

Electricity Expansion: Rwandan Catalyst for Skills Acquisition and Graduates Inclusiveness

Kosisochukwu Pal Nnoli

Jacobs University Bremen

Kampala, Uganda

email: k.nnoli@jacobs-university.de

Abstract

As a developing economy, Rwanda has been exploring transitioning to being a technologically driven and sustainable economy. Moreover, research on economic growth have focused on the need to improve human capacity potential within increasing demands of climate change activists but there remains a theoretic and practical lacuna in including renewable energy resources in economic growth and expansion of electricity access. Therefore, it is necessary to study the impact of competent skill acquisition and graduate employment market on the interaction mix between economic growth and the expansion of energy access in Rwanda, particularly finding out the problems advancing the non-inclusiveness of engineering graduates, which result to high rate of unemployment and diversions, especially for the graduates specializing in energy fields. As a result, the following open questions were raised with variations 1; how did employees penetrate energy-sector labour market opportunity in Rwanda? 2; what influenced employee's decision in pursuing a career in Rwanda's labour market, 3; what were the specific employee competent skills that enabled smooth transition in energy-sector employment after graduation and the ones required to maintain their current positions? 4; what specific competent skills are required for inclusivity of today's engineering graduates in energy sector employment market? The study is qualitative and it uses the exploratory research design. It is based on the growth pole theory employing snowball/chain purposeful sampling technique, whereby key informants in Rwanda energy sector were located. Data was specifically collected from these primary sources through semi-structured interviews and documentary method. Interview data and text from documents were inductively analysed. The study generally recommended institution or program for connecting learning institutions, industry and employment market in the distributed and renewable energy resources to promote competent skills acquisition,

competition and improve graduates' inclusiveness in the expansion of electricity access, thereby leading to economic growth in Rwanda.

Introduction

Background to the Study

The trends in the integration of distributed energy resources (DERs) and other forms of renewable energy resources (RER) into future electrical power grids have received almost a worldwide implementation in response to the campaign against climate change. Meanwhile, the large integration of these schemes as well as the reduction of the non-hydro conventional energy resources negatively affect the frequency dynamics and electromechanical stability of electricity grids (Nnoli and Kettemann 2021), inclusively Rwanda electricity grid which requires investment and labour attention. At the same time, climate change has placed demands for adaptive labour and market of African economies (Edeh, Leo-Nnoli and Eme 2014). In response to this, the Rwandan national employment program through its five-year lifespan focused on three objectives which were creating enough jobs which are better, sustainable and with standard remuneration; equipping the labour force with needed attitude and skills for productivity through the private sector, and; developing a national coordinating framework for employment initiatives and activities. All these were programmed for faster-growth economic results and are internally supposed to improve skills that will transform the Rwandan economy in energy, transport, logistics, and manufacturing (Program for Results Information Document 2016).

Rwanda is a landlocked country and located in Eastern Africa. Joining the East African Community in 2007, it increased its' access to the regional market, social political and economic potentials. Rwanda is also a signatory to different agreements such as the common market protocol (CMP) signed in November 2009, which started operations in 2010. With this, cooperation among partner states increased, specifically in the area of free movement of goods, persons, and labour with the establishment of resident rights for movement of services and capital. Furthermore, "Article 10 of the CMP" with its free movement clause guaranteed citizens of member states right to employment and contracts within respective national laws of member states. It is on this note that Friedrich Ebert Stiftung initiated studies for effective implementation of the employment policy within the labour market of member states, by commissioning professionals from East African countries' member states. In the same light, Workforce Development Authority, (WDA) was established on 27th March 2009 to promote, develop and upgrade skills and

competencies of labour force on ground, in order to improve their competitiveness and reduce unemployment through technical and vocational education and training (TVET) system (Usengumukiza and Barihuta, September 2012). Meanwhile, corroborating the above, research in Kenya showed a statistically significant impact of educational facilities on training and skill acquisition for students in engineering courses in the Lake Victoria region. By way of influencing national development, technical institutions with the availability of teaching equipment and material resources could help in sustaining and consolidating industrial performance to bring out skill-oriented and comprehensive modules needed for the labour market as studied for Kenya. These may be relatable to Rwanda as an Eastern African country. Scholars argue that there is urgent need to update relevant skills for the labour market in engineering skill sets to close employment gap and bring up economic development in developing economies (Ojera, Simatwa and Ndolo 2021).

Again, between the years 2002 and 2009, labour growth in formal sectors of Rwandan economy were in areas of agriculture, hunting, forestry and fishing; banking and insurance, real estate, financial services, construction and public works; industrial manufacturing; extracting industries; wholesale and retail trade, restaurants and hotels; transport, storage and communication; electricity, gas and water. Meanwhile, following the speech made by the minister of finance and economic planning in Rwanda, the government of Rwanda have focused on specific areas of investment for the years 2010 and 2011, which included the energy sector among others. (See Ministry of Public Service and Labour 2019) However, the statement was without specific attention on investments in labour of energy and renewable energy resources, which is fundamental for sustainable growth of Rwandan economy. It is crucial to look at the economic (i.e., market and industry) potentials when our attention is fully focused on energy expansion possibilities in Rwanda.

Statement of the Problem

As has been hinted so far, skill acquisition and graduate inclusiveness in Rwanda have connections with economic and climate adaptive challenges due to lack of inclusiveness of energy expansion to economic growth (Edeh, Leo-Nnoli and Eme 2014; Program for Results Information Document 2016; Nnoli and Ketteemann 2021). Still, all over the world, there is inadequacy of inclusiveness of first graduates in different degrees in their expected employment positions. Although Rwanda is comparatively not the worst case with reference to several other developing economies in Africa, there is need to harness and diversify investment through opportunities found in the marketability of the renewable energy resources sector, optimization of employment opportunities and diversification

of government economy from agricultural to a multisectoral economy, using local content and being amenable to new power projects, which is a need for many African countries (See Nnoli, Bolu and Obazenu 2016).

Integration of new sectors and diversification of the labour market are very possible. Although many other intricate challenges come up inside the skill acquisition industry and graduate labour force, aside from the historical and political factors. The labour market in Rwanda was reformed in the 2010s following conventions from the international labour organisation (ILO). Rwanda has been achieving great strides through business regulations and labour laws since 2018, which has expanded labour rights in the market especially regarding employer and employees' rights. Notwithstanding the growth of informal economy which has created gap in the labour regulations, often due to lack of information, program or incentives, many workers in the Rwandan labour market have been moved to statutory remunerations in order to get a baseline and organisation for the labour market through policies and regulations. Also, there has been shift from one sector to another in the employment and labour markets and this is partly due to growth in productivity of certain economic sectors, such as agriculture and manufacturing. With this, micro small and medium enterprises (MSMEs) constitute about 98% of total businesses, while the same constitute 41% of private-sector employment. The challenge of micro small and medium enterprises in Rwanda still, were inadequate entrepreneurial training and limited innovation, poor competition and inadequate technical and administrative skills. There is also the challenge of assessing and using different pricing systems at local, regional and international levels, poor market information and insufficient knowledge about the labour market. The products of labour internationally, nationally or regionally also constitute challenge to the labour market profile of Rwanda (Danish Trade Union Development Agency, DTDA 2021).

At the moment, extenuating the current unemployment in Rwanda has been explained as either minutely as skills mismatch or broadly as gap between industry and market, concerning the distributed energy resources, manufacturing, industry trade and commerce, agricultural industry and market. Thus, it becomes necessary to understand the nexus between economic growth through investment in skills and knowledge acquisition and graduate inclusiveness in Rwanda. The following questions would guide this study: 1; how did employees penetrate energy sector labour market opportunity in Rwanda? 2; what influenced employees' decision in pursuing a career in energy sector in Rwanda's labour market, 3; What were the specific employee competent skills that enabled smooth transition in energy sector employment after graduation? 4; what specific competent skills are required for inclusivity of today's engineering graduates in energy sector employment market?

Justification of the Study

This research finds its relevance in qualitatively investigating the root cause of non-inclusiveness and diversion of engineering graduates from energy sector in Rwandan economy, especially with recent extensive global and local business opportunities and investments in the deployment and integration of RER into the existing power grids as well as its off-grid applications. By energy sector, we mean the economic sector responsible for electricity generation, transmission and distribution in Rwanda. From this research, we observe that the stakeholders of this sector may include experts from various fields of learning and may require certain varying skills depending on their specialization field of entry to energy sector. Presently, this qualitative study tends to provide a strategy for unavoidable future expansions along with the sustainability agenda (i.e., graduates' inclusiveness), especially in this era of energy transition in accordance to the world global warming resolutions at COP26 conference 2021 (United Nations 2021). The purpose of establishing these new strategies on the existing infrastructure is to continuously guarantee energy expansion and transitioning, thereby providing investment opportunities, sustaining competent skill transfer, providing informed direction and all serving as a catalyst for graduate inclusiveness and skill acquisition in Rwanda energy economy (with specific attention to the labour market and industry). The Rwanda electricity grid modelling as a later contribution will provide basis for the practical expansion strategies and improve knowledge of the Rwanda grid while pointing to possible future instability areas of the network. The rest of this paper is structured in sections as follows; literature review, theoretical background, methodology, discussions on findings and summary.

Literature Review

Skill acquisition goes a long way to facilitate industrial processes while graduate inclusiveness brings out the importance of formal education in the labour market where investments are made for economic growth. In skill acquisition, vocational educational training is used to update informal trainees through recognition of prior learning as done in Pakistan, where various skills existing in the market were standardized through certifications and accreditation with definite costs marked for outlined specialized programs (Janjua and Naveed 2009).

Even within vocational educational training system for workforce development, it has been noted that skill sets were variegated. Skillsets between industrial training was quite different from skill sets developed by specific training organisations. Both required specific certifications and qualifications followed by regulation through licenses or prescriptions. These highlights the importance of stakeholders within the system to redefine the skill sets in Rwanda.

Poor individual definition by people in the industry as well as organisations and training institutions should not be overlooked but accommodated for sustainable economic growth and labour market in the renewable energy resources inclusiveness (Mills, Bowman, Crean and Ranshaw 2012).

On the same note, competency-based approach is very crucial for technical training and vocational education in Africa due to its impact. The implementation process of this competency-based approach have been able to link government and the private sector using curricular data available in the private sector as efficient instruments in the labour market. This could go a long way to improve the employability requirements at the levels. In the same way, micro small and medium enterprises, which have been excluded, would be integrated for the growth of the economy following the renewable energy resources program. (Institut de la Francophonie pour l'education... 2020).

Comparatively, in India, higher education skill development requires the introduction of skill development programme with collaborations and partnerships as well as incentives (Brar 2015). Shifting from built-on to built-in curriculum for students in the electricity and RER, and ensuring sustainable and economic development, Rwanda also shifted from theory-based curriculum to competency-based curriculum in 2015. Since then, there has been needed to improve on the teaching clarity, mastery, participation, motivation, innovation, learning materials, and laboratory equipment in the educational institutions by involving stakeholders in the industry. This has proved that a competency-based curriculum is expected to bring in a dynamic learning structure to accommodate future energy and employment needs of Rwanda as part of the global political economy (Nsengimana 2021).

In the same vein, technical and vocational education and training (TVET) rally opportunities for the collaboration between industries and universities that lead to skills in the labour market. Sustainability through renewable energy resources courses built within the existing vocational education and training and university curricula would also present a competency-based training and employability status of Rwanda graduates for economic expansion. In this manner, problem-solving skills required by TVET could also be possessed by youth graduates, thereby improving their employability status, entrepreneurial knowledge, business development skills and growth of enterprises. A qualitative study of TVET in graduate employability in Rwanda Ngororero district, with about 250 respondents, showed that those training in vocational education and training schools that used competency-based training programs had high level of technical training opportunities following a unique experience based on industries occupation standards. The students who underwent the competent based trainings performed better at workplace than students who did not (Dukuzumuremyi and Dushimimana 2021).

Given the existing competitiveness, 70% of leading businesspeople in a survey agreed that higher education should engage in one area of TVET or the other with business organisations. This could exist in form of collaboration and competition between the universities and business providers whereby universities and other higher education providers improve commercially, especially in areas of marketing and sales organisation. When such happens, the market improves especially for first job readiness of young graduates and apprenticeships. (Puckett, Pagano, Heny, Krause, Hilal, Trainito and Frost 2020).

In the same way, market demand in the area of business, collaboration between industry and higher education collaboration was looked into to ascertain solutions through a professional work ready graduate scheme. It was noted that there is need in preparing qualified graduates with employable skills to meet with the market demand of expanding labour, as platform for encouraging competitiveness and economic growth internationally. One of the notable challenges facing the duality of industry and education is in the area of creating balance between demand and supply of graduates' skills. (Umar, Bakar and Rashid 2015)

Ascertaining employment prospects in skill acquisition through apprenticeship by focusing on training workers in Germany, it was argued that when apprenticeship is based on voluntary participation by firms, it improves specific skills. Such apprenticeship system could also serve as an opportunity whereby marketable skills are improved upon. There are possibilities of coexistence of mixed qualities in the apprenticeship system while high and low-quality come together as well as young mix with older workers in the labour market. It also accommodates diverse nature of prospective employees and provide a well-balanced labour market with employment security. It also accommodates impute of national planning for organisational motivation and deployment where such are needed. The German apprenticeship system suggests that firm-specific apprenticeship help young graduates of diverse kinds to acquire soft skills with a retention of about 30% of these graduates after 5 years (Winkleman 1996).

In India skill development initiative has taken the route of public-private partnership to increase the employment space. It highlighted the importance of government intervention to encourage short-term, long-term and vocational courses. They showed that problem of skill mismatch and employment gap require a multi-sectoral approach to improve the economy. The argument emphasize the need for modification of office assistant courses as well as employability attributes in a centrally organised and incentivized or nationally orchestrated scheme or programme (Gupta and Agarwal 2018). Likewise, skills employability and entrepreneurship program are needed in the Rwandan

labour market to reduce skills mismatch between demand and supply of labour and bring up innovation in the labour market (African Development Fund, March 2013).

Knowledge in the modern world is very crucial for economic growth through the building of human capital. Its' techniques, sharing and usage could directly influence market through the management of knowledge maps (K-maps). This set of knowledge system helps organisational knowledge to be felt by employees. It also helps to bring professional help to beginners and encourage communication for professionals to access crucial knowledge related to problem solving for their clients. These are needed mostly in academic institutions management. It also improves university and other training institutions' marketability of theoretical and practical knowledge for the needed skills in the labour market. Of course, this portends good benefits for the growth and expansion of Rwandan economy through the inherent knowledge in the renewable energy resources skill sets (Mohajan 2016).

Compared to the case study on economic transformation in Rwanda, there is a relationship between knowledge gained through information and communications technology and business outsourcing. This research acknowledge that the government had interest in attracting investors in information and communication technology (ICT) because ICT development had more opportunities for business development in different sectors, particularly in business development services. This supports entrepreneurship information exchange and opportunities created with potential market and products. This report showed that majority of growth was achieved not through new products but through expansion of international market. The problem with this was that the export market in Rwanda was monocultural. To overcome this barrier to market, Rwanda needs to improve its competitiveness (Malunda and Musana 2012).

Undergraduate students' entry level needs transformative system of educational development, which would integrate them into market needs and opportunities. In doing this, issues such as relevance, satisfaction, enjoyment, as well as content or information would help to bridge skill gaps in education. These are very important for undergraduate education and also need to be incorporated into graduates and postgraduate educational system, and technical and vocational education system to promote soft skill sets designs (Raina 2013). Although, this study is focused on graduates and/or youth employability, the importance of satisfaction and fulfilment, which are crucial for innovation and transformation in today's skill acquisitions, cannot be overemphasized.

Theoretical Background

Elaboration on the Theoretic Context of the Study

This study is based on the growth pole theory proposed by a French economist, Francois Perroux in 1955. The theory posits that concentration of innovative and technically advanced industries has to be linked with businesses and industries in order to engender economic growth or development. Certain characteristics are needed for growth pole. These characteristics include that the market should be large, accommodate innovation, have fast growing sector that prioritizes intense and have quantitative interrelations with other sectors. In its industry, the growth pole has the aim of a sustainable economy through high level of technology and managerial enterprise, high-income demand for its products, interdisciplinary linkage, and ability to get local multiplier effect (Gavrila-Paven and Bele 2017).

Justification of the Gap

The justification for this theory is that it relates to peculiarities of skill acquisition, innovation and graduate employment in Rwanda. In search for a meeting point between the renewable energy resources industry and the existing theory and practices on distributed energy resources in Rwanda for labour market expansion, there is need for provision of ICT and industry focused program, multi-sectoral, incentive-sparked, specialized, certified, export oriented, market and competitive driven program. In this case, the renewable energy resource knowledge and training infrastructure (which can be infrastructural or institutional) is noted to have the capacity to accommodate immediate utility and futuristic inputs, with the use of incentives, peer-to-peer recommended, specialized, collaborations, and 'build-in' innovations in industry and market demands. The growth pole theory supports the character found in the interactions of these variables in the expansion of energy access through investment, skill acquisition and graduate inclusiveness in Rwanda (See Figure 1 below).

Methodology

Research design and sample

The research design used for the study is the exploratory research method. It equips the researcher with the baseline information to understand the subject matter. It works well with purposeful sampling and the combination of instruments of qualitative data collection and analysis. It is often employed in studies as a first step in a multipart or extensive research project, that helps the researcher to gain greater understanding and to identify variables

and how related they are. This explains why it is sometimes seen as pilot study method (Biereenu-Nnabugwu 2018 p.9).

Sampling and Data Collection

The sampling method used was the chain purposeful sampling technique, where information-rich key stakeholders of Rwanda's energy sector were located. The chain of these recommended interviewees typically diverged initially but converged as key patterns became repeated over and over (Peters and Waterman 1982; Patton 2002). Data was collected from the primary and secondary sources. The primary source was specifically in form of interviews, which were personal communications with six interviewees. The sampling involved six information-rich key energy/electricity experts from Rwanda energy groups and other independent/private power producers and contractors. The background fields of the interviewees ranged from Electrical engineering, Mechanical engineering, Energy Economics, Finance, Business Management, Architecture, Biology and Chemistry. Here, presupposition lead-in questions enabled interviewees the freedom to give deep responses. To be able to reach these information-rich key interviewees, the researchers applied directly for interview appointments and observed research ethics in gathering data. The researchers also informed the participants of the expected use of the interview results, and they granted informed consent for the purpose of this research. The question form was a semi-structured interview ranging from opening questions; introductory questions, transition questions, key questions and closing remarks (See Patton 2002 p.367). The secondary sources were mainly documents from online sources comprising texts, journals, official documents, conference papers and dissertation on the study's subject matter.

Analytic approach

In the analysis of data, analytic induction of interview responses with reference to textual analysis of documents through open coding, under specific concepts to support or build general ideas or themes, as derived from the primary and secondary sources of data.

Discussion on Findings

Q.1. How did employees penetrate the energy-sector labour market in Rwanda?

...I had internships at companies from my second year at university, joined NGO for climate environment initiative, received UNDP funding for environment, developed pipelines for geothermal...I rechanneled my study focus to geothermal energy development and won prizes in competitions abroad...I am the director

of the main Rwanda power company... I had eight months of private company consultancy and then joined energy group as an energy planner. I coordinated regional products in energy, also designed programs for electrification, energy access, power generation for transmission negotiation, handled financing contracts...doing product management and policy formulation... I would move on to global impact projects. (T, Personal communication, 2021).

Responding to the question, 'what skills and/ education enabled you to get your first job?' The third interviewee as above, answered that his industry/impact focused study and experience specifically helped in bringing him into his first and current employment. For this question, this study generally found that background information of respondents showed that, there were people with a background on university programmes that target energy sector employment but feel that the university studies did not actually help them in getting their first jobs and others who accessed energy sector employment without an educational background related to the energy sector.

I spoke English and French at the same time, communication skills... good interaction with friends and investors... I am the chief executive officer (CEO) of two energy companies... character driven development, here in Rwanda, people do business with people and not with institutions beliefs... you need to show confidence and trustworthy exhibition, understanding that European business is different from African business in context and practice... and that the universities are too academic (G, Personal communication, 2021).

...project design and management, GIZ and EPD (Energy private developers) Association trainings on feasibility studies, solar photovoltaic (PV) and hydropower generation... I am the CEO and manager of my company...I took more training in feasibility studies and mini grid project management, trainings on asset management and its application to hydro power, training in business and finance management...trainings in decentralized renewable energy (E, Personal communication, 2021).

From the second interviewee's position, we argue that skills-set mismatch was the challenge at entry level, particularly for employees in the engineering and energy sector. The opportunities were either peer-to-peer recommended or based on the industrial readiness or competitiveness of the workers to meet industrial demand and not on institutional certification and practice of employees. Breaking this down, the study noted that some interviewees did

not have engineering backgrounds; some disclosed that their entry into the energy sector was due to recommendations and for some others; their skill met the industrial demands. Thus, it was not due to their energy related certifications or education. The fourth and fifth respondents also admitted that their present position in the job was not connected to their previous training. It was the job demands that brought them their specific roles in their present jobs. These show that there is little opportunity for innovation in the energy sector with reduced growth speed and less quantitative interrelations with other sectors. (See Gavrila-Paven and Bele 2017; Gupta and Agarwal 2018). These also deepen the skill set mismatch and gap within the energy industry and market in Rwanda. The respondents also answered as follows;

...computer skills like in Accounting like QuickBooks and Sage software, MS Access, and SPSS for statistics. Communication skills, driving and language skills (I speak[s] English, French and Swahili) ... I am the Business development manager in this company, electricity is the business... I prepare[s] winning bids, tenders for big projects, maintain contacts with our production factories in Europe and China... I now give engineering advice to engineers, develop projects from scratch to commissioning... I have more on job experience in electricity, water and medical equipment businesses. (C, Personal communication, 2021).

...ability to handle the business financial outsource and project management. We did some financial modules in the university, which helped me... ability to coordinate projects, with management skills. Operation and management using SCADA systems, use of MS excel and management tools... I had a good industrial attachment experience. Theories from my university studies helped to understand the basics but no understanding of the real world practice from the university days...I am the project manager in this company but I worked as a banker for two years before joining the energy sector...I went to conferences and seminars, home and abroad. I had a lot of interactions during events... due diligence, internships and success in project investments helped me... (A, Personal communication, 2021).

.... I am presently the Chief Technical Engineer of one of the first [private] Rwanda power companies... I had technical know-how from internships, some skills in financial negotiations... reporting skills, operations and maintenance of power plants and transmission systems... every breakdown in power system gives new knowledge- mindset growth, efficient communication with manufacturers, mini grid designs and development... (P, Personal communications, 2021).

There may be implications to these assertions. On one hand, it implies that the learning institutions focusing on the electricity and energy markets may not have observed this undirected inflow of energy-untrained professionals in the energy market, most probably because of lack of definition of their requirements or standards for inclusiveness. Secondly, this inflow of initially untrained professionals into the energy market may continuously redefine competent skills and presumably reduce the chances of employment for the already trained graduates. More so, it may lead some energy graduates' redirecting their career to other areas of the economy due to excessive competition and unprotected career field. These responses above emphasize the need to redefine skill sets in Rwanda, supporting that nationally defined skill sets were limited in form of a 'building on' package. In defining skill set, peer-to-peer recommendation as entry for those with specific skills is crucial for using existing structure. Skill sets need to be particularized and broken down to every needed role in the labour market in Rwanda while accommodating sustainability in the area of graduates' inclusiveness (Mills, Bowman, Grean and Ranshaw 2012). This also supports the view that skill set mismatch could be tackled by the competent commercialization of technical and vocational education and training in partnership with certifying institutions for standardization of the Rwandan Labour. From this, one can see the importance of peers and colleagues in providing opportunities for fresh graduates to get job in the renewable energy sector (Puckett, Pagano, Heny, Krause, Hilal, Trainito and Frost 2020). It also highlights the essentiality of amendment of courses as well as employability aspects, which are organised, and incentivized (Gupta and Agarwal 2018). The African development fund programme projected that both entrepreneurial programme and skills that guarantee employment are requisite in the Rwandan labour market to lessen skills mismatch in the demand and supply of labour (African Development Fund, March 2013).

Q2. In your present job position, what are the specific skills and/ education that are required to perform well in it?

... ability to perform feasibility studies in solar and hydro mini grid projects, preparing fundable climate finance proposals and asset management application to hydropower generation (E, Personal communication, 2021).

...use of financial software like QuickBooks (accounts), knowledge of project management, analysis...due diligence, exposure to technical knowhow in hydropower generation... communication skills to deal with stakeholders (RURA, REG, banks, Finance, Ministries) ... ability to give reports to Rwanda development board

(RDB), RDB is a government institution that is responsible for investment. Then I need to give reports to ministry of infrastructure. Ability to write reports to stakeholders (C, Personal communication, 2021).

...leadership skills, which include project management, human (Engineers) resource management for smooth operations... project development skills, public presentation skills, handling meetings with stakeholders (A, Personal communication, 2021).

...technical knowhow like design of power plant, civil construction, installation, operation and maintenance of electrical equipment, ordering maintenance parts (good contact with manufacturers) (T, Personal communication, 2021).

Responding to the question, 'If you have changed working companies, careers, job positions or sustained one job after your education, what skills or education was required at this stage for this transition(s)? The study found that competitive based collaboration and marketable education systems or programs-challenges informed and helped the decisions of the workers in pursuing a career in energy sector. The first respondent gave certain skills in the energy sector as relevant area of consideration. This was collaborated by the fourth, fifth and sixth respondents as above.

Meanwhile the second respondent pointed out the issue of management and collaboration as driving skills in the sector, but more particularly, is that the second respondent affirmed that management and collaboration were important aspects of the sector, saying the following: '...Management. Get yourself the right management in form of employees, business colleagues and creative personnel' (G, Personal communication, 2021). The third respondent emphasized that creativity found in the sector kept his desire more afloat for the chosen career path. The possibilities within the sector go along with specific soft skills and ethics found within the sector. He was noted to say the following:

...soft skills, basic knowledge in engineering, internships, commitment to work, focused mindset and being a principled person... timely delivery, innovative, honesty and hardworking... have a positive mindset that things will work, able to make presentations in financial and technical aspects of projects... (T, Personal communication, 2021).

Puckett, Pagano, Heny, Krause, Hilal, Trainito and Frost, 2020 also highlighted that collaboration and networking, apart from helping to land a job entry position, could also help employees to finish specific task in the engineering

industry, and such is shown in the renewable energy sector mix within Rwanda. This of course extrapolated to collaboration with other certifying institutions. One of the respondents clarified this stating as follows:

...ability to establish trustworthy contacts and create relationships between stakeholders- customers, clients, financial institutions, factories... communication and useful information acquisition, ability to run-around clients and investors creating connections and doing business for the company (C, Personal communication, 2021).

The need to shift from one sector to another also aid and drives career path and as well the labour market. It also increases innovation and transfer of ethics and knowledge as has been substantiated by the labour market profile of Rwanda (Danish Trade Union Development Agency, DTDA 2021). Sustainability and expansion of the economy through energy resource market needs to be integrated with collaboration with the universities as has been done in Chile. Mainstreaming RER market in the Rwandan energy market will grow the employment sector through collaboration and in-built process in technical, vocational education and training industry (See Dukuzumuremyi and Dushimimana 2021; Umar, Bakar and Rashid 2015).

Q3. Based on your vast industrial experience, are there specific and essential skills and education that your company or labour market at large require from graduates of (electrical) engineering for easier transition and faster inclusiveness?

...useful skills in design and software... skills in power operation and maintenance... I use Homer Pro for the solar systems, I also use PV manager software, AutoCAD and ArchiCAD.... open and business mindedness, graduates cannot be too specialized, they must be able to multitask and try new tasks... take up challenges in other domains...(E, Personal communication, 2021).

...constant research and learning, commitment to learning... hard skills in plant operation and maintenance, knowledge of plant dynamics for repair, knowledge of basic engineering Instruments, construction of transmission lines, application of safety and health requirements... soft skills in system simulations, impact finding using test benches, ETAP simulations for impact studies, communication skills like proposal writing and presentation with adequate technical and financial implication knowledge... (T, Personal communication, 2021).

...communication skills, software skills used in energy sector and for project management, more practice-oriented training... (C, Personal communication, 2021).

...commitment to work, proof of technical knowhow, good project and time management, improvise (i.e., innovative) ... commitment to constant leaning, smartness... some soft skills like use of MS office, power system software tools, use of internet to find solutions, communication skills, understanding of some basic technical terminologies... (A, Personal communication, 2021).

Responding to the question, ‘what were the specific employee competent skills that enabled smooth transition in energy sector employment after graduation? It was discovered that software and industry specific programs availed the workers with specific competent skills, which enabled their transitioning to the energy sector, as well as needing multi-sectoral export-oriented skills after graduation. Affirming Mohajan (2016), when it stated that knowledge is the intersection loop between appropriate information (i.e., raw data), experience and skilled insight. ICT presents this loop, as an integrating link to practical work. Here, the employees narrated how their work is made easy by certain ICT products or programmes in the energy sector of the Rwandan economy. ICT gives a solid background for integrating future and new experiences and skills not minding their specificity. The ICT go along with other soft skills for the employees, alongside skills that may be needed in social protection and governance, investment, and transport which are crucial areas of the Rwandan economy (Ministry of Public Service and Labour 2019). See Table 1 for some interviewees’ excerpts on competent skills.

Table 1: Some inductive competent skills mentioned by respondents

Technical know-how	Soft skills	Others	Interpersonal skills
Plant maintenance	ETAP Software	Project management	Commitment to work
Plant automation	GIS Software	Public speaking	Open-mindedness
Feasibility studies	PowerFactory Software	Public presentation	Ability to multitask

Basics of electrical engineering and Network analysis	Homer Pro Software	Bid/proposal writing	Innovativeness
Transmission line construction	QuickBook Account Software	Stakeholder reporting	Internship and constant practice
Network planning	ArchiCAD Software	Financial analysis	Due diligence
Civil works in Plants	SCADA Software	Language and Communication	Futuristic

The above also suggests that there is a connection between ICT and other sectors, which may require help from outside the local market, leading to business outsourcing. The majority of growth in economy has been achieved through expansion of international market due to business outsourcing. They could help to improve the transition from the agriculturally based or mono-sectoral nature to multi-sectoral based market economy with competitive export-labour integration in Rwanda (Malunda and Musana 2012). The respondent confirmed this stating that: 'Graduates lack needed skills like project management skills, no knowledge of plant and site feasibility studies. Foreigners still do this job until now... no skills in machine and equipment installation, environmental and social impact assessment'... (C, Personal communication, 2021).

Q4. What other recommendations or advice do you have for electrical engineering graduates to ease their market transition?

...need of innovative graduates with different kind of thinking, universities are too theoretical... constant innovative mindset due to competitions... (G, Personal communication, 2021).

...need to go for internships... good connection between universities and business companies, I recommend partly studying and partly working at the industries from the start to enhance problem solving mindset and employability... (P, Personal communication, 2021).

Developing and upgrading skills and proficiencies of labour force in place, could reduce unemployment through introduction of multisectoral technical and vocational education and training (TVET) system (Uengumukiza and

Barihuta September 2012) employing the methodology used in Chile and Ngororero district to improve competence and future integration in a built-in process (See Dukuzumuremyi and Dushimimana 2021). Thus, there is need to have open mindset.

Responding to the question, 'what specific competent skills are required for inclusivity of today's engineering graduates in energy sector employment market? The information-rich interviewees proposed vocational education training which is relevant and futuristic for engineering students' inclusiveness into Rwandan labour market in general and in particular, energy market. In closing the gap between theory and practice, equip young people with the skill and also get the graduates included in the economic growth, specific but practical engineering skill sets should be incorporated to the electricity and renewable energy programmes in the universities (Ojera, Simatwa and Ndolo 2021). The sixth, first and fifth respondents noted as follows:

...go for practical knowledge first, volunteer for internship, take advantage of academia-industry partnerships to undergo trainings... I recommend 2 years of study of theories and 2 years of industrial experience-a suggestion to the curriculum... government should invest in academia to enable internships and knowledge acquisition... (P, Personal communication, 2021).

...practice more, training the students to widen their skill sets on the use of technology and software... (E, Personal communication, 2021).

...there should be MOU between universities and REG Companies for training purpose, graduates need knowledge in Turbine installations, line construction, grid assessment... I recommend more visits to sites than studying only in the class... commitment to internship... (A, Personal communication, 2021)

The second and fourth interviewees affirmed that insufficient knowledge about the labour market needs to be met through international, national or regional profiling of labour and skill set market in Rwanda (See Danish Trade Union Development Agency, DTDA, 2021). The third respondent spoke to the mind-set of the individual, to be daring and bold to handle new challenges in the labour market, with the punchline 'see yourself as a product', he remarked as follows:

...see yourself as a product, differentiate yourself from others, [and] get knowledge in network planning and software for impact analysis and network simulation and control like PSSE/DigSILENT/GIS. Get

knowledge in power plant automation, load balancing, distance protection, and understand impact of system dynamics... (T, Personal communication, 2021).

Moreover, further inclusive inductions from the qualitative interviews conducted were coded. Figure 1 below illustrates the realization of the growth-pole theory in Rwanda. Contributions to unemployment and non-inclusiveness of engineering graduates in energy sector and labour market include their lack of or very limited knowledge in the influential and key point factors shown in Figure 1. An institutionalised approach focusing on compensating for these lacks would successfully transit Rwanda into skilful, intentional and electricity-sufficient and exporting economy in the near future as at when implementation takes place, especially in this era of massive energy transition.

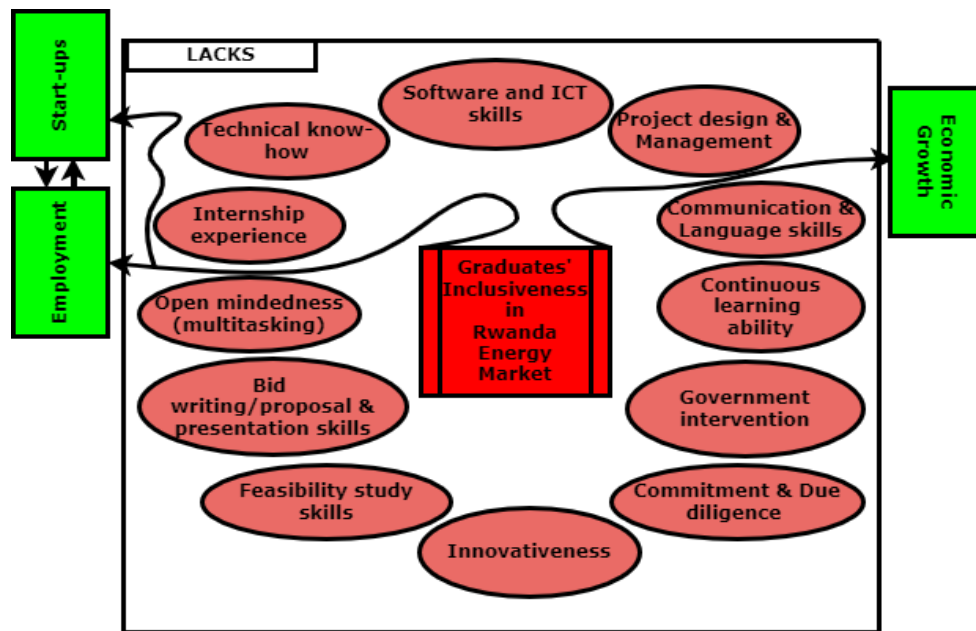


Figure 1: Inclusivity inductions of the growth-pole block from Rwanda Energy Stakeholders (Source: Researcher's Fieldwork, December 2021).

Summary

We conclude based on the findings that the government has some sort of pre-designed templates for sectoral employment and their individualistic skills set development approach for employment opportunities, which still need to be intentionally redefined in the areas of specialization, especially in the energy sector for renewable energy

inclusion following built-in processes. The general recommendation is made for a collaborative institute for integration of renewable energy resources and distributed energy in Rwanda, which should be incentivized for engineering students, accommodating industry and labour market. The following specific recommendations follow suit:

1. The growth pole Rwanda acknowledged the gap in competent skill sets needed in the electricity or energy sector even in the face of large integration of renewable energy resources. Rwanda should act to sustain practical knowledge for effective and sustainable energy transition with its economic and employment benefits to Rwanda.
2. The competent skill sets should be broken down to modules, which are marketable, attractive, competitive, collaborative and incentivized for the market and industry in both the existing energy infrastructure and renewable energy subsector.
3. The skill-set market should be able to support ICT products focusing on electricity, renewable energy and other specific soft skills ranging from learning programme design in project management, feasibility study assessment and cost benefit analysis to implementation of renewable energy resources projects along the existing energy infrastructure. The modules of the program for renewable energy resources should be based on existing energy projects with great relevance to immediate utility and future innovations.
4. The program station should be a multi-sectoral living room for exploring the vast areas of economic growth in the competence market. It should be born out of university education, technical and vocational training with strong industrial experience mix. Its potential of providing arrangements for electricity and renewable energy resources practical knowledge should be positioned for the international market. It should also accommodate the integration and transition from agricultural economy to a sustainable energy economy deliberate on exportation of Rwandan competent-skill labour market with impact on the local, regional, national and international economics.

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