SECTION A:	***QUALIFICATION DETAILS***																	
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology																	
TITLE	Bachelor of Science (Data Science)														***NCQF LEVEL***	*7*		
FIELD	Information and Communication Technology		***SUB-FIELD***	Computer Science											***CREDIT VALUE***	*495*		
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:

In our every day to day lives we are involved in actives that generates vast amount data, e.g., social media, shopping, finance, and biological process. Data Science is concerned with extracting intelligence from data. This done by applying cutting edge techniques from Statistics, Mathematics and Computer Science. The amount of data involved normally ranges from small, medium, and big scales and of different formats. The techniques used to understand the modern abundance of data are at the intersection of computing and mathematics, including statistics and machine learning, and there is a high demand in industry.

Botswana VISION 2036 recognises education and skills development as the foundation of development of knowledge-based economy. In line with Pillars 1 and 2, tertiary education providers are mandated to provide quality training opportunities. A qualification in bachelor's in Data Science is thus in line with mandate. Furthermore, the qualification will aid in making data-driven decision in a the bid to attain Sustainable Environment and

Sustainable Economic Development.

The qualification is also in line with the goals stated in the National Information and Communications Technology (ICT) Policy (Maitlamo), NDP 11 and ETSSP. The need for a degree in Data Science is also supported by Human Resource Development Council (HRDC) of Botswana, PRIORITY SKILLS AND PROSPECTS report of 2019. In the report Data Science is the basis of at least 4 future jobs listed on page 1 of. There is also a demand from employers in Botswana for Data Science graduates who can extract information and insight from current and past data – the statement supported by the documented discussions with the members of the Departmental Stakeholder Advisory Committee held on October 13, 2016, March 3, 2017, and July 5, 2019 (final approval of qualifications). The minutes of the said meetings are attached to the submission.

PURPOSE:

The purpose of this qualification is to produce graduates who have specialised knowledge, skills, and competencies to:

- Apply data driven model in various fields like finance, biology, health, education, agriculture and another field.
- Communicate in technical and non-technical terms concepts of Data Science in different sectors of the economy.
- Develop new data processing models.
- Apply developed models to various problems.
- Develop multiple programming languages used for expressing solution.
- Safeguard the ethical use of data in all aspect of their profession.
- Work effectively in a team.
- Communicate effectively.
- Develop research skills.
- Develop entrepreneurial skills.

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirement:

- Certificate IV, NCQF level 4 (General Education or TVET) or equivalent.
- Access through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) will be provided through ETP policies in line with National RPL and CAT Policies

SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
LO 1. Pre-process data using specialized data mining techniques in a small to medium organisation.	1.1. Maintain data storage facilities. 1.2. Integrate data from a variety of source for storage and analysis. 1.3. Implement measures to secure data and its integrity.
LO 2. Apply a range of specialised technical data processing models to get insight to enhance organizational performance through effective use of data.	2.1. Develop a variety of models to analyse data to get insight for organisational needs. 2.2. Assess performance in line with the organisational needs. 2.3. Advise how organisational needs can be met, improved based on insight from data. 2.4. Improve already existing data models and solutions.
LO3. Enhance organizational performance through effective use of data.	3.1. Develop organisational process to archive digital transformation. 3.2. Solve organisation problems using advanced data modelling techniques. 3.3. Set up data framework for the organisation to follow. 3.4. Work in a team to improve organisation process in the use of Data. 3.5. Document all the process for future use of Data Mining.
LO 4. Adopt high standards of ethical use of data.	4.1. Recommend on social, legal, and ethical data standards by the organisation and individuals within the organisation. 4.2. Implement social, legal, and ethical data standards within an organisation.
LO 5. Demonstrate specialised communication and organizational skills.	5.1. Work in a team to solve organisational challenges. 5.2. Prepare reports and document to present to both internal and external stakeholders.

	5.3. Plan and execute given tasks in a timely manner within an organisation. 5.4. Utilize time management skills and tools to deliver solutions in a timely manner.
LO 6. Demonstrate specialised business entrepreneurship skills	6.1. Develop innovative solutions to help advance a business on Data Mining. 6.2. Show new solutions and take them to market. 6.3. Manage business processes.

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*	Pre-Calculus	24			24
	Physics	12			12
	Writing and Communication	12			12
	Programming skill	6			6
	Business and Entrepreneurship	30			30
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Computer Architecture		12		12
	Programming skill		12	***12***	24
	Computer Networks		12		12
	Data Structures and Algorithms		12		12
	Operating Systems		12		12
	Discrete Mathematics for Computer Science		12		12
	Calculus		12		12

	Professional Issues and Ethics			12	12
	Project Management			12	12
	Databases			12	12
	Linear Algebra			12	12
	Probability and Statistics			12	12
	Research Methodology			12	12
	Machine Learning			24	24
	Data Visualisation			12	12
	Multivariate Statistics			12	12
	Individual Project in Data Science			24	24
	Data Analytics			12	12
	Data Mining			12	12
	Industrial Attachment			60	60
	Artificial Intelligence			12	12
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	Biology I	***12***			12
	Chemistry I	***12***			12
	Mobile Operating Systems		9		9
	Optimization		9		9
	Cloud Computing		9		9

	Cryptography		9		9
	Emerging Technologies		9		9
	Advanced Computer Networks		9		9
	Computational Biology			9	9
	Computational Finance			9	9
	Emerging Technologies			9	9
	Natural Language Engineering			9	9
	Algorithms Analysis			9	9
	Computational Statistics			9	9
	Big Data Databases			9	9
	Big Data Technologies			9	9
	Advanced Artificial Intelligence			9	9

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
Level 5	96(12 taken from electives)
Level 6	102 (18 taken form electives)
Level 7	297 (45 taken from electives)
TOTAL CREDITS	**495 (75 from taken elective)**

Rules of Combination:

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

The qualification consists of a total of **495 credits** with **84 credits** Fundamental Components **336 credits** Core Components and **75 credits** made from choosing several Elective Components.

Rule

Students will be awarded the qualification after completing and attaining the minimum 495 credits.

Electives

Candidates are required to select a minimum of 75 credits of electives. A minimum of 9 credits from level 5 (One must take either Biology I or Chemistry I), 18 credits from level 6, 45 credits from level 7.

ASSESSMENT ARRANGEMENTS
Formative and summative assessments will be used. Formative assessment (Weighs more than Summative Assessment) Will include continuous assignments that will collectively contribute to the final grade. Integrated assessment procedures to ensure that the purpose of the qualification is achieved. Summative assessment (weighs less than Formative Assessment) There shall be examinations that shall contribute to the final grade. Assessment will be in accordance with respective ETP's regulations and procedures.
MODERATION ARRANGEMENTS
Internal Moderation: Pre-moderation is done by relevant internal structures. Quality assurance of the assessment instruments is conducted prior to administration. **External Moderation:** There will also be external moderation. Moderators must be BQA registered and accredited.
RECOGNITION OF PRIOR LEARNING
There shall be an award of the qualification using Institutional RPL Policy in line with the National RPL Policy.
CREDIT ACCUMULATION AND TRANSFER
There shall be access and award of credits of the qualification using Institutional Credit Accumulation and Transfer (CAT) Policy in line with the National CAT Policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Learning Pathways

Horizontal Articulation:

- Bachelor of Science (Statistics)
- Bachelor of Science (Applied Mathematics)
- Bachelor of Science (Computer Science)

Vertical Articulation:

- Bachelor of Science Honours (Data Science)
- Bachelor of Science Honours (Software Engineering)
- Bachelor of Science Honours (Applied Mathematics)

Employment Pathways

There is strong market demand for data scientists from all sought of sectors including:

- Finance, Banking,
- Accounting industries,
- Biology, Physics,
- Astronomy,
- Health services and retail services.

The Qualification also equips learners with entrepreneurship skills; hence they can always do data science start-up companies.

QUALIFICATION AWARD AND CERTIFICATION

Award of the Qualification:

To be awarded a Bachelor of Science (Data Science) qualification a candidate is required to achieve a minimum of **495** credits inclusive of **348** credits for Core courses, **63** credits for Optional/ Elective Courses.

Certification:

Candidates meeting prescribed requirements will be awarded the qualification; **Bachelor of Science Data Science** in accordance with standards prescribed for the award of the qualification and applicable policies.

REGIONAL AND INTERNATIONAL COMPARABILITY

In summary the following international universities we used for benching marking:

1. The IT University of Copenhagen (Denmark): BSc in Data Science
2. Warwick University (the UK): BSc in Data Science
4. The University of San Francisco (the US): BSc in Data Science

The IT University of Copenhagen in Denmark offers a BSc degree in Data Science. On their website, a Data Scientist is defined as someone with comprehensive analytical and technical skills covering all aspects of handling and analysing data. The learner gains skills to be able to work in interdisciplinary teams and use their organisational knowledge and market understanding to make a difference. Businesses and other organisations accumulate enormous quantities of data for software market research, disaster prediction, investment analysis, policy development, artificial intelligence and more. The graduate of the Data Science program possesses enough skillsets to undertake any role in the described areas. During the programme, the Learner receives extensive teaching in the technical subjects of Mathematics and Statistics for Data Sciences, data visualisation, Programming, Machine Learning, Algorithms Development and Data Management. A graduate of the degree programme has direct access to MSc in Computer Science as well as MSc in Digital Innovation and Management.

Warwick University in the UK offers a BSc Programme in Data Science. The entry requirements to this programme are based mostly in the A Level Mathematics. The University has made the curriculum as flexible as possible as the learner progresses through the degree. There is enough room to select some electives from different departments. At the second year, the learner has access to 15% of optional modules and at the third year the learner has 60% of optional modules. The programme is designed to have contact time of 15 hours per week and the class sizes are capped at 180 students. The assessment of the programme is such that the first-year counts for 10% of the degree, the second year contributes 30% while the third and final year contributes 60% of the final BSc degree. As proposed by the Data Science qualification, the curriculum from Warwick University allows students to take a year off from the programme and study abroad from different partner universities. Students can also pause the programme midway and undertake some paid work and return to the programme later. The Core modules of the programme are Programming for Computer Scientists, Mathematical Programming, Mathematical Analysis, Statistical Laboratory, Introduction to Probability, Algorithms, Software Engineering, Mathematical Statistics and Data Science Project. The University offers a pool of optional modules that students can choose from. Some modules in the pool include among other Decisions and Behaviour, Machine Learning, Statistical Genetics, Mathematics for Random events etc. Major difference is the entrepreneurial skills added in this proposed qualification.

The University of San Francisco (the US) also offers an undergraduate degree in Data Science. The graduate of Data Science from the University of San Francisco is ready made to acquire, manage, and explore the data. This includes predicting consumer behaviour, extracting information from medical images, uncovering hidden stock market indicators, studying human genetic structures, etc. Students are expected to have covered areas of Mathematics, Computer Science, Economics, Data Driven Visualisation, Software Development, research projects and more. Like before the major difference is the entrepreneurial skills added in this document and credit breakdown.

In terms of regional benchmark, there is no regional university offering the programme at this level. Only at Wits University which something similar is offered at NQCF Level 8.

REVIEW PERIOD

Every five (5) years.