SECTION A:	QUALIFICATION DETAILS					

QUALIFICATION DEVELOPER (S)	Botswana University of Agriculture and Natural Resources (BUAN)

TITLE	Bachelor of Science in Agricultural Mechanization	NCQF LEVEL	7

FIELD	Agriculture and Nature Conservation	SUB-FIELD	Agricultural Mechanization	CREDIT VALUE	512

New Qualification	✔	Review of Existing Qualification	

SUB-FRAMEWORK	General Education		TVET		Higher Education	✔

QUALIFICATION TYPE	Certificate	I	II	III	IV	V	Diploma	Bachelor	✔
	Bachelor Honours		Post Graduate Certificate			Post Graduate Diploma			
	Masters				Doctorate/ PhD				

RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE:

Several studies by the Ministry of Agriculture (MoA) have reported that only 25% of MoA staff are trained professionals. The remaining 75% have limited training in agriculture. Thus, there is a need to develop educational qualifications that can bridge the knowledge deficiency. National Development Plans 8 and 9 have also identified the lack of qualified personnel as one of the bottlenecks to implementation of agricultural policies and development projects. On the other hand, the Government of Botswana has implemented various projects, policies and programmes aimed at improving arable and pastoral farming, in order for the country to achieve food security. These initiatives include various irrigation horticulture schemes, National Master Plan for Arable Agriculture and Dairy Development (NAMPAADD), National Policy on Agricultural Development, 2006, the Integrated Support Programme for Arable Agricultural Development (ISPAAD) and Agricultural Service Support Project (ASSP). There is therefore a skills gap to implement these MoA programmes.

The BSc Agricultural Mechanization qualification will produce scientific officers who will provide technical and managerial services and hence, assist in agricultural mechanization policy formulation. These scientific officers shall positively contribute to the (NAMPAADD) since it advocates for mechanization of agricultural production operations in order to improve agricultural productivity. The National Development Plan 9 (NDP9) also emphasizes in this area in response to the human resource needs of agriculture and its allied fields.

There are other associated career opportunities which exist for these BSc Agricultural Mechanization graduates in the agricultural production sector and related agribusiness organizations. These include food and feed processing organizations and farms. Banks and financial institutions can also employ graduates as agricultural project managers and mentors. Machinery manufacturers and dealers can employ graduates as sales or service representatives. Land improvement consultants or contractors can employ graduates for planning, design and installation of irrigation and drainage systems as well as land management structures. After gaining work experience, the graduates of this qualifications can apply for membership of Botswana Institute of Engineers or any other international professional bodies.

Results of needs assessment surveys from as far back as 2004 through questionnaires sent to government, non-governmental, private institutions and companies involved in agricultural engineering related professions have shown that skills are needed in the agricultural mechanization sector. The following organizations and government departments responded to the survey: Jim's Farm Supplies, Mechanized Farming, Department of Prisons and Rehabilitation, Department of Agricultural Research, Department of Crop Production & Forestry, NAMPAADD, Botswana Agricultural Union, Rural Industries Innovation Centre and Botswana Development Corporation.

The Human Resource Development Council, HRDC Agriculture Sector Human Resource Development Plan (2015) provides information on the manpower requirements in the agricultural sector. Related to Agricultural Mechanization The skills in Table 1, which are related to Agricultural Mechanization, were identified as in high demand.

Table 1: Skills in high demand

Skill	Indicative numbers per year
Irrigation specialists (hydrologist)	50
Agricultural Engineers	20
Soil conservationists	20
Irrigation specialist	60

Source: HRDC, 2015.

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PURPOSE:

The country needs graduates who can provide adequate guidance on issues that include appropriate irrigation technologies; selection, operation and maintenance of agricultural equipment and machinery; as well as implementation of environmentally sustainable production systems. Sustainable agricultural production should be complimented by appropriate design and construction of farm structures, use of renewable energy, and information technologies for appropriate decision-making. This qualification will produce graduates who will be able to;

a) Demonstrate understanding of scientific knowledge to advance agricultural production through mechanization
b) Provide technical expertise and support in matters relating to machinery acquisition, operation and maintenance
c) Demonstrate understanding of project planning and design to influence policy.
d) Demonstrate advanced use of ICT skills in the implementation of government policies related to agricultural mechanization and environment protection.
e) Initiate and manage agribusiness profitably
f) Demonstrate understanding of the importance of agriculture in the national economy

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirements:

- Certificate IV (NCQF level 4) or equivalent, with credits in Mathematics, Physics and Chemistry.

- Candidates who do not meet the above minimum requirements will be considered for entry through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT).

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SECTION B	QUALIFICATION SPECIFICATION

GRADUATE PROFILE (LEARNING OUTCOMES)	ASSESSMENT CRITERIA
At the end of the qualification, the graduates will: 1.0 Demonstrate understanding of scientific knowledge to advance agricultural production, and post-production activities through appropriate mechanization management strategies;	1.1 Explain mathematical / biometry / numerical engineering concepts to different stakeholders 1.2 Explain physics related engineering concepts to different stakeholders 1.3 Explain chemistry related engineering concepts to different stakeholders 1.4 Explain biological systems and bio-diversity concepts to different stakeholders 1.5 Explain machinery operations engineering concepts to different stakeholders 1.6 Explain controlled environments (soil mechanics and foundations, farm structures, heating, ventilation, air conditioning) engineering concepts to different stakeholders 1.7 Explain farm power energy (renewable, electrical, tractor and fluid) engineering concepts to different stakeholders. 1.8 Apply scientific and engineering concepts to formulate solutions *1.9* Promote new advancements in agricultural mechanization and engineering through appropriate research. *1.10* Produce field attachment reports that demonstrate a broad perspective and understanding of agricultural sector importance
2.0 Provide technical expertise and support in matters relating to machinery acquisition, installation operation and maintenance	2.1 Explain agricultural mechanization resources management processes. 2.2 Provide expertise to stakeholders on machinery acquisition 2.3 Provide expertise on machinery instrumentation, testing, evaluations, management, operations and maintenance) to stakeholders.

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	2.4 Provide guidance on mechanization systems installations.
3.0 Demonstrate understanding of mechanization systems planning, design, management processes for environmentally sustainable production systems and to influence policy formulation.	3.1 Explain the planning pathways of Agricultural mechanization projects. 3.2 Design agricultural mechanization systems 3.3 Produce agricultural mechanization project designs, layouts, and monitoring and evaluation plans. 3.4 Produce project management reports which demonstrate environmental sustainability. 3.5 Make subject matter presentations to stakeholders 3.6 Incorporate Global Positioning System, GPS and Environmental Impact Assessment, EIA technology in mechanization systems design for nature conservation and promotion of sustainable agriculture production.
4.0 Demonstrate advanced use of ICT skills in the implementation of government policies related to agricultural mechanization and environment protection;	4.1 Use modelling techniques for logical quantitative decision-making scenario analysis. 4.2 Use spreadsheet ICT skills in the development of mechanization systems. 4.3 Apply engineering computing software for decision making and project management.
5.0 Demonstrate entrepreneurship skills that can foster employment creation	5.1 Explain agricultural economics concepts to stakeholders for profitable business ventures. 5.2 Produce fundable agricultural project proposals 5.3 Initiate profitable agricultural enterprises 5.4 Produce project management reports which demonstrate profitable agricultural enterprises. 5.5 Monitor and evaluate agricultural enterprises

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SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	*TITLE*	*Credits Per Relevant NCQF Level*			*Total (Per Subject/ Course/ Module/ Units)*
		Level [5]	*Level [6]*	*Level [7]*	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	Computing and Information skills fundamentals	16			16
	Mathematics	24			24
	Physics	24			24
	Biometry		*16*		16
	Communication and academic literacy skills		*16*		16
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Biology of Cells		*12*		12
	General and Inorganic Chemistry		*12*		12
	Physical and Organic Chemistry		*12*		12
	Soil mechanics and foundations		*12*		12
	Agricultural Economics		*8*		8
	Farm workshop practice		*8*		8
	Computer applications in engineering			*8*	8
	Biodiversity			*12*	12

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	Measurement techniques in agro-biological sciences			*12*	12
	Farm implement technology		*12*		12
	Farm structures			*12*	12
	Problem-solving with spreadsheet			*8*	8
	Field Practical Training (farm)			*12*	12
	Tractor power			*12*	12
	Renewable energy			*12*	12
	Electrical power			*12*	12
	Environmental impact assessment			*12*	12
	Soil tillage and traction			*12*	12
	Heating, ventilating, and air conditioning			*12*	12
	Farm business management			*8*	8
	Fluid mechanics			*12*	12
	Field Practical Training (office)			*12*	12
	Research Project Proposal			*8*	8
	Agricultural machinery testing and evaluation			*12*	12
	Current Issues in Agricultural engineering			*4*	4
	Project appraisal and evaluation			*8*	8

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	Research Project Implementation			*8*	8
	Agricultural mechanization management			*12*	12
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	Principles of crop production / Introduction to animal science	*12*			12
	Statics / Engineering design	*12*			12
	Land surveying and evaluation / Land drainage	*12*			12
	Handling and storage of agricultural produce / Crop harvesting technology			*12*	12
	Agricultural processing / Fluid power			*12*	12
	Introduction to remote sensing / Geographical information systems			*12*	12
	Choose any 4 of the following			*12*	12
	Irrigation Water Supply and Conveyance			*12*	12
	Ground Water Hydrology			*12*	12
	Soil and Water Conservation			*12*	12
	Design of Irrigation Systems			*12*	12
	Irrigation and Water Quality			*12*	12
	Land Drainage			*12*	12
	Hydrology and Climatology			*12*	12

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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	*Credit Value*
5	*64*
6	*144*
7	*304*
TOTAL CREDITS	

Rules of Combination:

(Please Indicate combinations for the different constituent components of the qualification)

NCQF LEVEL 7	CREDIT VALUE 512
Fundamental	96 Credits
Core	296 credits
Elective	120 credits
TOTAL CREDITS	512 Credits

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ASSESSMENT ARRANGEMENTS

Formative assessment

Learners will be subjected to the formative or continuous assessment that will contribute 50% towards the final grade.

Summative assessment

Learners will be required to undergo a written final examination which constitutes the remaining 50% of the overall mark.

MODERATION ARRANGEMENTS

There will be internal and external moderation carried out by qualified professionals registered and accredited by BQA as Assessors and Moderators.

RECOGNITION OF PRIOR LEARNING

There will be provision of Recognition of Prior Learning (RPL) for award of the qualification using Institutional RPL Policy in line with the National RPL Policy.

CREDIT ACCUMULATION AND TRANSFER

There will be provision for Credit Accumulation and Transfer (CAT) for award of the qualification using Institutional CAT Policy in line with the National RPL Policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Once registered for this qualification, learners can progress as follows:
  a) Horizontal Progression
  (i) Bachelor of Science in Soil and Water Conservation Engineering Level 7
  (ii) Bachelor of Science in Food Science and Technology Level 7
  (iii) Bachelor of Science in Agriculture and any other related field at Level 7

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b) Vertical Progression
(i) Agricultural Mechanization at level 8
(ii) Renewable Energy at level 8
(iii) Agricultural Processing and other related fields at Level 8

c) Diagonal progression
(i) Master of Business Administration at Level 8
(ii) Master of Risk Management at Level 8
(iii) Master of Project Management at Level 8.

d) EMPLOYMENT PATHWAYS

(i) Mechanization officers
(ii) Milling and Feed Processing Engineers
(iii) Farm Managers
(iv) Agricultural Mechanization Consultant
(v) Self Employment (managing own farm)

QUALIFICATION AWARD AND CERTIFICATION

The learner will be awarded the qualification **Bachelor of Science in Agricultural Mechanization** upon successful completion of a minimum of 520 credits.

The learner will be issued with a certificate upon successful completion of the **Bachelor of Science in Agricultural Mechanization**

REGIONAL AND INTERNATIONAL COMPARABILITY

This qualification compares well with the Bachelor of Science in Agricultural Engineering offered at Sokoine University of Agriculture (Tanzania) and University of Kentucky (USA) of similar length of 8 semesters and offering both core and elective modules. It also compares well with the Bachelor of Science Agriculture and Bio-Systems Engineering qualification offered by the University of Eswatini also with 8 semesters and core modules. Table below shows the qualifications compared with this qualification.

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Table showing qualifications compared with

University	Title	Duration	Structure
Sokoine University of Agriculture (Tanzania)	BSc Agric Engineering	8 semesters	Core and Electives
University of Eswatini	BSc Agriculture & Biosystems Engineering	8 semesters	Core
University of Kentucky (USA)	Bio-system and Agricultural Engineering	8 semesters	Core and Electives

REVIEW PERIOD

The qualification shall be reviewed every 5 years

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