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ARTICLE

- Glaring mismatch in the demand and supply of technical, entrepreneurial, vocational education and training (TEVET) skills in the agricultural sector: An analysis of the oil seeds and sugar industries in Malawi** 62
Andrew Chimpololo

Full Length Research Paper

Glaring mismatch in the demand and supply of technical, entrepreneurial, vocational education and training (TEVET) skills in the agricultural sector: An analysis of the oil seeds and sugar industries in Malawi

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Several studies and strategic papers point out a general clamour from industries on a limited supply of technical, entrepreneurial, vocational education and training (TEVET) skills in Malawi. In the oil seeds and sugar industries, organisations lament as regards the quality and quantity of experts available in the local market. This paper analyses the availability of TEVET skills in the two industries from the perspective of employers in response to the industrial complaints. The study adopts the mixed-methods approach and uses semi-structured interviews, questionnaires and document analysis as tools for collecting data. The results indicate great disparities in the availability of TEVET skills against the demand from the industries. While critical skills is absent in the two industries, there is also need to promote multi-skilling at the artisan and technician levels to enable graduates to perform multiple-related functions once they are employed. The shortfall in the availability of skills in the two sectors has resulted in human resource shortfalls which are affecting production processes. The study suggests the facilitation of academia-industry linkages to promote harmonious working relationships which would ensure that curricula are informed by industrial needs.

Key words: Technical, entrepreneurial, vocational education and training (TEVET) skills, agriculture sector, sugar industry, oilseeds industry, Malawi.

INTRODUCTION

The United Nations Educational, Scientific, and Cultural Organisation (UNESCO) defines technical, vocational education and training (TVET) as “those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences

and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupation in various sectors of economic life” (UNESCO, 2015). UNESCO argues that TVET equips people not only with vocational skills, but with a broad range of knowledge,

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skills, and attitudes that are now recognized as indispensable for meaningful participation in work and life. Enyekit et al. (2011) added that TVET is a vehicle upon which the skills of the workforce are built. It is an instrument for change and development and a provider of service-oriented skills which play a significant role in economic revival for sustainable human capital development. Within the Southern African Development Committee (SADC) region, the concept of TVET incorporates entrepreneurial skills and hence becomes technical, entrepreneurial, vocational education and training (TEVET) (TEVETA Malawi, 2009). This is the concept adopted in this paper.

TEVET plays a pivotal role in agricultural and rural employment as it prepares people for work both in the formal and informal sector. Bisariya and Mishra (2015) observed that the better the TEVET training and the more refined the skills are in terms of human capital, the higher the income and the better the livelihoods of people in rural areas. Although, agriculture remains the key pillar for economic prosperity in the developing world, Clark (2006) observed that the training of agriculture experts in sub-Saharan Africa has failed to adequately replicate the performance of similar systems in other countries. In Mozambique, for example, most of the reforms occurring in agriculture education and training do not seem to capture the key elements of the innovation systems perspective (Davis et al., 2008). Furthermore, the current educational approaches do not adequately develop individual or organizational capabilities to innovate. Among other issues, they are unable to produce technically and professionally qualified human resources, conduct research and produce applied knowledge and technologies and conduct outreach and dissemination of research results. Vandenbosch (2006) therefore calls for increased investment in training and development of more relevant and effective agriculture education and training models that are responsive to changing demands in the labour markets.

In Malawi, the agricultural sector accounts for one third of the GDP and employs about 80% of the eligible population (World Bank and FAO, 2015). The primary objective of the government's main development instrument, the Malawi Growth and Development Strategy (MGDS) II (2011 - 2016), is to reduce poverty through the promotion of agriculture and food security as a key priority area. The strategy recognises TEVET skills development as a catalyst for increasing agricultural productivity and diversification for sustainable economic growth. Enyekit and Enyenihi (2007) sums up that the role of technical and vocational education is to prepare people for employment in any occupation for which specialized education is required, and for which there is a societal need. While the MGDS II acknowledges that competencies, skills and knowledge are the foundation of Malawi's productive base and its export capacity, the

Malawi Labour Market Survey of 2013 (NSO, 2013) reveals a disconnection between those who demand and those who supply them (Government of Malawi, 2013a, b; TEVETA, 2009). Alide (2007) also pointed out lack of experts at the technician level in the industrial sector in Malawi. He argued that the status of TEVET personnel forms a dumb-bell shape- with more artisans at the bottom, few technicians in the middle and more engineers at the top, rather than the ideal triangular structure having relatively more artisans, fewer technicians and few engineers. Clark (2006) argues that agricultural education and training systems in sub-Saharan Africa have failed to build innovative and responsive systems. Among other issues, they have not succeeded to produce technically and professionally qualified human resources, conduct research and produce applied knowledge and technologies and conduct outreach and dissemination of research results.

This study analysed the availability of TEVET skills from the perspective of employers in the oil seeds industry at the factory level and sugar industry at the farm and factory levels in Malawi. The analysis was conducted as part of broad study to identify skills gaps which could derail the successful implementation of the country's National Export Strategy (NES) 2013 – 2018. The NES is the government's blueprint for increasing the production and export of manufactured products to address the current imbalance between imports and exports (Government of Malawi, 2013). It points out that the development of a demand-driven training system with quality TEVET programmes would facilitate the attainment of a skilled population base required to accelerate the country's economic growth and development.

The oil seeds and sugar industries fall under the broader sector of food processing. Basically, food processing is the transformation of raw ingredients into food, or of food into other forms. Food processing typically takes clean, harvested crops or butchered animal products and uses these to produce attractive, marketable and often long shelf-life food products. Oilseeds can be processed into edible food products or crushed to produce vegetable oils and feed meals, providing multiple final uses in the food, feed and associated industries (Xia et al., 2012). The major oilseeds produced globally are soybeans, cottonseeds, rapeseeds or canola, peanuts and sunflower seeds.

METHODOLOGY

This study combined the qualitative and quantitative methods. The combined approach helped to provide alternative interpretations during data analysis and strengthened the conclusions drawn from the findings. Researchers argue that multi-method designs not only expand the foundation upon which knowledge claims are based so that more relevant and practical knowledge is created (Robey, 1996), they also provide a more comprehensive outlook (Pozzebon

et al., 2014) and allow alternative approaches to building the body of knowledge (Chen and Hirschheim, 2004).

The study used document analysis, semi-structured interviews and questionnaires to collect data. The data collection exercise took two months and was conducted in 2014. The exercise started with document analysis of relevant policies and strategies provided by government agencies and obtained through internet search. The reviewed documents were the Malawi Growth and Development Strategy II, National Education Sector Plan (2012–2017), Education Sector Implementation Plan (ESIP) 2009, TEVET Policy (2013) and National Export Strategy (2013 – 2018). The study also reviewed the TEVET Policy (2013), Mapping and Analysis of the TEVET Sector (2013), National Labour Market Survey (2009) and National Labour Market Survey (2013). The results of the review were used to establish the level of the research problem as depicted by the various documents analyzed.

Eighteen organisations from the two industries took part in this study- 12 from the oil seeds industry and the remaining six from the sugar industry. According to the Malawi Ministry of Industry and Trade, there are 25 registered organisations in the two industries and the sample represented 72% of the registered organisations. As required by ethical standards, permission was sought from each of the participants before data was collected. Semi-structured interviews were held with 24 staff members from the human resource and production departments in the oil seeds companies and 11 members in the human resource and production departments in the sugar industry. Additionally, eight TEVET training institutions including TEVETA Malawi, whose curriculum is offered in seven public and nine private technical colleges, took part in the interviews. The interviews involved 19 members from the training institutions who comprised 3 registrars, 4 faculty deans, 6 heads of department and 6 programme coordinators. All the interviews were conducted at the participants' workplace. Interview guides were developed for the process and used in a semi-structured manner to allow follow-up questions and exploration of emerging issues. The interview questions covered the skills required in the production processes, skills available on the local market, skills available but limited in quality and quantity and skills not available. All the interviews were recorded and later transcribed prior to data analysis.

Twenty two members from the oil seeds and 8 from the sugar industries participated in the questionnaire survey. The questionnaire survey mainly sought respondents' input on the numerical skills gaps affecting the development and growth of companies in the two industries. Other government ministries and agencies such as the Ministry of Labour and Technical and Entrepreneurial and Vocational Education and Training Authority (TEVETA) Malawi were also included in the study to provide insight into the relevant skills policy and planning issues.

RESULTS AND DISCUSSION

The results of this study present the sets of TEVET skills required in each industry and then isolate skills which are locally available from those which are difficult to find or are completely unavailable. Skills limited in quality and quantity were also identified separately. In this study, quality was measured in terms of relevance of the skills or curricula in meeting industrial needs as well as their currency. The skills are analysed in relation to the Malawi TEVET Qualifications Framework (TQF) which comprises assistant operatives (Level 1), operatives (Level 2), artisans (Level 3) and technicians (Level 4).

For small companies and few large ones which are keen on maintaining lean staffing levels, it was revealed that operatives and artisans perform multiple functions for Levels 1 up to 3. The study also analyses skills at the professional or specialist level comprising graduate (bachelor's degree) and postgraduate (postgraduate diploma and above) certificate holders.

Oil seeds industry

The interview results indicated that the production processes for the oil seeds industry involve farm management, seed drying and grading, seed crushing, oil extraction, oil refinement, product mixing, quality management and packaging. The industry requires expertise in agriculture extension services, agri-business, quality management, food technology including cooking oil and essential oils technology, sales and marketing, mechanical and electrical engineering, solvent plant engineering and machine operators. According to Xia et al. (2012), technical expertise in the oilseeds industry is needed both when managing the crops in the field as well as during post-harvest activities.

At the operative and artisan levels, the expertise required include expeller machine operators, electricians, turners, plumbers, general fitters and farm assistants (skilled irrigation, crops and livestock management). At the technician level, the companies need food technologists, farm scouts and supervisors, quality assurance supervisors, mechanical engineering technicians (with skills in tool machining), laboratory technicians and electrical engineering technicians. At the professional and specialist levels, they employ agri-business or farm managers (multi-skilled in crop and livestock management), mechanical engineers (with skills in plant installation and maintenance), electrical engineers, process engineers and monitoring and evaluation experts. The interviews showed the skills situation in this industry as depicted in Table 1.

The study, however, showed that the sector is facing an acute shortage of various experts. At the operative and artisan levels, 17 of the 24 interviewees (71%) stated that the sector has a short supply of farm scouts and machine operators equipped with new technology skills. Furthermore, 14 interviewees (58%) indicated a scarcity of fabricators, agri-business supervisors (with entrepreneurial skills) and food technologists at the technician level. The results are consistent with Rivera (2006) who argues that agriculture education and training in sub-Saharan Africa has failed to produce technically competent human resources due to several constraining factors such as limited resources and insufficient funding. The industry noted food technologists equipped with knowledge and skills related to essential oils technology like vetiva and lemon grass are hard to

Table 1. Skills situation in the oil seeds industry.

Oil seeds industry	
Skills demanded	Skills supplied
Expeller machine operators	Expeller machine operators
Electricians	Electricians
Turners	Turners
Plumbers	Plumbers
General fitters	General fitters
Farm assistants (skilled irrigation, crops and livestock management)	Farm assistants
Food technologists	Food technologists
Farm scouts	Farm scouts
Quality assurance supervisors	Quality assurance supervisors
Mechanical engineering technicians (with skills in tool machining)	Mechanical engineering technicians
Laboratory technicians	Laboratory technicians
Electrical engineering technicians	Electrical engineering technicians
Agri-business managers (multi-skilled in crop and livestock management)	Agri-business managers
Mechanical engineers (with skills in plant installation and maintenance)	Mechanical engineers
Electrical engineers	Electrical engineers
Process engineers	Process engineers
Monitoring and evaluation experts	
Skills not supplied	Skills supplied but not adequate in quality and quantity
Food technologists (with skills in essential oils technology)	Farm assistants (skilled irrigation, crops and livestock management)
	Farm scouts
	Machine operators (with skills in new technology)
	Fabricators
	Agri-business supervisors
	Agri-business (farm managers) multi-skilled in both crop and livestock management
	Mechanical engineering technicians (with skills in tool machining skills)
Graduate-level monitoring and evaluation experts	Mechanical engineers (with skills in plant installation and maintenance)
	Hybrid (electrical and electronics) technicians
	Electrical engineers
	Process engineers
	Procurement specialists
	Occupational health and safety skills
	Preventive maintenance skills
	Finance-for non-finance experts
	Leadership and management skills

find on the local market. At the specialist level, 20 of the interviewees (83%) complained about a lack of farm managers multi-skilled in both crop and livestock management and procurement specialists while all the participants (100%) pointed out the shortage of graduate-level monitoring and evaluation (M&E) experts to be

engaged in agri-business projects. It was observed that such M&E experts are usually outsourced outside the country to work in these projects and their remuneration packages are quite high. A summary of the level of skills shortage in this industry according to the questionnaire survey is presented in Table 2.

Table 2. Skills shortages in the oil seeds industry.

Skills area	TQF level	Shortage of experts
Farm scouts	3	40
Machine operators	3	22
Fabricators	3	16
Agri-business supervisors	4	40
Food technologists	4	22
Multi-skilled farm managers	Undergraduate	11
Procurement specialists	Undergraduate	6
Monitoring and evaluation experts	Postgraduate	6
Mechanical engineering technicians	4	22
Mechanical engineers	Undergraduate	11
Electrical engineers	Undergraduate	11
Process engineers	Postgraduate	11

Sixteen of the 22 respondents (73%) in the questionnaire survey revealed that although mechanical engineering technicians and engineers, electrical and electronics technicians and engineers and process engineers are available on the local market, they are normally on high demand due to low graduation levels. Additionally, the technicians do not possess sufficient knowledge of modern machines. The respondents therefore proposed that training institutions need to introduce courses such as finance-for non-finance experts or basic accounting in technical programmes as well as leadership and management skills in technical programmes. Other courses mentioned were occupational health and safety skills, preventive maintenance, tool machining skills, project management and essential oils management including the extraction process. Organisations in this industry also called for university-industry linkages which would facilitate agreements on research projects and other simple activities like tool machining services which some companies are currently outsourcing abroad. Along the same line, Lututala (2012) portends that although the major skills gaps in Africa are cognitive (especially numerical and critical-thinking), non-cognitive (especially communication, leadership and decision-making) and technical (depends on industry), the non-cognitive skills are becoming increasingly important as the economies change and good leadership becomes indispensable.

Such linkages would also enable staff exchange programmes that would benefit academic staff to gain the much-needed industrial experience for them to appreciate the modern machines and technology being used by companies. It was observed that these university-industry linkages are currently given lip-service only.

Sugar industry

The study showed that this industry is composed of

companies involved in the production of sugarcane products such as sugarcane, sugar, absolute ethanol, extra neutral alcohol, rectified alcohol, and food grade carbon dioxide. The processes involved in the sugar industry can broadly be categorised into sugarcane farming and factory processing (sugar milling).

Sugarcane farming

Sugarcane farming is related to a number of activities such as land preparation, planting, fertiliser application, irrigation, pest and disease control, weeding (chemical and physical weeding), cutting or harvesting and transportation. The interview results showed that personnel involved in these activities include general labourers, farm equipment operators, capitao (assistant supervisors), farm supervisors, farm managers, area managers, field managers and agriculture managers. As Nazir et al. (2013) explain with reference to Pakistan, well-qualified staffs are crucial in sugar production since the gap between potential and actual yield is growing due to poor farm management practices and post-harvest losses. Practically, land preparation and transportation is carried out by privately hired contactors. The sugarcane farms also houses a workshop for keeping farm and irrigation equipment, and is mostly managed by a foreman, auto-electrician and motor vehicle mechanic. Table 3 presents the skills situation in the sugarcane growing sector as obtained through the interviews.

All the 11 interviewees (representing 100%) indicated that the required personnel in this industry are available on the local market. However, the major challenge is related to low level of knowledge and skills in sugarcane farming among the experts. The interviewees further observed that a large part of the current content being taught in training institutions is long out-dated and the content on sugarcane farming is very minimal. For

Table 3. Skills situation in the sugarcane growing sector.

Sugarcane growing sector	
Skills demanded	Skills supplied
General labourers	General labourers
Farm equipment operators (with knowledge in sugarcane farming)	Farm equipment operators
Capitaos or assistant supervisors (with sufficient knowledge in sugarcane farming)	Capitao (assistant supervisors)
Farm supervisors (with sufficient knowledge in sugarcane farming)	Farm supervisors
Farm managers (with sufficient knowledge in sugarcane farming)	Farm managers
Area managers (with sufficient knowledge in sugarcane farming)	Area managers
Field managers (with sufficient knowledge in sugarcane farming)	Field managers
Agriculture managers	Agriculture managers
Foremen or workshop supervisors	Foremen or workshop supervisors
Auto-electricians	Auto-electricians
Motor vehicle mechanics	Motor vehicle mechanics
Skills not supplied	Skills supplied but not adequate in quality and quantity
Business management skills (entrepreneurial skills and basic accounting skills) for smallholder farmers	Farm equipment operators (mainly diesel plant operators)
	Capitao (assistant supervisors)
	Farm supervisors
	Farm managers
	Foremen or workshop supervisors
	Auto-electricians
	Motor vehicle mechanics
	Supervisory skills

example, it was observed that some of the sugarcane varieties in the curriculum at the Lilongwe University of Agriculture and Natural Resources (LUANAR) are no longer in use in the industry. Consistent with the results of this study, Goel (2009) observed that the mismatch between training content and workplace skills is steadily growing as a result of disconnect between training institutions and the industry. There is need to initiate strategies of bridging the widening gap in the academia-industry relationship. Eight of the interviewees (73%) noted that their companies currently either train their staff internally through in-house capacity building programmes or send them to other countries for training like South Africa at the South Africa Sugar Research Institute in Durban. The institute offers three-week as well as five-week junior and senior certificate short courses, respectively.

Chidoko and Chimwai (2011) stress the importance of good crop management practices in sugarcane farming which could be provided through agricultural extension services. They observed that farmers require good access to extension services in order to improve their knowledge of farming practices like observing planting times, fertilizer application, pest and disease control and

harvesting techniques. Additionally, farmers need to acquire the right expertise for post-harvest activities (Muli, 2014). The industry also pointed out that their operations are affected by low quality supervisory skills among farm supervisors and capitaos. Again, smallholder farmers in this industry lack business management skills which include entrepreneurial skills and basic accounting skills. According to the questionnaire survey, the extent of skills shortage in this industry is shown in Table 4.

Factory processing

Results from the interviews showed that the factory processing category can further be sub-divided into sugar and carbon dioxide production. For sugar production, the factory processes involved are extraction, clarification, evaporation, crystallisation, separation, drying, packing and dispatch. Other additional processes include fermentation, distillation and molecular sieve dehydration. The production of carbon dioxide involves ethanol scrubbing, CO₂ equalising, CO₂ compressing, dehumidification drying, refluxing, carbon filtering, police filtering, distillation and CO₂ condensing. Muli (2014)

Table 4. Extent of skills shortage in the cane growing sector.

Skills area	TQF level	Shortage of experts
Capitaos (assistant supervisors) skilled in sugarcane farming	3	36
Farm supervisors (skilled in sugarcane farming)	4	24
Farm managers (skilled in sugarcane farming)	Undergraduate	12
Auto electricians	4	12
Motor vehicle mechanics	4	12
Mechanical engineers	Undergraduate	18

stated that the quality of factory processes play a big role in the profitability of the products in sugar production.

The results also indicated that the companies need machine operators, general fitters, welders, boiler makers and turners at the operative and artisan level in the factory. At the technician level, they require the services of laboratory technicians, instrumentation technicians, refrigeration technicians, mechanical engineering technicians, electrical engineering technicians and charge hands (supervisors or team leaders). The industry also needs process, instrumentation, refrigeration, mechanical and electrical engineers at the specialist level. A depiction of the skills required in factory processing (sugar milling) is provided in Table 5.

However, the study indicates a significant shortage of certain experts in the sector. Ten of the eleven interviewees (91%) in this industry lamented the limited availability of pan boiler makers and machine operators, instrumentation technicians, advanced refrigeration technicians and motor vehicle technicians with knowledge of mechatronics. Furthermore, 7 of the interviewees (64%) observed that there is also a shortage of specialists such as process, instrumentation, chemical and mechanical engineers. Vandenbosch (2006) pointed out that the training of appropriate experts in the developing world requires increased investment in the development of effective agriculture education and training models which meet the fluid demands of the industry. All the 11 interviewees (100%) further suggested that training institutions need to integrate sugar technology skills in existing programmes to make them more relevant to the requirements of the industry. Additionally, they recommended the introduction of courses in instrumentation, quality management, occupational health and safety and pan boiler making with a bias in sugar processing. Ten of the interviewees (91%) observed that the current disparity in the demand and supply of skills in the country is caused by limited interaction between the industry and training institutions.

Two interviewees (18%) further indicated that short-term interventions could improve skills situation in the sugar sector. For instance, the Cane Growers Capacity Building Programme by Concern Universal is already showing signs of success in the lower Shire River Valley.

Courtesy of the programme, the interviewees observed that cane growers in the area are now more organised than before in terms of governance and administration. Previously, they used to have several groupings which made coordination very difficult but these have been merged to create a single organisation. This is in line with Chidoko and Chimwai's (2011) recommendation on the need to promote the establishment of cooperatives as well as improve agricultural extension services in sugar production. In spite of this success, the interviewees revealed that more still needs to be done to change the attitude of the farmers on critical issues such as time management and commitment. The questionnaire survey portrayed the skills status in factory processing (sugar milling) as presented in Table 6.

Review of TEVET programmes

TEVETA Malawi institutions provide training in 14 different trades and these are: Automobile mechanics (AMM), administrative studies (AS), bricklaying (BR), carpentry and joinery (CJ), electrical installation (EI), fabrication and welding (FW), food production (FP), general fitting (GF), motorcycle mechanics (MCM), painting and decorations (PD), plumbing (PL), printing (PR), refrigeration and air conditioning (RAC), tailoring and design (TD), vehicle body repair (VBR) and wood work machining (WWM).

Available data indicate that a total of 1,084 trainees were selected from the 16 TEVET providers in the 2013 recruitment. Table 7 presents the recruitment trend between 2005 and 2013 for TEVETA Malawi into public technical colleges.

Generally, access to tertiary education in Malawi is quite minimal. The Malawi Skills Development Project Brief (2014) puts the tertiary education enrolment rate in the country at only around 0.4%, which is one of the lowest in Africa. At 35 per 100,000 inhabitants, the enrolment into formal TEVET institutions is equally lower than those of other SADC countries, with Lesotho registering 110, Mozambique 130, Botswana 1228 and Mauritius 1561 (World Bank, 2010).

Out of the total 11,829 applicants who expressed

Table 5. Skills situation in the factory processing (sugar milling) sector.

Factory processing (sugar milling) sector	
Skills demanded	Skills supplied
Machine operators	Machine operators
General fitters	General fitters
Welders	Welders
Boiler makers	Boiler makers
Turners	Turners
Laboratory technicians	Laboratory technicians
Instrumentation technicians	Instrumentation technicians
Refrigeration technicians	Refrigeration technicians
Mechanical engineering technicians	Mechanical engineering technicians
Electrical engineering technicians	Electrical engineering technicians
Charge hands (supervisors or team leaders)	Charge hands (supervisors or team leaders)
Process engineers	Process engineers
Instrumentation engineers	Instrumentation engineers
Refrigeration engineers	Refrigeration engineers
Mechanical engineers	Mechanical engineers
Electrical engineers	Electrical engineers
Skills not supplied	Skills supplied but not adequate in quality and quantity
	Pan boiler makers (with skills in sugar processing)
	Machine operators
	Advanced refrigeration technicians
	Mechatronics technicians
Instrumentation technicians	Process engineers
	Chemical engineers
	Instrumentation engineers
	Mechanical engineers
	Sugar technology skills
	Quality management skills
	Occupational health and safety skills

Table 6. Extent of skills shortage in the sugar milling sector.

Skills area	TQF level	Shortage of experts
Pan boiler makers	2 and 3	60
Machine operators	2 and 3	60
Instrumentation technicians	4	12
Advanced refrigeration technicians	4	12
Motor vehicle technicians	4	12
Mechanical engineers	Undergraduate	18
Chemical engineers	Undergraduate	6
Process engineers	Postgraduate	11

interest to pursue programmes in TEVET institutions in 2013, only 5,289 trainees— representing nine percent got selected. It can therefore be valued that the rate of participation in the TEVET sector is very low. Figure 1 depicts the demand for apprenticeship training in 2013.

Other providers in the TEVET sector include the Malawi Polytechnic, Chancellor College, Automotive Mechatronics Training Centre, DMI-St John Baptist University, Lilongwe University of Agriculture and Natural Resources (LUANAR) including the Natural Resources

Table 7. TEVETA Malawi enrolment figures from 2005 to 2013.

Year	Males	Females	Total recruits
2005	224	88	312
2006	525	244	769
2007	521	209	730
2008	493	205	698
2009	385	209	594
2010	973	373	1,346
2011	890	272	1,162
2012	1,127	453	1,580
2013	782	302	1,084

Adapted from the 2013 National Pre-Apprenticeship Selection Results.

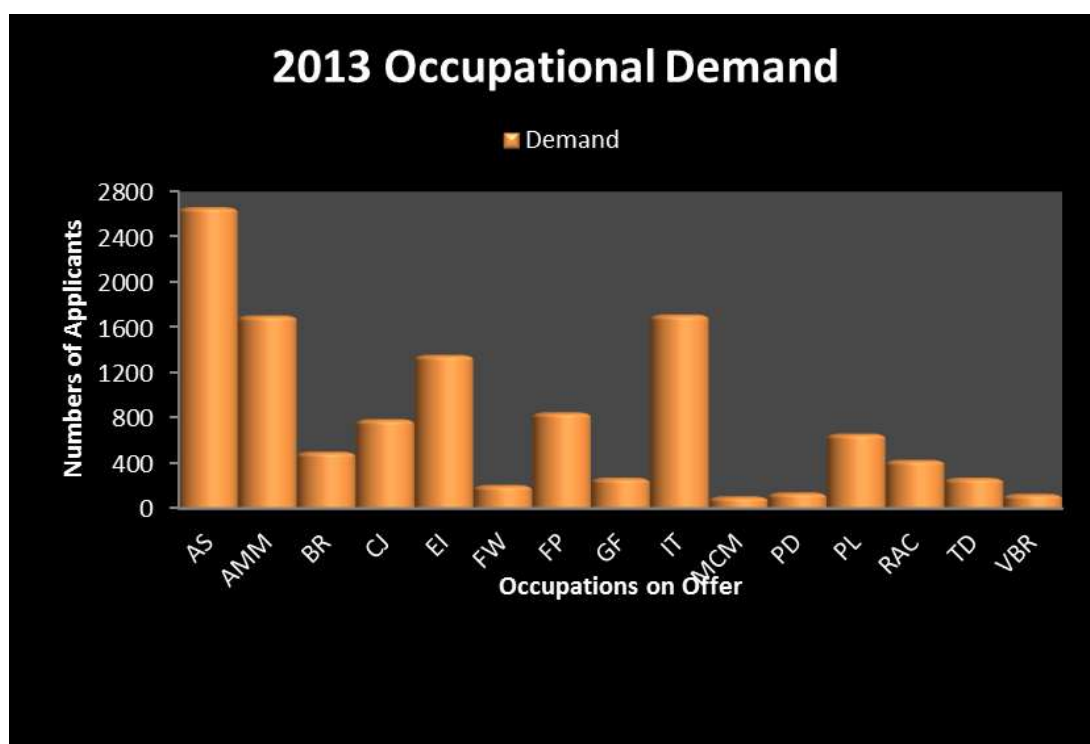


Figure 1. Demand figures for apprenticeship training in 2013. Adopted from the 2013 National Pre-Apprenticeship Selection Results.

College, Malawi University of Science Technology (MUST), Mwimba College of Agriculture, Malawi College of Fisheries and Marine College. Additionally, the Malawi Institute of Education (MIE) is responsible for developing, reviewing and reforming the primary and secondary school curricula as well as that the primary teacher education.

Malawi Polytechnic, a constituent college of the University of Malawi, is a centre of excellence in scientific

and technological education and training. The mainstream college has a total student population of about 3,475, with 3369 pursuing undergraduate programmes and 106 undertaking postgraduate studies. An outline of the programmes is presented in Table 8.

The Malawi Polytechnic College also provides certificate and diploma programmes in technical and vocational education through the Continuing Education Centre (CEC) which works in partnership with faculties

Table 8. Programmes offered at Malawi Polytechnic.

Undergraduate degree programmes		
Environmental Health	Environmental Science and Technology	Information Technology
Management Information Systems	Mathematical Science Education	Architectural Studies
Land Economy	Land Surveying	Physical Planning
Quantity Surveying	Accountancy	Business Administration
Business Communication	Education (Business Studies)	Education/Science (Technical)
Journalism	Automobile Engineering (Hons)	Civil Engineering (Transportation) (Hons)
Civil Engineering (Water) (Hons)	Civil Engineering (Structures) (Hons)	Electrical and Electronics Engineering (Hons)
Electronics and Computer Engineering (Hons)	Electronics and Telecommunication Engineering (Hons)	Energy Engineering (Hons)
Industrial Engineering (Hons)	Mechanical Engineering (Hons)	
Masters programmes		
Mphil Applied Sciences (Environmental Sanitation)	MPhil Applied Sciences (Renewable Energy)	MPhil Applied Sciences (Industrial Process Technology)
MPhil Applied Sciences (Environmental Protection and Management)	MPhil Applied Sciences (Environmental Health)	MPhil Engineering (Industrial Management)
MPhil Engineering (Infrastructure Development and Management)	MPhil Engineering (Power and Machines)	MPhil Engineering (Telecommunications)
MPhil Engineering (Sustainable Engineering Management)	MPhil Engineering (Transport Systems)	Masters in Technical and Vocational Education
MA Health and Behavioural Change Communication		
PHD programmes		
PhD Applied Sciences (Environmental Sanitation)	PhD Applied Sciences (Renewable Energy)	PhD Applied Sciences (Public Health Engineering)
PhD in Financial Management	PhD in Strategic Management	PhD in Entrepreneurship
PhD Applied Sciences (Information Technology)	PhD Engineering (Industrial Management)	PhD Engineering (Infrastructure Development and Management)
PhD Engineering (Power and Machines)	PhD Engineering (Telecommunications)	PhD Engineering (Sustainable Engineering Management)
PhD Engineering (Transport Systems)		

and departments within the college. The programmes range from mechanical, automobile and electrical engineering, and laboratory technology to secretarial studies and information technology. These programmes comprise college-owned courses as well as those offered through City and Guilds International and their average

annual intake enrolment is 1,329. The single biggest contributor for Level 4 programmes is the Malawi Polytechnic through its self-developed programmes as well as those run under foreign-based examination boards (International Labour Organisation 2010; TEVETA, 2009). A similar centre, the Management Development Centre

(MDC), also offers certificate and diploma courses in business administration, human resource management, logistics and transport, purchasing, banking, sales and marketing, and has an average annual intake of about 1,093 students.

The Automotive Mechatronics Training Centre, based at Stansfield Motors Limited in Blantyre,

was established in 2007 under a public-private partnership to provide automotive diagnostic and repair technician programmes in order to improve the quality of technical capacity in the transport sector. The centre offers two programmes, a nine-month certificate and 18-month diploma in automotive mechatronics, which are accredited by TEVETA Malawi. Since its opening, 46 trainees have graduated from the centre and its annual intake ranges between 7 and 13 students. The curriculum of the programmes comprises auto-electronic content which is collaboratively designed and reviewed by the Daimler Global Training Consulting in Germany and the centre. The centre has state-of-the-art equipment such as an auto-electronics laboratory fitted with latest Mercedes Benz technology, computer-based training laboratory and three running training vehicles. Stansfield Motors plans to hand over the centre in the future to an established training institution once proper operational arrangements are put in place.

The DMI-St John Baptist University is another institution which offers technical and vocational education programmes. Among other diploma and degree programmes, the private university offers information technology management, computer science and engineering. During the 2014 intake, the university enrolled about 171 students- a majority of whom gets admitted into the business-related programmes. Current plans indicate that new programmes will be developed in the field of education. An additional programme will also be developed in secretarial studies and will include a course in computer-based typing to address the challenge facing secretaries in the modern era.

Experts in the agriculture sector are mainly trained by LUANAR. The university recently merged with the Natural Resources College (NRC) although this process has not yet been implemented. For this reason, these two institutions are discussed separately. LUANAR offers seven PhD programmes, 24 masters' programmes, three postgraduate diploma programmes, 26 undergraduate degree programmes and four diploma programmes. An outline of the programmes is presented in Table 9.

In the 2014/15 academic year, LUANAR had an intake of 766 first year students, 320 mature students and 114 postgraduate students. Although, LUANAR has 61 programmes in the field of agriculture, there is no programme which specialises in sugarcane agriculture or sugarcane technology. These subjects are only covered as part of the broad area of agronomy. However, the scope of their programmes includes agro-processing under which oil seeds science is covered as well as agriculture engineering where farming mechanisation is taught.

The newly-opened Malawi University of Science and Technology (MUST) is providing training in a range of programmes which will impact on the development and growth of the manufacturing, oil seeds and sugar

clusters. The university, whose vision is to be world class centre of science and technology education, research and entrepreneurship, has this year registered its first students and the intake figures are presented in Table 10.

Furthermore, the university will, in the next few years, enrol more students in the new programmes of BSc in Geriatric Medicine, BSc in Sports Medicine, BSc (Hon) in Traditional and Herbal Medicine, BSc (Hon) in Cancer and Palliative Care, BSc (Hon) in Earth Sciences, BSc (Hon) in Meteorology and Climate Science and BEng (Hon) Manufacturing Engineering.

At Chancellor College, the Faculty of Science also offers programmes which contribute human resource to the prioritised sectors of the NES. The faculty enrolls an average of 95 students annually in its undergraduate programmes and 27 in the postgraduate programmes. At the undergraduate level, the faculty offers the Bachelor of Science (generic), Bachelor of Science (Food and Nutrition) and Bachelor of Science (Family and Consumer Sciences), while the Master degree level includes the Master of Science in Environmental Sciences, Master of Science in Water Resources Modelling and Governance, Master of Science in Biostatistics, Master of Science in Informatics, Master of Science in (Biology/Chemistry/Mathematics). The faculty is, however, planning to introduce new programmes such as the specialised Bachelor of Science degrees in biological sciences, chemistry, computer sciences, geology and mining, human geography, mathematics, statistics and physics. There are also plans to introduce the MSc in actuarial sciences.

The Natural Resources College in Lilongwe also offers diploma programmes in the field of agriculture. The field of study for the programmes include agriculture, irrigation, environmental management, food nutrition, animal health and horticulture. The college also runs a degree course in food technology. The annual enrolment rate for the college is 500, with about 250 students being recruited each semester. The vision of the college is to be a leading and self-sustaining agriculture, environment and natural resources management centre of excellence within Malawi and beyond. The college is planning to introduce more degree programmes in the near future.

Another agricultural training institution is Mwimba College of Agriculture in Kasungu. It is an arm of the Agricultural Research and Extension Trust (ARET) responsible for training tobacco experts and farmers in the country. The college provides a one-year certificate in agriculture as well as a two-and-a-half year diploma in agriculture programme. Tailor-made short courses are also organised from time-to-time depending on demand, and the participants include foreign-based students from Zambia and Mozambique. In 2014, the college enrolled 58 new students but the rate will rise significantly following the completion of a new hostel. Plans are

Table 9. Programmes offered at LUANAR.

Diploma programmes		
Youth development	Gender development	Seed science and technology
Dairy science and technology		
Undergraduate degree programmes		
Irrigation engineering	Agricultural engineering	Animal science
Veterinary medicine	Agronomy	Agriculture
Soil science	Crop protection	Seed systems
Crop improvement	Agri-business management	Agricultural enterprise and development finance
Agricultural economics	Agricultural extension	Agriculture education
Agriculture development communication	Aquaculture and fisheries science	Forestry
Horticulture	Environment sciences	Natural sciences management (Wildlife and ecotourism)
Natural resources management (Land and water)	Nutrition and food sciences	Food science and technology
Human sciences and community services	Biotechnology	
Postgraduate diploma programmes		
Seed science and technology	Social forestry	Horticulture
Masters programmes		
Horticulture	Plant biotechnology	Forestry
Social forestry	Agroforestry	Environment and climate change science
Aquaculture	Fisheries	Soil science
Agronomy (with plant breeding, agronomy options, breeding, agronomy, crop protection)	Plant health	Entomology
Strategic crop improvement	Soil surveys and land improvement	Irrigation agronomy
Agricultural education	Agribusiness management	Agribusiness management (distance learning)
Agricultural economics	Development and natural resource economics	Rural development and extension
Animal science	Home economics and human sciences	Agronomy (with crop protection, weed sciences options)
PHD programmes		
Animal science	Agriculture (Soil science)	Resource economics
Aquaculture and fisheries science (taught)	Aquaculture and fisheries science (research)	Environmental science
Rural development and extension		

underway to develop new programmes in livestock management and irrigation farming.

At the Malawi College of Fisheries in Mangochi,

there is a pre-service diploma programme being offered for Fisheries Technical Assistants. The curriculum includes boat-building, fishing gear

technology and marine engineering which involves boat engine maintenance skills. The college also runs some outreach training

Table 10. Programmes offered at MUST.

Programme	Enrolment number
Bsc. in BioMedical Engineering	48
Bsc. in Chemical Engineering	50
Bsc. in Metallurgy and Mineral Engineering	44

programmes for communities around Mangochi. The diploma programme runs for two years and has an annual average intake of 20 students. However, the college has a maximum capacity of 50 students but this figure is not met due to availability of limited resources. There are currently plans to introduce a Bachelor of Science in Aquaculture and Fisheries Management programme. It was also revealed that about three years ago, the Government of Malawi announced plans to merge the Malawi College of Fisheries and Marine College to form the University of Marine Biology. The university was expected to develop programmes in shipping, navigation, tourism and hospitality management and customs clearing.

Another training institution in the fishing industry is the Marine College in Monkey Bay which trains personnel for fishing vessels. The college currently offers a four-year advanced diploma programme in marine engineering and navigation. The programme's curriculum focuses on marine engineering, navigation and skipping. Previously, the institution used to run six-month training programmes in which trainees were only awarded a certificate of competence but now the focus is on merchant fishing. The Marine College enrolls about 30 students in each intake. However, they only register new students after every four years as the college cannot accommodate two cohorts at once due to lack of adequate resources. With resources permitting, the college plans to introduce degree and diploma programmes in marine engineering, navigation, shipping logistics, shipping management and naval architecture. The college also hinted on the planned merger with the Malawi College of Fisheries.

At the MIE, recent developments indicate that the primary school curriculum was reviewed around 2007 to accommodate emerging issues in the education sector. Prior to the review, the primary school curriculum had a subject titled craft and technology which comprised topics in wood work, metal work, and technical drawing and design. However, educational research findings indicated that the content in the various fields was very narrow and could better be taught as separate subjects. Following the review, the current curriculum has stand-alone subjects in science and technology, expressive arts, creative arts and performing arts. Under science and technology, the content is made up of biology, chemistry, technology, home economics and physics while the creative arts includes drawing, sculpture, needlecraft and

decorations. The expressive arts comprise physical education and the performing arts consist of drama and music. The MIE also indicated that another subject, craft and technology, is currently being piloted in six primary schools.

The secondary school level is made up of independent technical subjects such as wood work, metal work, technical drawing, clothing and textiles, performing arts, creative arts, computer studies and business studies. Entrepreneurship and life skills are, however, integrated as in all these subjects as core elements—entailing that they are included as broad areas of study where topics are drawn from. In the primary teacher education programme, the content mirrors that for primary schools, only that the content has more depth. MIE therefore recommends that there is need to have more stand-alone subjects in technical and vocational education at both the primary and secondary school levels. It was also suggested that it should be mandatory for future secondary school students to be studying at least one technical and vocational subject during the course of their learning. Craft and technology was provided as an example as the subject is not resource intensive and does not require a complicated workshop and it can easily be taught in community day secondary schools. If resources could be available, the institute further recommends the introduction of some basic elements of automobile mechanics, auto-electrics and electronics at the secondary school level.

Conclusion

This study has revealed disparity in the availability of some TEVET skills in the oil seeds and sugar industries on the local market. One of the major possible causes of this situation is the low level of linkages between training institutions and the industries which results in curricula being developed with less input from employers. Thus, the content which students are taught in colleges and universities is likely misinformed and misaligned against the needs of the industries. There is need for policies that facilitate harmonious working relationships between the academia and industries. Currently, the level of university-industry linkages is quite minimal and significantly contributes to the mismatch between demand and supply of skills. Training institutions and the

industry need to partner with research projects and outreach activities for their own mutual benefit. Such linkages would also facilitate staff exchange programmes that would make academic staff to gain practical industrial experience and appreciate the new technology currently being used in the industry.


Furthermore, the current global trend points towards the training of experts replete with leadership and entrepreneurial skills which would prepare them and make them to be able to create employment opportunities for others by setting up new businesses. Training institutions therefore need to introduce courses such as finance-for non-finance experts or basic accounting in technical programmes as well as leadership and management skills in TEVET programmes. Other courses such as sugarcane farming, occupational health and safety skills, preventive maintenance, machining tool skills, project management, and essential oils management also need to be incorporated into new as well as existing programmes.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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A hand holding a magnifying glass over a whiteboard filled with business diagrams and icons. The whiteboard contains various sketches including a pie chart, a bar chart, a line graph, a lightbulb, a dollar sign, a question mark, and the word 'leadership'. The background is a light blue gradient.

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