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Innovative pedagogy of Competence Based Training in horticulture: case study of TVET Education in Kenya

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ABSTRACT

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Horticulture is the fastest growing sub-sector in Kenya. It contributes the most towards the envisioned poverty reduction, and overall food security. It is generally a labour-intensive industry with high demand of skilled workers, trained supervisors and professional managers. Most Agricultural Technical and Vocational Education Training colleges (ATVETs) have a very general focus and there is lack of specialized and competent workforce in horticulture. The training is classroom and institutional centred with limited access to necessary resources and facilities, and limited interactions with industry and world of work. In this project, a consortium of partners worked with selected ATVETs to close the skills gaps using a non-traditional pedagogy of competency based training in horticulture. This was by strengthening the capacity of the ATVETs through a strong collaboration and link-

ages between the education institutions and the private sector to enable practical learning and innovation in the horticulture sector. The project integrated the curriculum for horticulture, water and climate to suit the needs of the students and the labour market, and tailored it to the local context. Each of the participating colleges invested in hands-on training through dedicated agricultural innovation hubs and creating strong links with the local stakeholders. To compliment curricula developed by the Curriculum Development Assessment and Certificate Council (CDACC), training manuals were developed for selected courses. In addition tutors were trained to enhance their capacity in design, delivery and evaluation of competence based education. Problem based learning in the Kenyan context as well as joint learning sessions between Kenyan and Dutch students were the other non-traditional pedagogy methodologies that were explored. The project increased interactions between the ATVET, industry and partners in horticulture within Kenya and in the Netherlands. The ATVETs created more local partnerships relevant to their training and practical work. The students were the primary beneficiaries through enhanced quality teaching. These benefits have been cascaded to the surrounding communities and the impact is expected to be sustainable.

Introduction

Horticulture is the fastest growing sub-sector in Kenya and makes a significant part of the agriculture sector (MoALF&I, 2019). It is expected to

contribute the most towards the envisioned poverty reduction, and overall food security. The sub-sector has an annual value of US\$ 2 billion split

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equally between export and local market (FPEAK, 2021). It is generally a labour-intensive industry with high demand for trained workers, supervisor and professional managers. Over six million Kenyans are directly and indirectly employed in horticulture contributing to economic growth of rural and surrounding towns. Women constitute 75% of the labour force (MoALF&I, 2019). For the horticulture sector to be competitive, sustainable and inclusive, it is necessary to address both the needs of commercial and small scale farmers including marginalized groups in Kenya and whose livelihoods depend on small scale horticulture considering that 75% of Kenya's total agricultural output still comes from smallholder farmers. The government established Technical and Vocational Education and Training (TVET) institutions to offer practical training at certificate and diploma level in the agricultural sector to provide hands on technical skills for staff and farmers (MoAL&F, 2017). One principle of Kenya's Agricultural transformation is to invest in talent, with the aim of building highly capable workforce of change-makers including last-mile extension officers (MoALF&I, 2019). However, the current Agricultural Technical and Vocational Education and Training (ATVET) institutions and associated education institutions have a very general focus and there is lack of specialized and properly skilled workforce in horticulture. Meru University of Science and Technology (MUST) in a consortium with partners carried out a project titled "Enhancing Partnerships for Industry-led Vocational Training and Education in the Horticulture Value Chains of Kenya" (ePIVOT) with aim of addressing the above named gaps. Strengthening linkages between ATVETs, private sector and various actors is necessary for practical learning, skilling and innovation in the horticulture sector. The objective of the project was to improve professional education and vocational training at the level of Polytechnics and Agricultural Technical and Vocational Education Training Colleges (ATVETs) in the horticulture value chains through strong collaboration with the private sector.

Project relevance

Food and nutrition insecurity is high in Kenya due to inefficient production, high post-harvest losses and lack of food safety. This situation, which affects the development of the horticulture sector, is caused by among other factors: lack of knowledge and skills, low interest of youth to engage in agriculture, limited value addition of crops, limited training on nutrition and lack of a functioning system of food traceability and safety checks (Matui et al., 2016). These can be addressed through training and capacity building, which is currently being provided by a few ATVETs. Competency based education and training being implemented requires profiling of occupation standards, development of training materials and renewed approach to the training of trainers. Especially in agriculture, this initiative needs to be paired with strengthening outreach services in order to provide a good practical approach to training. ATVET teachers are often not prepared to give practical, competency-based lessons. ATVETs lack a positive image and the provisions at educational institutes are less favourable for teaching.

Several counties in Kenya have recognized horticulture as an engine for growth and potential investment (County Government of Tharaka-Nithi, 2018, County Government of Meru, 2018, County Government of Migori, 2018 and County Government of Kisumu, 2018). However the execution of the programmes that support horticulture sector development in the counties remains often vague as the County Integrated Development Plans (CIDPs) do not provide concrete directions for this. In strengthening the ATVETs with a specialisation in horticulture the project sought to link the entire "green education pillar" to the sector in a limited number of clusters, defined as a combination of a County with a strong focus on horticulture, ATVETs, centred around a HCD facility of the Horticulture Crops Directorate (HCD) and where possible linking to a centre of the Kenya Agricultural and Livestock Research Organisation (KALRO). The partnership sought to create collaboration with the relevant private sector and make

optimal use of the emerging relationships towards development of the required competencies of labour in the sector. The outcome of domestic research system does not flow back into education and the increasing demands for traceability, quality and safety in the domestic market remains a challenge. The link between research and education in ATVETs is largely non-existent cutting out all the benefits that both would obtain. Generally in many fields, linking research to practice is often complex and difficult. Boser and McDaniels (2018) have proposed a Research-Practice-Partnership approach in addressing this difficulty. In this project, the ATVETs were supported to improve the engagement with universities, research institutions and private sector actors in education provision. The project aimed to contribute to the establishment of occupational competencies and Competency Based Education and Training (CBET) curricula, establishment of mechanisms for access to facilities for students and practical training sessions e.g. attachments and internships. Additionally, the project aimed at the development of farm and processing facilities for ATVETs to serve as models of local industries. The project also aimed at devising mechanisms for joint delivery and financing of training programme between ATVET institutions, agribusinesses and private sector trainers and advisors, and establishment of mechanisms for facilitation of accreditation of agriculture training programmes based on public-private collaboration with national accreditation bodies.

In this project, in-depth discussions between project partners and various stakeholders established the institutional, organizational, educational and individual capacity needs both for Kenya and Netherlands. These included supporting ATVETs training facilities, creating incentives for youth, women and the marginalized in horticulture in Kenya. On the other hand, the Dutch education institutions in the project had the ambition to internationalise their education.

The desired improvements included skilling staff and students in the ATVETs. Staff and graduates with hands-on practical experience will be

better able to work on strategies for sustainable water use and climate smart agriculture. A baseline survey of the ATVETs during the selection process established weak linkages with industry. The current staff and student are predominantly male (around 80%), failing to meet the desired gender and inclusivity standards. The Government of Kenya has a policy that at least 30% of each gender should be represented in all public sector related activities. The government has also recognized the need to remove the impediments that hinder the participation of women, youth and People Living with Disabilities (PWDs) in agriculture (MOALF&I, 2019). It is there desirable to enhance linkages with industry and support efforts towards inclusivity. Additionally, the level of entrepreneurship among the ATVETs graduates is low. There was need to design deliberate programmes to introduce students to practical entrepreneurship, focused on one hand on providing all students introduction to entrepreneurship through innovation hubs and on the other hand on incubation for the select few who would have decided to make entrepreneurship a career path.

Selection of the clusters/ATVETs

A baseline survey was used to select clusters in Meru, Tharaka Nithi, Kiambu, Nakuru, Migori and Kisumu counties. These counties represent regions with advanced horticulture and marginalized regions. A cluster was defined as one ATVET together with HCD and KALRO centres in the surrounding. Clusters selection was done to ensure a mix of counties with a strong horticultural industry and those marginalized in terms of horticulture development. The other selection criteria included willingness of ATVET to participate and availability of basic agricultural resources. The clusters were each geared to having their thematic focus within the horticultures sector (greenhouse and open field horticulture). In this project, MUST acted as a focal point from which the established clusters were supported. Using the set criteria, the following clusters were selected (Table 1):

S/No	Cluster/County selected	Basis	ATVET selected
1	Meru	Advanced horticulture	Marimba Campus Meru University of Science and Technology (MUST) Meru National Polytechnic (MNP)
2	Tharaka Nithi	Marginalized horticulture	Tharaka Tehnical and Vocational College (TVC)
3	Migori	Marginalized horticulture	Siala Technical Training Institute (TTI)
4	Kisumu	Marginalized horticulture	Ahero Vocational Training College (VTC)

Table 1: Clusters, counties and ATVETs selected.

Among the counties selected for the project, only Meru is among leading counties in horticulture in terms of volumes and values (HCDA, 2017, County Government of Meru, 2018). The production volumes and values in Migori, Kisumu and Tharaka Nithi are either low or not significant relative to the leading counties. Migori, Kisumu and Tharaka Nithi counties have favourable climatic and ecological conditions for horticultural production (County Government of Migori, 2018; County Government of Kisumu, 2018; County Government of Tharaka Nithi, 2018). The level of horticulture production in Migori, Kisumu and Tharaka Nithi counties is below the potential.

Project outputs

Producing graduates with competences to address key issues in the horticulture sector and respond to the labour market

This output aimed to address the horticulture private sector demand for competent labour force. The key strategies used to realize this were:

- i) Competence based Education (CBE) training for staff
- ii) Development of attachment manuals
- iii) Investments in horticultural innovation hubs
- iv) CBE training for teaching staff

This training was offered to a total of 23 teaching staff from Ahero VTC, Siala TTI, Meru National Polytechnic, Tharaka TVC, Marimba Campus, KEWI and MUST. The Aspects of the CBE training included topics on competencies, assessment,

CBE teaching methods, online teaching, attachment in CBE, and external resource persons in CBE.

The training, which lasted three months, was aimed at equipping the tutors with knowledge, skills and attitude necessary for competency based education. This is key for successful implementation of CBE curriculum (Owala, 2021, Cheptoo and Ramdas, 2020, Oonk et al, 2020). The shift from teacher-centred approaches to CBE requires that the teachers and tutors obtain continuous education for effective performance (Mauki et al., 2020). The tutors are currently implementing CBE approach within their programmes. Marimba Campus is running Competency Based Curriculum (CBC) and the tutors are able to practice what the training offered. The project will evaluate the process to gauge if the students have been appropriately trained to be competent in horticulture for the industry and labour market.

Development of attachment manuals

Attachment was identified as one of the training activities with high potential to impart knowledge, skills and attitude to the students. A baseline survey indicated that the current organization of attachment was not adequately addressing the needs of horticulture students. This project consultations with industry developed attachment guidelines specific to horticulture. The benefits of attachment in skilling and providing hands on experience at the world of work are well recog-

nized (Dondofema et al., 2020).

Investment in Horticultural Hubs

The project invested in creating horticultural innovation hubs within the participating institutions. The specific investments were decided on in a consultative process involving the institutions and the project partners. Overall, there was a greenhouse based hub, and an open field based hub. These investments were a response to needs assessments from all the participating institutions. They were meant for training for students and staff, and a learning platform for farmers, extension officers, entrepreneurs and the community. This was aimed at training the student's individual personality and motivate them towards entrepreneurship, which is necessary for success business startup (Santoso et al., 2021). Each institution developed a business plan in line with the investments. Factors for supporting entrepreneurship and business startup include vibrant private sector, an entrepreneurship culture, an entrepreneurial thinking, consultancy services, and provision of the physical space, business skills, network building, market, and access to financial resources (Mohammadi et al., 2019).

Initially, one day training was offered to the staff, farm managers and farmers on all aspects necessary to run a greenhouse business (Fig. 1). During the first season in January 2022, the greenhouse innovation hubs were not operating optimally in the institutions (Table 2). The crops had largely failed and the greenhouses were either empty or broken down (Fig. 2). This was attributed to inadequate competencies in running the

greenhouse. The project then devised an approach of relatively longer hands-on training and this enabled the institutions to make the greenhouse to serve the intended purpose in the second season in May 2022 (Table 2, Fig. 3). Involvement of students ensured that they acquired the skills necessary for greenhouse production.

Strengthened staff capacity of the participating educational institutes translating labour market demand

Instructional manual development

The instructional manuals designed to guide the tutors in delivery of the training. Consultations among the project partners selected the topics for the instructional manuals. The manuals were developed by tutors from the participating ATVETS supported by the researchers from Dutch participating institutions (Wagenigen University Research -WUR, AERES University of Applied Sciences, HAS University of Applied Sciences and VHL University of Applied Sciences), MUST, HCD and a Kenyan team of project consultants. The topics selected for this activity included Avocado fruit production, tomato production, IPM and food safety, vegetable postharvest handling, tropical fruit postharvest handling and entrepreneurship.

Extension staff trained by participating institutions offer results-based contextualized technical information to farmers

Provision of appropriate extension service to smallholder farmers in Kenya is one of the key constraints facing agriculture. This problem is more acute in horticulture, crops and dairy (MOA,

Institution	Status at January 2022	Status at May 2022
Siala TTI	Unhealthy tomatoes being produced in soil	Healthy tomatoes fruiting
Ahero VTC	Greenhouse destroyed by winds	Healthy tomatoes at seedling stage
MNP	Tomato crops drying up	Healthy tomatoes at seedling stage
Tharaka TVC	Greenhouse empty	Healthy tomatoes flowering
Marimba/MUST	Greenhouses empty	Healthy tomatoes flowering

Table 2: Status of greenhouse hubs in 2022



2012, Muthoni, 2018). There are six basic extension approaches at various levels of implementation in Sub-Saharan Africa (Olayemi et al., 2021). These include top-down, participatory, demand-led, group versus individual targeting, private sector, and free/paid extension services. The common

extension approaches in Kenya include field days, demonstrations, farmer visits, farmer Field Schools, and extension to organized and registered farmer groups (NASEP, 2012). In all these approaches, the overall thinking is that of demand driven extension (Oleyemi et al., 2021). There is



Figure 3: Healthy greenhouse tomato crops under longer hands-on training

there is a need to move to result based extension service to transform agriculture. This is likely to enhance the output from extension services. The project mapped the extension providers in the clusters of the project sites. A gap analysis of extension system against a result-based extension system was done. This indicated inadequate extension as evidenced by the relatively low crop productivity and low incomes to the farmers.

Workshops were done to sensitize the extension staff, farmers and trainers in the colleges on the need for result-based extension service and presentation of one identified result-based extension model. A total of 19 extension staff, 16 tutors and 8 farmers were involved in the workshops. The participants were taken through RASTA (Register, Analyse, Share, Train, Adjust) Model, a result based extension approach. This is a methodology that guides the Mazao Safi extension and service delivery, a subsidiary of TradeCare Africa (<https://www.tradecareafrica.com>, Kilelu et al., 2020). It has 5 activities: Register (R), Analyse (A), Share (S), Train (T), Adjust, Act (A). It involves registering data, analyzing the registered data, sharing information, training the actors, making adjustments based feedbacks and acting. RASTA follows a supply chain approach. RASTA does not seek to replace the known methods of extension; rather it is an approach of offering extension service. A similar data driven approach for improved crop management decisions has been reported in Colombia (Jiménez et al., 2019).

Based on the feedback on RASTA from the sen-

sitization workshop, the project consortium developed a short training course on RASTA. Pilot training was done over a period of two days for nine extension officers, 2 farmers and 8 tutors. The trainees noted that smallholder farmers can benefit from the model if they aggregate and engage in semi-commercial or commercial farming. They also noted that the model can have challenges in implementation especially due to reduced funding on public extension services which have been devolved.

Consolidated institutional collaboration between “green” education institutions in Kenya and the Netherlands

Internationalization in TVET Education

Internalization in Education at the TVET level is limited. Networking and internalization is beneficial in terms of commercial and developmental interests of the collaborating institutions (Gao, 2019). The benefits include contributing to staff mobility, research and technical skills development. Internationalization in TVET education faces challenges such as curricula incompatibility, lack of interest from staff, and institutional focus. The project organized a seminar that brought together participants from Kenya and Netherlands, which focussed on internationalization. The benefits of internationalization discussed included staff and student exchanges for enhanced experiences, joint activities such as curricula review, research and training, and sharing facilities, resources and human resources.

Kenya-Dutch student and staff Problem Based Learning Interactions

HAS university, one of the Dutch partners in the project relies on Problem Based Learning (PBL) in teaching agriculture. In the project, PBL of two weeks brought together 20 Kenyan students, 5 Kenyan staff, 20 Dutch students and 7 Dutch staff. It was noted that successful implementation of PBL in horticulture is able to enhance entrepreneurship among the students.

Conclusion

The CBE training was successfully conducted and enabled staff to acquire knowledge, skills and attitude necessary for competency based education. This has greatly improved their role in their institutions. The developed guidelines for attachment have already been operationalized and resulted in positive feedback from the industry, students and the institutions. The key challenge experienced is the lack of financial resources on the part of students to participate in attachment, which requires further consideration. The setting up of horticultural innovations hubs is already impacting positively on learning in the institutions. Involving tutors in instructional manual development and the resultant interactions with Dutch and Kenyan partners greatly enhanced the tutors' capacity. Use of the manuals will enrich the learning process. The clusters embraced the result-based extension approach. The project has planted the seed of internationalization in the TVETs. These institutions are on way to getting the intended benefits. One product of internationalization was the joint PBL between Kenyan and Dutch students and staff. This has laid a solid foundation for more joint learning.

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