining the required skills needed by industry, particularly the oil and gas?

8 How well do you think industry (oil and gas) are Contributing/developing skilling up the talent in those occupations and skills?
9 Do you have any concerns regarding students mastering the skills that are been taught? In what ways?
10 Are you having success in turning out graduates who readily find jobs to fill the high-demand occupations in the oil and gas industry?
11 If No, why?

On-the-job training

12 Do the oil and gas companies offer on-the-job training opportunities for graduates from your institution? (obtain details on how programmes are structured, who is targeted population (new, hired, students etc)
   f. Student internship (before someone is hired)
   g. Partnership with any education provider?
   h. Apprenticeship (being paid while trained up)
   i. Paid schooling opportunities (tuition reimbursement)
   j. Others

Education and training providers' engagement with the oil and gas companies

I will like to find out more about how your institution work with the oil and gas companies? First does your institution collaborate, partner or interact with any local oil and gas company?

(If NO then to Q15) if YES ask Q11 through Q14)

13 Which local oil and gas companies does your institution typically interact with?
14 In what ways does your institution interact or engage with them?
(list out all the ways with all the companies. Eg. Curriculum development, employees gust lecturing in a class, internships, offering students tours of your facility, sharing data on workforce needs with the school, interviewing their graduates)
15 What does the collaboration process look-like? (ie meetings, student-employer interactions, planning and implementation of programmes)
16 To date what are some of the positive and negative experiences your institution has had?
17 In an ideal world how would your employees and education/training providers collaborate to ensure that your institution provide the right type of skills for industry?

Appendix D: Survey instrument

UNDERSTANDING DEMAND AND SUPPLY OF SKILLS IN THE OIL AND GAS UPSTREAM SUB-SECTOR IN GHANA **PhD Thesis** **UNIVERSITY OF WITWATERSRAND** **THEME: Technical and Vocational Education and Training Qualifications and Middle-Level Skill Jobs** **CEO and SUPERVISOR as individual respondents**			
Date of interview	**Day**	**Month**	**Year**
Name of company			
Job Designation			
No of years at company			
Qualifications			

This questionnaire aims to capture 'present' and 'futures' dimension about **Technical and Vocational Education and Training graduates' qualifications and job specifications** therefore most questions will ask you to think about current practices in your company, compare these to past practices and then extrapolate to future practices.

'Future'- orientated answers cannot be evidence-based so we ask that you rely on your understanding of your company and of the sector when you consider the future dimensions of the work of TVET graduates.

PLEASE NOTE:

In this research project the work of a Technical and Vocational Education and Training (TVET) graduate refers to **skilled work at the middle- or intermediate-level.**

In this company we are studying the job of _____ *(please insert)*

We ask questions in three areas:

- Identifying skilled work in your company
- Identifying occupations and qualifications
- The future of skilled work in your company

IDENTIFYING SKILLED WORK IN YOUR COMPANY

1. ***Which jobs in this company could be described as skilled jobs at the middle- or intermediate level?*** *(Name at least 3)*

JOB TITLE	JOB GRADE

2. ***Name one technical job at a <u>higher</u> level of skill than the skilled jobs listed above.***

JOB TITLE	JOB GRADE

3. ***Name one technical job at a <u>lower</u> level of skill than the skilled jobs listed above.***

JOB TITLE	JOB GRADE

4. ***What are the most important criteria against which you measure the kind of skilled job we are studying in your company and why? (Please mention at least three measures)***

This is very important in skilled work	**Why?**

5. ***What forms of <u>knowledge</u> are required in this job?***
   Please use the rating scale below to allocate a rating to each item.

   <u>Rating Scale</u>: 5 = 'very often' | 4 = 'often' | 3 = 'fairly often' | 2 = 'not often' | 1 = 'not at all'

	Rating
Formal knowledge (scientific laws and principles gained through study)	
Situated or practical knowledge (gained through on-job experience)	
Knowledge of rules and procedures (as specified in company manuals)	
Other (specify)	
Discuss:	

6. ***What forms of skill are required in this job?***
   Please use the rating scale below to allocate a rating to each item.

   <u>Rating Scale</u>: 5 = 'very often' | 4 = 'often' | 3 = 'fairly often' | 2 = 'not often' | 1 = 'not at all'

	Rating
Hand dexterity or manual skills	
Diagnostic and reasoning skills	
Planning, organising and time management skills	

Reading, writing and calculation skills	
Social and team work skills	
Other (specify)	
Discuss:	

7. Which of the following kinds of diagnostics and problem solving apply to the skilled job we are studying in your company?

Please use the rating scale below to allocate a rating to each item.

Rating Scale: 5 = 'very often' | 4 = 'often' | 3 = 'fairly often' | 2 = 'not often' | 1 = 'not at all'

(Tick as applicable)

Diagnostics and problem solving, as part of routine work or maintenance

Standardised diagnostics and problem solving, as specified in operations manual s or through using diagnostic tools

Working out solutions to unknown or novel problems through practical experimentation with actual tools and materials

Drawing on past experience of similar or related problems and then making drawings or sketches before tackling the problems practically

Drawing on formal scientific principles/theories to diagnose and solve problems in the mind or 'virtually' before proceeding with identified solutions

Using Google and the internet to find solutions used by others experiencing the same kind of problem

Bringing new problems to a team meeting for joint diagnostics and problem solving

Other (describe)

8. Has the way work is done in this job changed over the last five years?

Yes, a lot	A few changes but fundamentally the same	Almost no change
If yes, how did skilled workers learn the new work methods?		
Discuss:		

9. Have the <u>tools or technology</u> used in this job changed over the last five years?

Yes, a lot	Updated but not fundamentally changed	Almost no change
If yes, how did skilled workers learn how to use the new tools/technology?		
Discuss:		

10. Have the <u>materials</u> used in this job changed over the last five years?

Yes, a lot, with re-training required	Somewhat but skilled workers could easily adapt	Almost no change
Discuss:		

11. What are the kinds of things that can go wrong in this job?

12. How is risk minimised?

IDENTIFYING OCCUPATIONS AND QUALIFICATIONS OF SKILLED JOBS

13. What are the middle-level and lower-level skilled occupations and corresponding qualifications in your company? (List as many as you have)

Type of Occupations	Qualifications/Institutions
Middle-Level	
Lower-Level	

THE FUTURE SKILLED WORK IN YOUR COMPANY

14. Do you think the middle-level skilled job which you have described above will still exist in your business in 10 – 20 years *(Please give reasons for your answer)*

1. Yes, definitely	2. Yes, but artisanal or middle-level skilled work of this kind will **shift upwards** to a higher level of knowledge and skill at technician level	3. Yes, but, artisanal or middle-level skilled work of this kind, will **shift downwards** to a lower level of semi-skilled work	4. This kind of work will simply disappear	5. Other (describe)
Discuss:				

15. If you selected 1, 2 or 3 above then please say what forms of <u>knowledge</u> will be required in this job in the next 10 - 20 years?

Please use the rating scale below to allocate a rating to each item.

<u>Rating Scale</u>: 5 = 'very often'/ 4 = 'often' | 3 = 'fairly often' |2='not often' |1 ='not at all'

	Rating
Formal knowledge (scientific laws and principles gained through study)	
Situated or practical knowledge (gained through on-job experience)	
Knowledge of rules and procedures (as specified in company manuals)	
Other (specify)	
Discuss:	

16. What forms of skill will be required in this job in the next 10 – 20 years?

Please use the rating scale below to allocate a rating to each item.

<u>Rating Scale</u>: 5 = 'very often' | 4 = 'often' | 3 = 'fairly often' | 2 = 'not often' | 1 = 'not at all'

	Rating
Hand dexterity or manual skills	
Diagnostic and reasoning skills	
Planning, organising and time management skills	
Reading, writing and calculation skills	
Social and team work skills	
Other (specify)	
Discuss:	

17. Which of the following <u>would best describe</u> the kind of diagnostics and problem solving that will be required in this type of job in the next 10 – 20 years?

Please use the rating scale below to allocate a rating to each item, as applicable.

Rating Scale: 5 = 'very often' | 4 = 'often' | 3 = 'fairly often' | 2 = 'not often' | 1 = 'not at all'

Repetitive diagnostics and problem solving, as part of routine work or maintenance
Standardised diagnostics and problem solving, as specified in operations manuals or through using diagnostic tools
Working out solutions to unknown or novel problems through practical experimentation with actual tools and materials
Drawing on past experience of similar or related problems and then making drawings or sketches before tackling the problems practically
Drawing on formal scientific principles/theories to diagnose and solve problems in the mind or 'virtually' before doing so in practice
Using Google and the internet to find solutions
Bringing new problems to a team meeting for joint diagnostics and problem solving
Other (describe)

18. Will the way work is done in this job or his type of job change in the next 10 – 20 years?

Yes, a lot	Possibly a few changes but not much	Very little change
If yes, how will skilled workers learn the new work methods?		
Discuss:		

19. What tools or technology will be used in this job, or type of job, in the next 10 – 20 years?

20. How will staff learn to use the new tools and technology?

21. What materials will be used in this job or in this type of job in the next 10 – 20 years?

22. How will staff learn to work with the new materials?

23. Anything else you would like mention about the future of skilled work in your company?

End of Instrument: We appreciate your participation.

Appendix E: Information sheet

[redacted]

Dear Sir/Madam,

INFORMATION SHEET

My name is Hans Awude and I am a PhD student in the School of Education, University of the Witwatersrand, Johannesburg within the Centre for Researching Education and Labour (REAL). As a requirement of this degree, I am investigating why Technical and Vocational Education and Training (TVET) graduates are not able to meet the skill demand of the oil and gas industry in Ghana (a reported skill mismatch). My research is entitled ***"Understanding Skill Demand and Supply in the Oil and Gas Industry in Ghana: The Case of Exploration and Production Companies"*** and aim to highlight and argue employers' perception of skills and hiring decisions based on social, economic and institutional factors that affect the relationship between demand and supply of skills within a complex labour market and also explore the skill pathways and issues around skill utilization.

As part of this project I will like to invite you to take part in an interview in the Month of September/October, 2020. This activity will involve answering questions (a single interview) and will take around 45 - 60 minutes. With your permission, I will also like to record the interview using a digital device.

You will not receive any direct benefit from participating in this study, and there are no disadvantages or penalties for not participating. You may withdraw at any time or not answer any question if you do not want to. The information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym to represent your participation, in the final research report. If you experience any distress or discomfort, I will stop the interview or resume another time.

The information gathered is to assist me analyze workforce needs/Employer perception of hiring decisions, on-the-job-training, Company's engagement with education and training providers, coordination, forms of skills and knowledge that will be required in the next 10 – 20 years.

The data collected will be analyzed and documented in a research report. The research findings will be used for academic purposes only, including books, journals and or conference proceedings.

All research data will be kept securely in a locked cabinet or password protected computer folder and will be destroyed 5 years after completion of the project.

A meeting with yourself can be set up to take you through the study and the information required from yourself for the study. I look forward to your response at your earliest convenience.

If you have any questions afterwards about this research, feel free to contact me on the details listed below. The study will be written up as a research report which will be available online through the university library website. If you wish to receive a summary of this report, I will be happy to send it to you upon request. If you have any queries, concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (non-medical), telephone +27(0)11 717 1408, email Shaun.Schoeman@wits.ac.za

Yours Sincerely,



Student: Hans Awude

Telephone +27640413402/+233208133406, email 2060735@students.wits.ac.za

Supervisor: Professor Stephanie Allais (Research Chair: Skills Development)

Telephone +27(0)11 717 3076, email stephanie.matseleng@gmail.com

Appendix F: Participant consent sheet



PARTICIPANT CONSENT SHEET

1. I have been given a Participant Information Sheet which explains the nature and processes involved in this study, which is attached hereto;
2. I was given time to read it, or had it read to me, in the language I best understand;
3. I was given time to ask any questions I wanted to and found any answers given to me to be reasonable and satisfactory;
4. I believe I fully understand why the study is being conducted and what the intended outcomes will be;
5. I understand that there will be no immediate benefit to me, should I agree to participate, nor will I receive any payment; conversely, participation will not cost me anything but my time;
6. I understand that, even if I initially consent to take part in the study, I may subsequently withdraw at any time and would not be required to give any reasons; if that happened, any data collected about me for the purposes of the study would immediately be destroyed, unless I give consent for it to be retained
7. I hereby consent to audio recording of the interview
8. The recording will be stored in a secure location (password protected computer) with restricted access to the researcher and the research supervisor.
9. The recording will be transcribed and any information that could identify me will be removed (anonymity/confidentiality is guaranteed) throughout the research.
10. Direct quotes from my interview, without any information that could identify me, may be cited in the research report or other write-ups of research.

I have been given a range of contact details, listed below. If I require further information or become concerned about any aspect of this study, I am free to speak to any of these contacts

Contact Details:
Student: Hans Awude

Telephone +27640413402/+2338133406, email 2060735@students.wits.ac.za

Supervisor: Professor Stephanie Allias (Research Chair: Skills Development)

Telephone +27(0)11 717 3076, email stephanie.matseleng@gmail.com

Name of Participant: _____

Date: _____

Place: _____

Signature or mark _____

Witnessed by:

Name of Witness: _____

Signature: _____

Date: _____

Appendix G: Human research ethics committee (non-medical) clearance certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Awude

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H20/03/02**
PROJECT TITLE	Understanding Demand and Supply of Skills in the Oil and and Gas Industry in Ghana: The Case of Exploration and Production Companies
INVESTIGATOR(S)	Mr H Awude
SCHOOL/DEPARTMENT	Education/
DATE CONSIDERED	13 March 2020
DECISION OF THE COMMITTEE	Approved Permission letters on letterheads required before data collection can commence
EXPIRY DATE	17 May 2023
DATE 18 May 2020	**CHAIRPERSON** (Professor J Knight)

cc: Supervisor : Professor S Allias

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to submit an amendment of the protocol to the Committee. **I agree to completion of a regular progress report. For Minimal and Low studies, this is due annually on 31 December. For Medium and High Risk studies, this is due twice annually on 30 June and 31 December.**

01 / 06 / 2021

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES