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Abstract

Promoting the transition of smallholder farmers from subsistence to more commercial and market-oriented production is an important goal of the Tanzanian extension system. The Ministry of Agriculture Training Institutes (MATIs) contribute to this goal by providing training to frontline extension workers (FEWs). However, the capacity of the MATI system to produce agricultural extension practitioners with job-ready competencies has declined, leading stakeholders and employers to raise concerns about the quality and training of FEWs. The main purpose of this study was to develop recommendations for curriculum revisions at MATI Ilonga to improve its program of study. This was done using a competency-based approach that incorporated inputs from stakeholders into the curriculum assessment and revision process. A panel of eight local and external experts derived 23 competencies from a review of the MATI curriculum and extension literature. A survey instrument to assess competencies based on perceptions of importance and graduates' ability was designed and administered to 189 stakeholders from four stakeholder groups. Stakeholder-respondents considered all but two of the 23 competencies to be very high importance. Weighted discrepancy scores indicated that the highest rated areas for curriculum revision were Value Chains, Business skills, Climate Change, Fisheries, and Land Resource Management. All stakeholder groups except graduates, indicated Value Chains and Business Skills as high priorities requiring enhanced training to improve the ability of FEWs. Follow-up stakeholder consultations indicated support for using the competency-based approach, engaging stakeholders in the curriculum review process, and interest in applying the approach with other MATIs in Tanzania.

Keywords

Tanzania; agricultural extension; training; competencies

Erratum

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Abstract

Promoting the transition of smallholder farmers from subsistence to more commercial and market-oriented production is an important goal of the Tanzanian extension system. The Ministry of Agriculture Training Institutes (MATIs) contribute to this goal by providing training to frontline extension workers (FEWs). However, the capacity of the MATI system to produce agricultural extension practitioners with job-ready competencies has declined, leading stakeholders and employers to raise concerns about the quality and training of FEWs. The main purpose of this study was to develop recommendations for curriculum revisions at MATI Ilonga to improve its program of study. This was done using a competency-based approach that incorporated inputs from stakeholders into the curriculum assessment and revision process. A panel of eight local and external experts derived 23 competencies from a review of the MATI curriculum and extension literature. A survey instrument to assess competencies based on perceptions of importance and graduates' ability was designed and administered to 189 stakeholders from four stakeholder groups. Stakeholder-respondents considered all but two of the 23 competencies to be very high importance. Weighted discrepancy scores indicated that the highest rated areas for curriculum revision were Value Chains, Business skills, Climate Change, Fisheries, and Land Resource Management. All stakeholder groups except graduates, indicated Value Chains and Business Skills as high priorities requiring enhanced training to improve the ability of FEWs. Follow-up stakeholder consultations indicated support for using the competency-based approach, engaging stakeholders in the curriculum review process, and interest in applying the approach with other MATIs in Tanzania.

Keywords: Tanzania; agricultural extension; training; competencies

Introduction

Promoting the transition of smallholder farmers from subsistence to commercial and market-oriented production is an important development goal and strategy for improving livelihoods, food security, and promoting agricultural-led agricultural growth in Sub-Saharan Africa (Ferris et al., 2014; Rivera, 2009; World Bank, 2007a). This transformation is leading to changing demands in agricultural labor markets and the need for agricultural education training institutions to revise and update their training programs (Davis, Ekboir, & Spielman, 2008).

Agricultural extension has long played an important role providing new information and improved farming methods to smallholder farmers in many Sub-Saharan African countries (Davis, Ekboir, & Spielman, 2008; Msoffe & Ngulube, 2016). The training provided by agricultural education institutions to extensionists emphasized knowledge and skills transfer and the dissemination of new technologies to increase crop production and food security (Swanson, 2008; Kroma, 2003). However, it is now recognized that the training of extension agents will need to go beyond technology promotion and transfer if they are to contribute to transforming smallholder production systems (Davis, Ekboir, & Spielman, 2008; World Bank, 2007b). To accommodate this new orientation, many agricultural extension training institutions are looking to evaluate, adjust, and reform their training programs (Ferris et al., 2014; Kibwika, 2011; Ragasa, Ulimwengu, Randriamamonjy, & Badibanga, 2016; Rivera, 2011;).

In Tanzania, increased agricultural productivity is required to improve food security and economic growth. Tanzania has a largely agrarian-based economy, with 77 percent of its 54 million inhabitants reliant on agriculture as their main form of

livelihood (USAID, 2014). However, agricultural productivity remains low and insufficient to significantly reduce rural poverty and improve national food security. To address this challenge, the Government of Tanzania and donor agricultural development strategies call for an agricultural transformation that transitions smallholder farmers from semi-subsistence, low-input, low-productivity farming to knowledge-based, commercial agriculture that uses improved technologies to increase productivity for markets and improved livelihoods (Government of Tanzania, 2016; USAID, 2014; URT-MAFC, 2011). As an important source of new information and knowledge, particularly in rural areas, extension providers play a vital role in effecting this transformation.

A major goal of the Tanzanian extension system is to contribute to this transformation by improving the agricultural productivity of the nation's smallholder farmers. The Ministry of Agriculture Training Institutes (MATIs) play a major role in this process by providing training to frontline extension workers (FEWs) and other practitioners at the certificate and diploma levels. The graduates of the MATIs are then hired largely by the President's Office Regional Administration and Local Government (PO-RALG) and deployed at the local (village and ward) level to provide extension services. Over the years, the capacity of the MATI system to produce agricultural extension practitioners with job-ready competencies has declined. It has been almost a decade since their curriculum and training programs were revised. Training materials and experiential learning opportunities are often lacking, and linkages with external stakeholders including those in the private sector remain limited. This has led stakeholders and employers to raise concerns about the quality and training of FEWs and their lack of skills to contribute to

agricultural productivity, income generation, and market-led agricultural development (Msuya, Mattee, Shausi, Mapundo, & Nyamba, 2017a; Kibwika, 2011).

Improving the training of FEWs will be important to Tanzania's agricultural sector as it transitions and becomes more market and commercially oriented. The concerns expressed by stakeholders indicate that the MATI training programs need to be revised to better reflect the changing needs of the agricultural sector and produce graduates with skills that will enable them to contribute to Tanzania's agricultural transformation (Wambura, Acker, & Mwasyete, 2015). An important first step to improve the effectiveness of extension providers is to review, revise, and update their training curricula (Hussein & Suttie, 2016; Davis, Ekboir, & Spielman, 2008; World Bank, 2007a; Swanson, 2008).

In 2016, the USAID-funded [an initiative] in collaboration with Sokoine University of Agriculture's (SUA) Department of Agricultural Extension and Community Development (DAECD), and the Ministry of Agriculture, Livestock and Fisheries' (MALF) Department of Training (DAT) launched a pilot effort with MATI Ilonga, in Morogoro Region. It focused on developing program revisions to reflect the changing needs of Tanzania's agriculture sector and improve the performance and employability of its graduates.

Operational Framework

The major purpose of this study was to develop recommendations for curriculum revisions and staff development at the Ministry of Agriculture Training Institute (MATI) at Ilonga, Tanzania. The study utilized a competency-based approach to assess the curriculum and identify skill-gaps in the MATI Ilonga training program that was adapted from a model of training needs assessment developed by Borich (1980).

This approach was selected because it provides a coherent, straight-forward process that facilitates instrument construction, data collection and analysis, and yields easy to interpret practical recommendations for program improvement (Edwards & Briers, 1999).

Numerous studies have used competencies to evaluate training programs in the fields of vocational education, agricultural education, and extension (Albert, Roberts, & Harder, 2017). Competencies represent an array of skills, knowledge, and behaviors required to perform an occupation or task associated with an occupation (Scheer, Cochran, Harder, & Place, 2011; Athey & Orth, 1999). They can be used to form the structural objectives of a curriculum and the expected outcomes of a training program. They can also serve to determine training needs by determining the gap or discrepancy between the training objective related to a competency and its performance. By having respondents weight the importance of each competency, a Weighted Discrepancy Score (WDS) can be calculated that merges the perception of importance and performance (ability) into a single indicator that represents a "need for change", with higher WDS indicating priority areas for curriculum revision or enhancement (Borich, 1980).

Program planning has long relied on incorporating external stakeholder perceptions into the needs assessment process (Gary & Phillip, 1993; Bennett & Rockwell, 1995). Engaging the end-users of extension services, particularly employers and farmers, in the training needs assessment process has been advocated to improve the relevance and design of curricula used to train extension providers (Venkatesan & Kampen, 1998; Crowder, Lindley, Bruening, & Doron, 1998). This competency assessment was conducted with

four stakeholder groups including former MATI graduates, employers, farmers and Ministry of Agriculture, Livestock and Fisheries (MALF) training division staff. Their perceptions of MATI graduate competencies were intentionally included to enhance the relevance of recommendations and promote dialogue and institutional linkages among these groups.

Operationalizing the needs assessment model entailed implementing the following steps: deriving a list of competency statements; selecting respondents to assess competencies; creating an instrument to assess each competency statement based on its importance to extension work and perceptions of ability to perform the competency; and ranking competencies using WDS.

Purpose & Objectives

The main purpose of this study was to develop recommendations for curriculum revisions and staff development at MATI Ilonga. It was undertaken to improve the program of study at MATI Ilonga so that it might better address the changing needs of the Tanzanian agriculture sector and improve the performance and employability of its graduates. The main objectives were to: 1) compile a list of competencies needed by FEWs; 2) describe stakeholder assessment of each competency based on importance 3) describe stakeholder perceptions of FEWs' ability (competency) to perform each competency; and 4) determine weighted discrepancy scores (WDS) to prioritize recommendations for curriculum revisions and staff development.

Methods

A nonexperimental, descriptive survey design was used in 2016 to develop recommendations for revising the curriculum at MATI Ilonga, Morogoro Region, Tanzania. The approach utilized four stakeholder groups to assess the competencies of MATI Ilonga graduates. The first step in this process was to assemble a list of competencies needed by frontline extension workers (FEW) to do their work effectively. The list was compiled by a panel of eight experts: four from SUA's Department of Agricultural Extension and Community Development (DAECD), the Principal from MATI Ilonga, a representative from MALF's DAT, and two faculty consultants from [university's] Department of Agricultural Communications, Education, and Leadership. The panel derived competency statements from a review of the existing MATI curriculum (MALF, 2011), literature reviews of extension competencies and modeling (Cochran, 2009; Scheer, Cochran, Harder, & Place, 2011; Langdon & Whiteside, 2004; McLagan, 1997), reviews of current and future food and agriculture trends in Tanzania (Crawford, Minde, Colverson, Freed, & Haggblade, 2011), and extensive discussions among panel members. Content validity was established through reviews conducted with faculty from DAECD and members of MALF's DAT. A final list of 23 competencies was compiled and divided into functional (cross cutting) and core (technical) competency areas to maintain congruence with the structuring of competencies used by the National Council for Technical Education (NACTE), the main technical education curriculum certification body in Tanzania (Table 1).

Table 1

Operational definitions of selected competencies for FEWS used in curriculum assessment of MATI Ilonga, Tanzania

Competencies	Description
<i>General knowledge of Extension</i>	Ability to find information on agricultural issues/ technologies; understand policies/procedures of extension; and understand the general role of extension for agricultural development.
<i>Basic administration & management knowledge & skills</i>	Ability to manage time, human, financial, and other resources to successfully achieve intended targets and program outcomes.
<i>Program planning</i>	Ability to analyze a situation/identify a need [e.g. stakeholder analysis, analyze resource availability, analyzing available opportunities and obstacles, identify gaps], develop a work plan, and develop a budget.
<i>Program implementation</i>	Ability to execute planned programs including delivery methods [e.g. participatory approaches, demonstrations, mass media, individual contact] for supporting extension programs.
<i>Program monitoring & evaluation</i>	Ability to plan, conduct, analyze, and report an evaluation of a program at various stages of implementation.
<i>Leadership skills</i>	Ability to provide direction/ insight and to positively influence a wide range of diverse individuals and groups to achieve a commonly established goal or objective.
<i>Communication skills (oral & written)</i>	Ability to prepare and convey information in an understandable way to a range of recipients.
<i>Negotiation and advocacy skills</i>	Ability to facilitate discussion in order to reach an amicable solution or reach consensus on various issues; Ability to speak on the behalf of or support farmers to present their situation/contexts to others [policy makers/donors/researchers/NGOs/etc.] in order to influence decision or policy changes.
<i>Interpersonal skills</i>	Ability to successfully interact with diverse individuals and groups to create positive human relationships [e.g. networks, partnerships] and help to manage interpersonal conflict.
<i>Professional ethics</i>	Ability to apply professional values and guiding principles [e.g. honesty, respect, accountability, inclusion, transparency, and integrity] to reflect high levels of performance, strong work ethic, and commitment to the mission of agricultural extension.
<i>Information Communication Technology (ICT)</i>	Ability to apply knowledge and skills of ICT in disseminating information about new technologies and marketing opportunities to farmers and other stakeholders.
<i>Gender in Extension</i>	Ability to incorporate genders aspects in extension activities [e.g. consideration of resource requirements, timing of activities, cultural issues].
<i>Food processing/ preservation skills</i>	Ability to apply basic knowledge and skills of food processing and preservation to add value to agricultural and livestock produce.

<i>Health effects on labor and livelihoods</i>	Ability to advise household/farmer on decision making in human nutrition, health, and sanitation to minimize the effects of poor health on labor and livelihoods.
<i>Entrepreneurship</i>	Ability to advise farmers in identifying and utilizing opportunities for agricultural enterprise development and how to take risks in agricultural business or enterprise.
<i>Business skills</i>	Ability to advise farmers on how to prepare a good business plan; conduct a business appraisal; prepare a good loan/grant proposal; run a business (planning, budgeting, production, marketing, and record keeping).
<i>Value chain</i>	Advise farmer/farmer's group in value chain development for appropriate enterprise.
<i>Climate change</i>	Ability to recognize and advise farmers on the effects of climate change on agriculture and identify coping and mitigating measures.
<i>Environmental conservation</i>	Appreciation of the need for environmental conservation, ability to recognize environment degradation practices, and to identify and advise farmers on environmental conservation practices.
<i>Livestock husbandry</i>	Ability to apply basic and more specialized practices for livestock production (i.e., animal nutrition; disease diagnosis and management; pasture production; and animal housing/confinement).
<i>Crop husbandry</i>	Ability to apply basic and more specialized practices for crop production including land preparation, soil fertility management, pest management, and harvesting/post-harvesting operations.
<i>Fisheries</i>	Ability to apply basic and more specialized practices for fish farming (e.g., nutrition; disease; pond management; harvesting/processing).
<i>Resource management</i>	Ability to advise clients on proper water, land, and range resource management for sustainable agricultural and livestock productivity and production.

The second step was to prepare survey instruments for each stakeholder group through which they were asked to assess each competency statement based on its importance to extension work and their perception of graduates' ability (competency) to perform the competency. Stakeholder-respondents assessed the importance and ability of each competency statements using a five-point Likert-type scale: 5=Very High Importance/Ability; 4=High; 3=Intermediate; 2=Low; and 1=Very Low Importance/Ability. Cronbach's alpha reliability estimates for the importance scale and the ability scale were both .97. The core survey instrument was pilot tested with selected respondents

who did not participate in the final study and with extension professionals prior to being taken to the field. Based on the pilot test results, the project team made several revisions to the instrument including its translation into Kiswahili, the national language, and changing the term "competence" to "ability" for questions assessing perceptions of graduates' ability. The team also decided that some surveys would be interviewer-administered and others group-administered to accommodate for literacy levels and cultural considerations, in particular for farmer respondents.

Since formal sampling frames for the stakeholder groups were not available, a

stratified (purposive), convenience sampling method was used to identify and select survey participants, except those from MALF, in Morogoro, Kilosa, and Mvomero Districts all in Morogoro Region. All questionnaires were administered during October and November 2016. Eventually, a total of 189 persons from four stakeholder groups completed the survey.

The third step was to determine Weighted Discrepancy Scores (WDS) for each competency to indicate priority areas for future curriculum revision and staff development. This was done by first calculating a discrepancy score for each competency statement. Discrepancy Scores represent the gap between the importance and ability scores for each competency and were derived by taking the difference between stakeholder-determined levels of importance and their perception of graduate ability, or competency. Weighted discrepancy scores (WDS) for each item were derived by multiplying the discrepancy score by the mean importance rating for

each competency, providing a single indicator for prioritizing training needs. Higher WDS indicate priority areas for curriculum revision or enhancement.

Findings

The 189 total respondents included 120 Farmers, 41 Graduates, 20 Employers, and 8 MALF staff. Of these, 34% were female and 64% male. The proportion of female respondents across stakeholder groups was similar: Farmers (34.2%), Graduates (31.7%), Employers (35%), MALF (37.5%). The Graduates were certificate (32%) or diploma (68%) holders largely employed by PO-RALG at the local level as FEWs. Employers were largely from central or local government (the largest employers of MATI graduates), the private commercial sector, and non-governmental organizations. Farmers were from Morogoro Region, Kilosa and Mvomero Districts, produced a wide range of crops, and varied in educational attainment (Table 2).

Table 2
Demographic Characteristics of Farmers

Variable	Level	Farmers
District	Kilosa	58 (48.3%)
	Mvomero	62 (51.7%)
Sex	Male	79 (65.8%)
	Female	41 (34.2%)
Age (years)	Below 25	4 (3.3%)
	25 to 45	55 (45.8%)
	Above 45	55 (45.8%)
	Missing data	6 (5.0%)
Education level	No formal education	10 (8.3%)
	Primary	81 (67.5%)
	Secondary	28 (23.3%)
	Certificate	
	Diploma	
	Degree	1 (0.8%)

Note: *N = 120; Numbers in parentheses () are percentages.

Objective two was to describe stakeholder assessments of each competency

based on its importance to extension work (Table 3). Findings indicated that

stakeholder-respondents considered most of the 23 competencies to be very high importance ($M > 4.5$) or high importance ($M > 4.0$). Only farmers rated two

competencies, General Knowledge of Extension (functional) and Crop Husbandry (core), as intermediate in importance ($M < 4.0$).

Table 3

Mean Imp. Ratings of Comp. Statements by MATI Stakeholders in Morogoro Region, Tanzania

Competencies	Graduate N = 41		Employer N = 20		Farmer N = 120		MALF N = 8		Overall
	M	SD	M	SD	M	SD	M	SD	M
Functional									
General knowledge of Extension	4.63	0.65	4.75	0.55	3.93	0.76	4.22	0.97	4.38
Basic administration knowledge & skills	4.56	0.55	4.35	0.59	4.23	0.73	4.00	0.87	4.29
Program planning	4.44	0.63	4.45	0.69	4.33	0.74	4.56	0.53	4.45
Program implementation	4.44	0.55	4.55	0.61	4.32	0.73	4.22	0.44	4.38
Monitoring & evaluation	4.46	0.60	4.60	0.60	4.38	0.70	4.44	0.53	4.47
Leadership skills	4.54	0.64	4.40	0.60	4.21	0.73	4.44	0.72	4.40
Communication skills	4.54	0.51	4.80	0.41	4.36	0.70	4.56	0.73	4.57
Leading discussions & advocacy skills	4.32	0.72	4.60	0.50	4.41	0.74	4.33	0.87	4.42
Interpersonal skills	4.41	0.50	4.75	0.44	4.51	0.59	4.22	0.67	4.47
Professional ethics	4.27	0.71	4.60	0.50	4.14	0.88	4.44	0.53	4.36
Information Communication Technology	4.61	0.54	4.65	0.49	4.15	0.83	4.33	0.71	4.44
Gender issues in Extension	4.46	0.67	4.25	0.79	4.23	0.78	4.13	1.13	4.27
Food processing & storage skills	4.37	0.54	4.60	0.50	4.32	0.81	4.11	0.78	4.35
Effects of poor health on labor force & general livelihood	4.41	0.74	4.45	0.76	4.37	0.71	4.33	0.87	4.39
Entrepreneurship	4.53	0.51	4.75	0.44	4.13	0.80	4.33	0.71	4.44
Business skills	4.46	0.78	4.80	0.41	4.38	0.76	4.44	0.88	4.52
Value chains	4.32	0.72	4.75	0.44	4.47	0.69	4.44	0.73	4.50
Climate change	4.41	0.74	4.80	0.41	4.40	0.76	4.56	0.73	4.54
Environmental conservation	4.41	0.67	4.70	0.47	4.18	0.98	4.67	0.71	4.49
Total Functional Mean	4.45		4.61		4.29		4.36		
Core									
Livestock husbandry	4.49	0.55	4.63	0.50	4.29	0.72	4.56	0.88	4.49
Crop husbandry	4.41	0.59	4.68	0.48	3.63	1.20	4.67	0.50	4.35
Fisheries	4.32	0.72	4.47	0.62	4.28	0.71	4.11	0.78	4.30
Land resource management	4.46	0.78	4.70	0.47	0.00	0.00	4.33	0.71	4.50
Total Core Mean	4.42		4.62		4.07		4.42		

Note: *N = 189; Means are taken from responses on a five-point Likert-type scale.

Table 3 shows the most important ratings of competencies from all four stakeholder groups. The most important competencies rated by all stakeholders were: Communication Skills ($M = 4.57$), Climate Change ($M = 4.54$), Business Skills ($M = 4.52$), Value Chains ($M = 4.50$), and Land Resource Management ($M = 4.50$). The lowest rated competencies were: Gender Issues ($M = 4.27$), Basic Administration Knowledge ($M = 4.29$), Fisheries ($M = 4.30$), Crop Husbandry ($M = 4.35$), and Food Processing Skills ($M = 4.35$). However, there were differences in how each particular stakeholder group rated their perceived importance of each competency. Graduates rated General Knowledge of Extension ($M = 4.63$), Information and Communication Technology (ICT) ($M = 4.61$), and Basic Administration Knowledge ($M = 4.56$) as most important. Employers rated Communication Skills ($M = 4.80$), Business Skills ($M = 4.80$), and Climate Change ($M = 4.80$) as most important. Farmers rated Interpersonal ($M = 4.51$), Value Chains ($M = 4.57$), and Climate Change ($M = 4.40$) as most important. MALF training staff rated Environmental Conservation ($M = 4.67$) and Crop Husbandry ($M = 4.67$) as the most important followed by similar ratings ($M = 4.56$) for

Program Planning, Communication Skills, and Climate Change.

Objective three was to describe stakeholder perceptions of FEWs' ability to perform each competency (Table 4). Findings indicated that all stakeholders rated FEWs' ability as intermediate ($M < 4$) on eleven competencies and low ($M < 3$) on twelve competencies. The five highest rated ability statements in order, provided by all stakeholders, were: Program Implementation ($M = 3.60$), Communication Skills ($M = 3.34$), Basic Administration Knowledge ($M = 3.25$), Livestock Husbandry ($M = 3.25$), and Interpersonal Skills ($M = 3.24$). Individual stakeholder groups rated only five competencies as very high or high in ability. Graduates rated themselves with high ability ratings for Professional Ethics ($M = 4.22$), Leadership Skills ($M = 4.10$), and Leading Discussions ($M = 4.00$). Employers rated graduates' ability as very High for Program Implementation ($M = 4.55$) and farmers rated graduates' ability as high for Basic Administration Knowledge ($M = 4.21$). All other competencies, both functional and core, were rated intermediate or low, except for MALF training staff who rated graduates' ability as very low on Value Chains ($M = 1.75$) and Fisheries ($M = 1.75$).

Table 4

Mean Ability Ratings of Competency Statements by MATI Stakeholders in Morogoro Region, Tanzania

Competencies	Graduate N = 41		Employer N = 20		Farmer N = 120		MALF N = 8		Overall N = 189
	M	SD	M	SD	M	SD	M	SD	M
Functional									
General knowledge of Extension	3.59	0.63	2.95	0.83	3.15	0.85	2.75	0.71	3.11
Basic administration knowledge & skills	3.92	0.71	2.50	0.83	4.21	3.55	2.38	0.52	3.25
Program planning	3.71	0.81	2.40	1.00	3.29	0.98	2.38	0.52	2.95
Program implementation	3.66	0.69	4.55	0.61	3.32	1.03	2.88	0.64	3.60
Monitoring & evaluation	3.80	0.64	2.45	0.89	3.34	0.98	2.38	0.52	2.99

Leadership skills	4.10	0.70	2.45	0.83	3.55	0.96	2.38	0.52	3.12
Communication skills	3.98	0.65	2.95	0.95	3.28	1.00	3.13	0.99	3.34
Leading discussions & advocacy skills	4.00	0.67	2.45	1.05	3.66	1.05	2.75	1.04	3.22
Interpersonal skills	3.95	0.74	2.85	1.09	3.54	1.06	2.63	0.74	3.24
Professional ethics	4.22	0.79	2.65	1.04	3.12	1.07	2.75	1.04	3.19
Information									
Communication	3.61	0.77	2.60	1.00	3.27	0.97	2.00	0.76	2.87
Technology									
Gender issues in Extension	3.88	0.75	2.85	0.88	2.98	0.94	2.43	0.98	3.04
Food processing & storage skills	3.56	0.92	2.30	0.92	3.08	1.16	2.25	1.04	2.80
Effects of poor health on labor force & general livelihood	3.63	0.80	2.55	1.05	3.04	1.04	2.38	0.74	2.90
Entrepreneurship	3.88	0.78	2.65	0.88	3.11	0.99	2.25	1.04	2.97
Business skills	3.82	0.82	2.1	1.02	3.1	1	2.25	1.04	2.82
Value chains	3.71	0.75	2.25	1.12	3.14	0.91	1.75	0.46	2.71
Climate change	3.71	0.57	2.55	1.10	3.24	1.07	2.00	0.76	2.88
Environmental									
Conservation	3.56	0.92	2.90	1.12	3.16	1.01	2.25	0.89	2.97
Total Functional Mean	3.80		2.68		3.29		2.42		
Core									
Livestock husbandry	3.76	0.82	3.00	1.05	3.60	0.98	2.63	0.92	3.25
Crop husbandry	3.56	1.23	3.53	0.77	2.38	0.97	3.00	0.93	3.12
Fisheries	2.83	1.2	2.35	1.06	3.21	0.96	1.75	0.71	2.54
Land resource management	3.48	0.99	2.90	1.02	0.00		2.38	0.74	2.92
Total Core Mean	3.41		2.95		3.06		2.44		

Note: N = 189; Means are taken from responses on a five-point Likert-type scale.

All stakeholders provided the highest ability ratings of graduates for the functional competencies of Program Implementation ($M = 3.60$), Communication Skills ($M = 3.34$), and Basic Administration Knowledge ($M = 3.25$) and the lowest ability ratings for Value Chains ($M = 2.71$), Food Processing ($M = 2.80$), and Business skills ($M = 2.82$). For core competencies, all stakeholders rated Livestock ability as the highest ($M = 3.25$) and Fisheries ability as the lowest ($M = 2.54$). Graduates provided the highest mean ability ratings for both functional and

core competencies followed by farmers, employers, and MALF training staff. Compared to the other stakeholder groups, MALF training administrators rated graduates' abilities the lowest on both functional and core competencies.

Objective four was to determine priority training needs and areas to improve the curriculum. This was accomplished by establishing the gap or discrepancy between "importance" and "ability", then calculating weighted discrepancy scores (WDS) for each competency (Table 5). Priority areas

for curriculum revision or enhancement were indicated by higher WDS. All stakeholders indicated that the six highest rated training needs in order were: Value Chains ($M = 8.10$), Business skills ($M = 7.79$), Climate Change ($M = 7.67$), Fisheries ($M = 7.55$), Land Resource Management ($M = 7.09$), and ICT ($M = 6.97$). Graduates rated Fisheries ($M = 6.44$), General Knowledge of Extension ($M = 4.82$), and ICT ($M = 4.61$) as their three highest training needs. Employers rated Business skills ($M = 12.96$), Value Chains ($M = 11.88$), and Climate Change ($M = 10.80$) as the three highest training needs for graduates. Farmers rated Value Chains ($M = 5.95$), Health and Livelihoods ($M = 5.81$),

and Business skills ($M = 5.61$) as the three highest training needs. Finally, MALF rated Value Chains ($M = 11.94$), Climate Change ($M = 11.67$), and Environmental Conservation ($M = 11.30$) as the three highest training needs. The five lowest rated training needs (low WDS) rated by all stakeholders in order were: Program Implementation ($M = 3.36$), Basic Administration Knowledge ($M = 4.38$), Gender Issues ($M = 5.21$), Professional Ethics ($M = 5.23$), and Interpersonal skills ($M = 5.53$). Lower WDS do not indicate unimportance, but that it appears to stakeholders as being sufficiently addressed in the training program curricula.

Table 5

Weighted discrepancy scores (WDS) for MATI Stakeholders in Morogoro Region, Tanzania

	Graduate N = 41	Employer N = 20	Farmer N = 120	MALF N = 8	Overall N = 189
Competencies	M	M	M	M	M
Functional					
General knowledge of Extension	4.82	8.55	3.07	6.20	5.66
Basic administration knowledge & skills	2.92	8.05	0.08	6.48	4.38
Program planning	3.24	9.12	4.50	9.94	6.70
Program implementation	3.46	0.00	4.32	5.65	3.36
Monitoring & evaluation	2.94	9.89	4.56	9.15	6.63
Leadership skills	2.00	8.58	2.78	9.15	5.63
Communication skills	2.54	8.88	4.71	6.52	5.66
Leading discussions & advocacy skills	1.38	9.89	3.31	6.84	5.36
Interpersonal skills	2.03	9.03	4.37	6.71	5.53
Professional ethics	0.21	8.97	4.22	7.50	5.23
Information					
Communication	4.61	9.53	3.65	10.09	6.97
Technology					
Gender issues in Extension	2.59	5.95	5.29	7.02	5.21
Food processing & storage skills	3.54	10.58	5.36	7.64	6.78
Effects of poor health on labor force & general livelihood	3.44	8.46	5.81	8.44	6.54

Entrepreneurship	2.94	9.98	4.21	9.01	6.53
Business skills	2.85	12.96	5.61	9.72	7.79
Value chains	2.64	11.88	5.95	11.94	8.10
Climate change	3.09	10.80	5.10	11.67	7.67
Environmental conservation	3.75	8.46	4.26	11.30	6.94
Core					
Livestock husbandry	3.28	7.55	2.96	8.80	5.65
Crop husbandry	3.75	5.38	4.54	7.80	5.37
Fisheries	6.44	9.48	4.58	9.70	7.55
Land resource management	4.37	8.46	0.00	8.44	7.09

Note: N = 189

There were important variations in WDS ratings between stakeholder groups. All stakeholder groups except graduates indicated Value Chains and Business skills as priority areas requiring enhanced training curricula. Both employers and farmers gave Food Processing and Storage skills the fourth highest WDS. Additionally, both graduates and MALF gave ICT the third and fifth highest WDS, respectively.

Conclusions & Recommendations

Stakeholders validated the list of selected competencies by providing very high and high importance ratings for 21 of the 23 competencies. Only farmers rated two competencies, General Knowledge of Extension ($M = 3.93$) and Crop Husbandry ($M = 3.63$), as intermediate in importance (mean ratings < 4.0). During subsequent focus group discussions, farmers provided explanations of their lower importance ratings for these two competencies. In the case of General Knowledge of Extension, they assumed this would be sufficiently addressed in the MATI curriculum. In the case of Crop Husbandry, they assumed their indigenous know-how, gleaned from years of experience, was more important than knowledge provided by extension staff (Msuya, Mattee, Rodriguez, Mapundo, & Nyamba, 2017b).

Farmers, Employers, and MALF training staff rated the ability of graduates lower than the graduates rated themselves. This reconfirms the limitations of relying on self-assessment and the importance of bringing external stakeholders into the assessment process. MALF training administrators rated graduate abilities the lowest on all but six competencies. Conversations at follow-up stakeholder meetings confirmed these findings, with both farmers and employers indicating their dissatisfaction with the performance of FEWs (Msuya et al., 2017b).

Stakeholders indicated the priority competencies requiring curriculum enhancement to improve the training of MATI graduates: Value Chains, Business Skills, Climate Change, Fisheries, and Land Resource Management. These were the five highest rated training needs as reflected by WDS. All stakeholder groups except graduates identified Value Chains and Business skills as high priority areas for training. These corresponding skill gaps are important given current agricultural development policy priorities in Tanzania that emphasize the need to transition smallholder farmers from subsistence to commercial farming by facilitating their participation in producer-to-market value chains (Tanzania Daily News, 2017; World Bank, 2007b). Smallholders often lack the

necessary management skills to participate in a rapidly changing, market oriented agricultural economy; it is important for extension providers to acquire these skills through their training to effectively convey them (Swanson, 2007). That graduates did not rate these skills as priorities underlines the need for curriculum revisions to enhance the training of these competencies at MATI Ilonga. Additionally, extension providers across sub-Saharan Africa need to acquire non-technical agricultural skills, be able to conduct market assessments, and provide farm management training to address future business and marketing needs of employers and agribusiness (World Bank, 2007b).

MALF considered the agroecology competencies of Climate Change and Environmental Conservation as priorities for training strengthening. MALF and employers gave Climate Change their second and third highest WDS, respectively; MALF and graduates gave Environmental Conservation their third and fifth highest WDS, respectively. This reflects the emphasis being placed on these areas by the Government of Tanzania and its concern that climate change will increase the frequency of drought leading to the increased vulnerability of smallholder farmers who remain dependent largely on rainfed agriculture (Government of Tanzania, 2016).

Two other competency areas in need of curricular revision, each having divergent stakeholder group ratings, were Information Communication Technology (ICT) and Food Processing and Storage skills. Graduates and MALF gave ICT the third and fourth highest WDS respectively. These two stakeholder groups recognized the rapidly growing importance of ICT for communicating production and marketing information to farmers. Without additional training, FEWs will likely fall further behind in their

capacity to provide new information efficiently.

Similarly, employers and farmers gave Food Processing and Storage skills their fourth highest WDS. Employers recognize the value addition potential of food processing, while farmers acknowledge the important contribution of enhanced post-harvest storage to food security. The discrepancy in stakeholder ratings of FEWs' skill needs clearly demonstrates the importance of maintaining curriculum relevant and reflecting changing stakeholder priorities in FEWs' training. It is incumbent upon the training and curriculum development entities, in the case of Tanzania this falls to the MATIs, MALF, and NACTE, to ensure that these priorities are incorporated into the existing curriculum.

The assessment of MATI Ilonga's curricula was followed by two stakeholder consultations. The first was a stakeholder workshop to review the findings from the assessment; the second was held with MALF staff and other stakeholders to discuss recommendations derived from the study and the way forward. This pilot project systematically engaged stakeholders in the evaluation of MATI programs. Policy makers who attended the consultative workshop to validate the study expressed support for engaging stakeholders in the review of MATI curriculum (Msuya et al., 2017b). Workshop attendees articulated their concerns directly to government ministries stating support for the competencies rated highly by farmers to be given priority in the curriculum revision process. Stakeholders appreciated the opportunity to be involved in further refinement of the curriculum and it is recommended that they be engaged in future program evaluations and related program adaptations. Our approach to curricular review through the engagement of various

stakeholder groups at several points within the process can serve as a model for other extension training entities wishing to update FEWs' training.

Through their engagement in this process, policy makers recognized the need for the curriculum review, acknowledging the value of employing a competency-based approach using WDS which provided reliable and relevant results (Msuya et al., 2017b). Since this study focused on one MATI, we recommend using the approach and scaling the study to other MATIs in the national system to validate findings and allow for broader-based, future revisions and recommendations to be made.

Using WDS to determine training needs from varying stakeholders allows interested parties to see the difference between their assessment of perceived importance and ability. Over time, changes in priorities, government policies, and stakeholder needs can create discrepancies in the capacity for FEWs to meet and address those needs. This is not unique to Tanzania; curricula should reflect what stakeholders believe to be important and their perceptions of FEWs' ability to meet those needs. This will allow programming and curricular review to better train and prepare future FEWs, ultimately improving their ability to serve the pressing needs of stakeholders facing issues of food security, global climate change, and fluctuating markets.

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