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REPUBLIC OF RWANDA

Kigali, 22/06/2018

N°1267/12.00/2018

22/6/2018

MINISTRY OF EDUCATION
P.O. BOX 622, Kigali – RWANDA

ORIGINAL

The Vice - Chancellor,
University of Rwanda
Kicukiro District, Kigali City

Dear Vice - Chancellor,

Re: University of Rwanda's applications for accreditation of new MSc Degree programs

Reference is made to University of Rrwanda's submission to the Higher Education Council (HEC) applications for Accreditation of Four (4) New Master's Degree programs under the African Centre of Excellence for Data Science (ACEDS) and the African Centre of Excellence in Energy for Sustainable Development (ACEESD).

The assessment of UR's preparedness to host the new academic programmes involved discussions between HEC's review team and UR officials; and inspection visit to UR's campuses to assess the physical infrastructure and facilities. The guiding documents comprised, among others, UR's application, proposed academic programs narratives and expert review reports for each of the proposed programs.

The assessment indicated UR's readiness to effectively offer the new proposed academic programs including: the collaborating partners; the collaborative nature of the proposed academic programs with already identified sponsors and financing modality; the uniqueness of the proposed programmes, their relevance to the labour market; and the fact that, the proposed programs went through UR's internal verification and approval process. Generally, the rationale, objectives, structure, modules descriptions, and funding modalities for the proposed programs are in compliance with the established Higher Education norms and standards.

Based on the above assessment and renew, I am pleased to inform you that the four (4) New Master's Degree programmes have been accredited.

Sincerely,

Dr. Eugene MUTIMURA
Minister of Education

25.6.18

Cc:

- Minister of State in Charge of TVET
- Minister of State in Charge of Primary and Secondary Education
- Permanent Secretary, MINEDUC
- Chairperson Board of Directors, HEC (TBN)
- Executive Director, HEC

→ DVC AAR
Dr Celestin

REPUBLIC OF RWANDA

HIGHER EDUCATION COUNCIL
P.O. BOX 6311
KIGALI - RWANDA

REPORT ON THE ASSESSMENT OF UNIVERSITY OF RWANDA APPLICATIONS FOR ACCREDITATION OF NEW MASTERS ACADEMIC PROGRAMMES UNDER THE AFRICAN CENTER OF EXCELLENCE IN ENERGY FOR SUSTAINABLE DEVELOPMENT (ACEESD) AND THE AFRICAN CENTER OF EXCELLENCE IN DATA SCIENCE (ACE-DS)

BY

HEC ASSESSMENT TEAM

June, 2018

EXECUTIVE SUMMARY

1. On 26th May 2016, the World Bank Board approved the award of 24, competitively-selected, African Centers of Excellence (ACEs) for 8 countries in Eastern and Southern Africa. Four (4) of these Centers are based at the University of Rwanda namely: African Centre of Excellence for Data Science (ACEDS), based in College of Business and Economics; African Centre of Excellence in Internet of Things (ACEIoT) based at the College of Science and Technology[1];African Centre of Excellence in Energy for Sustainable Development (ACEESD), also based in the College of Science and Technology; African Centre of Excellence in Innovative Teaching and Learning Mathematics and Science (ACEITLMS)[2], based in College of Education.

2. The University of Rwanda designed the following four (4) new academic programmes and submitted them on separate dates, on 12/02/2018, 22/02/2018 and 16/03/2015 to the Higher Education Council (HEC) for accreditation:

i. MSc in Electrical Power Systems

ii. MSc in Energy Economics

iii. MSc in Renewable Energy

iv. MSc in Data Science with the following specializations :

a) Data Science in Data mining

b) Data Science in Econometrics

c) Data Science in Biostatistics

d) Data Science in Demography

e) Data Science in Actuarial Science

3. On 17/05/2018 HEC conducted a preview of the programmes and provided feedback to UR. Following UR's resubmission of revised academic Programmes on 14/06/2018, on 16 and 17/05/2018, HEC conducted an in-depth review of the Programmes as well physical assessment of the readiness to implement the new Programmes. The HEC Assessment Team used an assessment approach, applying both quantitative and qualitative methods, and assessing the available evidence related to the four (4) proposed new academic Programmes. The UR and Programmes' compliance was assessed against the established Higher Education norms and standards. The guiding documents comprised, among others, the UR application documents for the proposed academic Programmes, including Programme specification and module description forms) and evidence of available resources from UR and background documents to the African Centers of Excellences (ACEESD and ACE-DS).

4. The three (3) proposed Masters programmes under the African Center of Excellence in Energy for Sustainable Development (ACEESD) and one (1) under the African Center of Excellence in Data Science (ACEDS) are aimed at building a critical mass of African experts in the Energy for Sustainable Development and Data Science. They were developed and validated through the University of Rwanda's procedures for internal programme validation and approval processes (departmental, School, College and

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[1]*The academic Programme under the African Center of Excellence in Internet of Things (ACEIoT) have been accredited.*

[2]*The academic programme under the African Centre of Excellence in Innovative Teaching and Learning Mathematics and Science (ACEITLMS)has been pre-reviewed and feedback submitted to UR to resubmit for HEC to undertake a physical assessment.*

University level, before being approved by the University Senate). They were also externally reviewed by the University of Rwanda's external reviewers.

5. Conclusion

Based on the relevance at the national, regional and continental level of the proposed programmes to train experts in Energy for Sustainable Development and Data Science, evidence of available funding under the World Bank African Centers of Excellence Project II, availability of existing and quality of resources, facilities, including relevant laboratories, equipment and textbooks, advanced phases of ongoing procurement process of additional resources and facilities, existing academic staff at the University of Rwanda and the arrangements to access and share academic staff under the Centers of Excellence Project, including the sustainability plans for capacity building of academic staff upon completion of the African Center of Excellence project, the HEC Assessment Team is satisfied that UR can effectively implement four (4) new academic programmes namely: (i) MSc in Electrical Power Systems, (ii) MSc in Energy Economics, (iii) MSc in Renewable Energy, (iv) MSc in Data Science with specializations in Data mining, Econometrics, Biostatistics, Demography, Actuarial Science and Econometrics

6. Recommendations

a) The four (4) new proposed academic programmes **<u>are accredited</u>**, namely:

i. MSc in Electrical Power Systems

ii. MSc in Energy Economics

iii. MSc in Renewable Energy

iv. MSc in Data Science with the following specializations

1) Data Science in Data mining
2) Data Science in Econometrics
3) Data Science in Biostatistics
4) Data Science in Demography
5) Data Science in Actuarial Science

b) Before starting to teach the above new proposed programmes, the University of Rwanda should implement the following recommandations for three (3) programmes under the African Center of Excellence in Energy for Sustainable Development (ACEESD) and the one (1) programme under the African Center of Excellence in Data Science (ACEDS) and submit an implementation report to HEC for verification and approval:

I. MSc in Electrical Power Systems

- To incorporate the power system dynamics module in the programme
- To make seminars/workshops mandatory and credit bearing to ensure discussion of state of the art and emerging technologies in the power industry.

- To equip the electrical power system laboratory to ensure delivery of hands on skills.
- To reallocate workload to academic staff to avoid overloading some of the academic staff
- To have in place a mini physical library with relevant reference resources (books/journals, etc.) and enhance internet connectivity for accessing digital resources.
- To ensure accessibility of the infrastructure by people with disabilities

II. MSc in Energy Economics

- To incorporate Electric Power Market Analytics (regulation, tariff modelling, power purchase agreements, energy law) and consider additional modules such as Energy Policy, and Energy & Environment.
- To make seminars/workshops mandatory and credit bearing for discussing the latest trends in the power industry.
- To adjust accordingly the time allocated to the Dissertation, in view of the above recommended modules.
- To have in place a mini library with few books/journals and enhance internet connectivity for accessing digital resources.
- To ensure accessibility of the infrastructure by people with disabilities

III. MSc in Renewable Energy

- To allocate contact hours and credits seminars and workshops
- To redistribute the content of Hydropower in the modules of the programme as indicated in the report to prepare students for the Renewable Energy technology engagement in the market.
- To include Project Finance in Corporate Finance to equip students with different financing approaches/tools on financing instruments that are available in the market.
- To avail relevant hydropower/hydrology computer software
- To have in place a mini physical library with relevant reference resources (books/journals, etc.)
- To confirm availability of the academic, including the additional ones recommended in this report
- To provide evidence of availability of the facilities that are reported to be under procurement.

IV. MSc in Data Science with the following specializations:

1) Data Science in Data mining
2) Data Science in Econometrics
3) Data Science in Biostatistics
4) Data Science in Demography
5) Data Science in Actuarial Science

- To have in place the required computer laboratories well-equipped
- To avail the required facilities in the classrooms, including Smart Boards (direct link to e-resources).
- To implement the recommendations related to the content of the proposed programme and related specializations indicated in the report

c) Provide evidence that the implementation of the accredited programs will have a practical training component in partnership with relevant industries and Private Sector.

REPORT ON THE ASSESSMENT OF UNIVERSITY OF RWANDA APPLICATIONS FOR ACCREDITATION OF NEW MASTERS PROGRAMMES UNDER THE AFRICAN CENTER OF EXCELLENCE IN ENERGY FOR SUSTAINABLE DEVELOPMENT (ACEESD) AND THE AFRICAN CENTER OF EXCELLENCE IN DATA SCIENCE (ACE-DS)

1.0 Introduction

The Higher Education Council (HEC) received on separate dates, on 12/02/2018, 22/02/2018 and 16/03/2015, applications from the University of Rwanda (UR) for accreditation of new academic Programmes under the African Center of Excellence in Energy for sustainable development (ACEESD) at the College of Science and Technology (CST) and the African Center of Excellence in Data Science (ACE-DS) at the College of Business and Economics (CBE), namely:

Academic Programmes Under ACEESD :

i. MSc in Electrical Power Systems
ii. MSc in Energy Economics
iii. MSc in Renewable Energy

Academic Programmes under ACE-DS:

iv. MSc in Data Science with the following specializations
   1) Data Science in Data mining
   2) Data Science in Econometrics
   3) Data Science in Biostatistics
   4) Data Science in Demography
   5) Data Science in Actuarial Science

African Centres of Excellence (ACE) at the University of Rwanda

On 26th May 2016, the World Bank Board approved the award of 24, competitively-selected, African Centres of Excellence (ACEs) for 8 countries in Eastern and Southern Africa. Four (4) of these Centres are based at the University of Rwanda namely:

- African Centre of Excellence for Data Science (ACEDS), based in College of Business and Economics;
- African Centre of Excellence in Internet of Things (ACEIoT) based at the College of Science and Technology[3];
- African Centre of Excellence in Energy for Sustainable Development (ACEESD), also based in the College of Science and Technology;
- African Centre of Excellence in Innovative Teaching and Learning Mathematics and Science (ACEITLMS), based in College of Education[4].

[3] *The academic Programme under the African Center of Excellence in Internet of Things (ACEIoT) have been accredited*

In order to progress with the review of the applications, the Higher Education Council analyzed the applications to determine whether they were suitable for review and approval. On 17/05/2018, a pre-review meeting bringing together HEC and UR was held at Grand Legacy Hotel to undertake an initial review in preparation for an in-depth review as well a physical assessment of UR's readiness to deliver the Programmes. The observations and recommendations of the pre-review meeting were submitted to UR by letter date 23/05/2018 Ref. No ED/538/2018 for implementation and feedback to HEC.

On 14/06/2018 HEC received a letter from the Vice Chancellor of the University of Rwanda dated 14/06/2018 Ref.No:VC.0627/2018 resubmitting the new Programmes for consideration and accreditation. The resubmission included, revised academic Programmes, a report indicating how the recommendations from the pre-review meeting held on 17/05/2018 were implemented, and availability of the required resources and facilities to implement the new Programmes.

Following UR's resubmission of revised academic Programmes, HEC constituted a team of reviewers and scheduled to undertake an in-depth review of the Programmes as well physical assessment of the readiness to implement the new Programmes. The physical assessment that was conducted on 16 and 17/06/2018 was undertaken by the following members indicated in Table. 1 below:

Table 1: HEC Expert Assessment Team Members

No	Names	Roles/Expertise for Reviewers	Institution
1	Dr. Ndikubwimana Theoneste	Chairperson/Head of Academic Quality, Accreditation, Standards and Qualifications Framework Department	HEC
2	Dr. Marie Christine Gasingirwa	Member/Applied Sciences Quality Development and Enhancement Analyst/HEC	HEC
3	Dr. Baguma Abdallah	Member/Ag. Arts, Humanities and Social Sciences Quality Development and Enhancement Analyst	HEC
4	Eng. Mugiraneza Jean Bosco	Energy Expert	IER[5]
5	Eng. Leonard Boniface Kassana	Energy Expert	IER
6	Dr. Sanja Mutongwa Michael	Data Science Expert	HLI[6]/INES
7	Dr. Emmanuel Hagenimana	Statistics Expert	HLI/UoK

2.0 Methodology

The HEC Assessment Team used an assessment approach, applying both quantitative and qualitative methods, and assessing the available evidence related to the four (4) proposed new academic Programmes. The UR and Programmes' compliance was assessed against the established Higher Education norms and

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[4] *The Academic Programme under the African Centre of Excellence in Innovative Teaching and Learning Mathematics and Science (ACEITLMS), was submitted by UR and pre-reviewed by HEC. At the time of the physical assessment conducted on 16 and 17/06/2018, UR was yet to resubmit the revised programme taking into consideration the recommendations from HEC's pre-review for HEC to schedule a physical assessment and in-depth review of the programme.*

[5] *Institution of Engineers Rwanda*

[6] *Higher Learning Institution*

standards. The guiding documents comprised, among others, the UR application documents for the proposed academic Programmes (including Programme specification and module description forms) and evidence of available resources from UR and background documents to the African Centers of Excellences (ACEESD and ACE-DS).

During the physical assessment process, the following steps were followed:

- Planning and understanding the scope of work and methodology: The experts were provided with the relevant application documents, the HEC team members briefly met at the HEC offices in the morning on 16/06/2018 before travelling to UR
- A meeting at UR College of Science and Technology bringing together the HEC and UR Team from the Directorate of the Postgraduate Studies, ACEESD and ACE-DS . The UR Team made over presentations on the ACEESD and ACE-DS, in particular: Justification and descriptions of the Programmes, partnerships, UR readiness to launch the Programmes including information of academic staff and relevant infrastructure, laboratories and equipment. This was followed by Question-Answer/Clarification session.
- The HEC Expert Assessment Team split into two groups, one focusing on the new Programmes under the ACEESD at CST and the other on ACE-DS proposed Programmes at CBE to assess the availability and quality of infrastructure such as laboratories, libraries, and students support facilities for teaching and learning for the new proposed Programmes.
- The triangulation of data from the above sources provided the basis and evidence for the findings, conclusions and recommendations made in this report.

3.0 Findings of the HEC Physical Assessment Team on the Readiness of UR to Deliver the New Academic Programmes.

Factors for Considerations

The HEC Expert Assessment Team identified the following factors as signs (indicators) of readiness of UR to effectively offer and support the new proposed academic Programmes:

i. The uniqueness of the Programmes: proposed academic Programmes are unique, relevant and demanded in various industries in Rwanda including the public service and higher learning institutions

ii. The financing modality of the proposed academic Programmes under the African Centers of Excellence (ACE) project two (2), to fund the required facilities, academic staff and students, including collaborative nature to access academic staff from the region and beyond

iii. Adherence to the established Higher Education norms and standards in Rwanda: A situational analysis indicating that UR complied with its own internal Programme development and validation procedures as well committed to adhering to the established Higher Education norms and standards and to working with HEC to improve the quality of education;

iv. Verification and Validation Mechanism: The proposed academic Programmes went through internal verification in UR and were approved by relevant institutional organs like the Senate. External experts among the institution's also reviewed the Programmes.

v. The required resources and facilities: Assessment of the proposed existing resources and facilities to deliver the new Programmes and the evidence on the reported planned procurement or ongoing procurement of the additional resources and facilities.

4.0 Status of Readiness for Each of the Four Academic Programmes

4.1 Master of Science in Renewable Energy

Summary of Programme Details as provided by UR[7]

Programme Title: Master of Science in Renewable Energy

Host College/Faculty/Centre/Department: UR College of Science and Technology (CST). African Center of Excellence in Energy for Sustainable Development

Duration: Two (2) years.

Award: Master of Science in Renewable Energy

Entry Requirement and Students profiles:

Bachelor Degree with Second Class Honours Upper Division in Electrical, Mechanical, Electromechanical, Mechatronics, Energy or Renewable Energy Engineering.

Funding: Government of Rwanda and African Center of Excellence in Internet of Things (ACEIoT) through World Bank. But, UR did not clearly spell-out what GoR is going to fund in this Programme and what activities/items will be covered by the WB funding.

Justification of the Programme:

- The University of Rwanda is proposing to offer the Master of Science Programme in Renewable Energy with the aim to build a critical mass of African scientists and engineers in the field of RE.
- The Programme will meet the needs of Rwanda Energy (RE) Engineering skills in line with National Commission of Science and Technology (NCST) and United Nations Economic Commission for Africa (UNECA) 2014 Energy Access and Security in Eastern Africa report.

Programmes Development and Approval: The Programmes development teams were composed of the Programme Leader and 18 academic staff from UR-CST, 1 regional and 1 international expert from Research labs and Universities. Also, the team was composed of 2 people from industry Rwanda Utilities Regulatory Agency (RURA). The team was involved throughout the whole Programme development process from the writing of Programme proposal and planning of the module descriptors. The academic qualifications, area of expertise and experience of Programme development team members have been specified in the CVs submitted to HEC. In addition, the proposed Programme was designed and developed in line with the Higher Education Council's guidelines. Also, the Programme went through the entire University procedure for internal validation approval processes (departmental, School, College and University level, before being approved by the University Senate) as well as externally reviewed by academics/experts in areas related to the new academic programmes.

[7] *Additional information about the Programme is Annexed.*

Programme Content/Structure:

- Seminars and Workshops not given/allocated time/contact hours. The Assessment Team recommends to specifically allocating appropriate contact hours and should be given assessment credits.
- According to Luis Berga (2016), Hydropower is a clean, renewable, and environmentally friendly source of energy. It produces 3930 (TW.h).a−1, and yields **16%** of the world's generated electricity and about **78% of renewable** electricity generation (in 2015).
- In Rwanda, RE contributes **52%** of the total electricity generation (216 MW) and among existing the RE generation assets, Hydropower contributes **88%** of the RE generation
- Based on the above importance, then the MSc RE modules should reflect the importance of hydropower to well prepare students for this important RE technology engagement in the market in the country and the region in general.
- The Assessment Team proposes the following for redistribution of credits for consideration as follows:
    - ENE 6262 – 11 credits
    - REE 6261 – 12 credits
    - REE 6262 – 20 credits
    - REE 6263 – 12 credits

- ENE 6262: Corporate Finance should be expanded to include "Project finance" so that the student can be equipped with different financing approaches/tools available.
- Relevant hydropower/hydrology computer software should be sought
- Current meters for river flow measurement should be sought

Academic and Technical Staff: According to the evidence provided to the HEC Expert Assessment Team, UR has enough human resources available to run the new Programme. The Table 2 shows the plan for academic planning and the workload for available faculty staff.

Table 2: UR Academic Staff Listed for MSc in Renewable Energy

Academic Staffing	2017/18	2018/19	2019/20	2020/21	SOURCE OF FUNDS
Full professors	0	1	1	2	UR/ACE-ESD
Associate professors	1	2	3	4	UR/ACE-ESD
Senior lecturers	2	4	5	6	UR/ACE-ESD
Lecturers	3	4	5	6	UR/ACE-ESD
Support Staff	4	4	6	8	UR/ACE-ESD
Technical & Other Staff	2	2	2	2	UR/ACE-ESD

Source: UR/ACE-ESD data, June, 2018

However, it is worth to note the following:

- Number of teaching staff allocated considered fairly balanced except in Module ENE 6165 where only one academic staff has been earmarked/identified

- One teaching staff appears to be overloaded i.e. in too many modules and the teaching load may hamper his efficiency and effectiveness
- Highly qualified practicing experts' utilization from the RE industry within the country and the regional should be considered for the modules as they will make value addition with industrial experience sharing with students.

Infrastructure and Laboratories: The provided documents indicate that the Programmes will be supported by the following existing physical resources of the College of Science and Technology: 2 class rooms, 1 lab, offices; shared UR general library is available for the Programme.

The available classrooms, labs and library are adequate for the Programme. However, the following are additional observations/findings on infrastructure:

- Team recommends for consideration, a mini physical library to be stocked with relevant reference resources (books/journals)
- Internet connectivity should be enhanced e.g. 4 band
- Relevant hydropower/hydrology computer software should be sought (see comments in "A")
- By extension with respect to Partnership/Collaboration understanding with Energy Sectors players, power plants facilities in the country can be accessed by students for training thru attachments, etc.

Laboratory Procurement Status

- Desire to commence in September 2018 (in 2 months' time) may be too optimistic to achieve as the Lab equipment supply contract agreement is awaiting final signature from the UR
- The team was informed that the laboratory equipment will be supplied from Germany firm called Lucas-Nulle GmbH.
- Delivery date as per Minutes of the Contract Negotiating Meeting dated February 23, 2018 between UR and Lucas-Nulle GmbH indicates 60 days (2 months) after contract signing of both parties. The team was further informed that installation will take approx. two weeks
- Team considers 4 year warranty period sufficient
- UR/ACE-ESD should seek and incorporate in the supply contract the "after sales services" to ensure the equipment will be properly maintained and kept in functional order.

4.1.1 Conclusion

The proposed Programme of **MSc in Renewable Energy <u>should be accredited</u>**. However, UR is required to implement the following for HEC's verification before starting to teach the programme:

- **Seminars and Workshops not given/allocated time/contact hours:** Team recommends to specifically allocating appropriate contact hours and should be given assessment credits.
- Based on the importance of Hydropower contribution in the RE sector globally, regionally and nationally, the MSc Renewable Energy (RE) module credit system should reflect this importance to well prepare students for this important RE technology engagement in the market. Team proposes the following redistribution of credits for consideration as follows:
  - ENE 6262 – 11 credits
  - REE 6261 – 12 credits

- REE 6262 – 20 credits
- REE 6263 – 12 credits

- ENE 6262: Corporate Finance should be expanded to include "Project finance" so that the student can be equipped with different financing approaches/tools on financing instruments that are available in the market.
- Relevant hydropower/hydrology computer software should be sought and taught part of the REE 6262.
- Team recommends a mini physical library to be stocked with relevant reference resources (books/journals, etc).

Academic staff:

- Number of academic staff allocated considered fairly balanced except in Module ENE 6165 where only one academic staff has been earmarked/identified.
- One teaching staff appears to be overloaded i.e. in too many modules and the teaching load may hamper his efficiency and effectiveness
- The proposed teaching staff should be augmented with highly qualified practicing experts from the RE industry within the country and the region for the Programme modules since they will make value addition with industrial experience sharing with students.

4.2 Master of Science in Electrical Power Systems

Summary of Programme Details as provided by UR[8]

Programme Title: Master of Science in Electrical Power Systems

Host College/Faculty/Centre/Department: UR College of Science and Technology (CST). African Center of Excellence in Energy for Sustainable Development

Duration: Two (2) years.

Award: Master of Science in Electrical Power Systems

Entry Requirement and Students profiles:

- BSc in Mechatronics, Mechanical Engineering, Electrical Engineering, Electromechanical Engineering or Renewable Energy Engineering and other related fields.
- Second class upper division
- Second class lower division with at least two year relevant working experience
- Ability in English to undertake master's level work.

Justification of the Programme: The University of Rwanda is proposing to offer the Master's Programme in Electric Power System with the aim to build a critical mass of African engineers in the field of power

[8] *Additional information about the Programme is Annexed.*

system. The training has taken into consideration the aspect of Gender balance. The Programme will seek to ground students with knowledge in both theoretical and practical computational approaches in powers systems while pointing the students in the direction seeking more information and developing advanced skills as required. At the completion of the Programme the award is "Master of Science in Electrical Power Systems.

The proposed new Programmes follow the classical structure of face-to-face course work and dissertation. The major innovation however would be the "field attachment", which was introduced to give students Industry experience and hand on skills. In particular, the Programmes will be offered on a full-time basis for a period of two academic years. The first year will focus on the face-to-face course work. The field attachment and dissertation will be conducted. The projected first intake will be composed of 15 students from both Rwanda and East and South African region.

Programmes Development and Approval: The Programmes development teams were composed of the Programme Leader and academic staff from UR-CST, regional and international experts from Research labs and Universities. The academic qualifications, area of expertise and experience of Programme development team members have been specified in the CVs submitted to HEC. In addition, the proposed Programme was designed and developed in line with the Higher Education Council's guidelines and national qualification frame work. Also, the Programme went through the entire University procedure for internal validation and approval.

The proposed Electric Power System Programme went through internal verification in UR and was approved by relevant institutional organs up to the Senate level. External expert reviewed the Programme and made some recommendations.

Resources required to implement the proposed new academic Programme: The Programme will be supported by the existing resources of the College of Science and Technology. The Center has its own building that will accommodate classrooms, staff offices and labs. The library is shared with other schools. The team recommends the Center to have its own mini library that combines physical library and digital resources given the benefits and drawbacks of each of them.

Academic and Technical Staff: According to the evidence provided to the HEC Expert Assessment Team, UR has enough human resources available to run the new Electrical Power System Programme. The Table 3 shows the plan for academic planning and the workload for available faculty staff.

Table 3: UR Academic Staff Listed for MSc in Electric Power Systems

Academic Staffing	2017/18	2018/19	2019/20	2020/21	SOURCE OF FUNDS
Full professors	0	1	1	2	UR/ACE-ESD
Associate professors	1	2	3	4	UR/ACE-ESD
Senior lecturers	2	4	5	6	UR/ACE-ESD
Lecturers	3	4	5	6	UR/ACE-ESD
Support Staff	4	4	6	8	UR/ACE-ESD
Technical & Other Staff	2	2	2	2	UR/ACE-ESD

Source: UR/ACE-ESD data, June, 2018

Infrastructure and Laboratories

The following is list of existing facilities to start the proposed Programme. They are fit-for purpose.

- Two (2) classroom spaces
- One (1) Computers Lab
- One (1) electric power system Lab space
- Contract for Lab Equipment is ready for signature by both parties
- Library space.
- Digital Books and papers.

The evidence on the reported planned procurement or ongoing procurement of the laboratory facilities need to be monitored carefully, if the Center needs to launch the Programme in September 2018. The installation of the power system laboratory is the key requirement before launching the Programme. The launch of the Electrical Power System Programme should be subject to the availability of that laboratory.

Funding: Government of Rwanda and African Center of Excellence in Electric Power System Programme through World Bank.However, UR did not clearly spell-out what GoR is going to fund in this Programme and what activities/items will be covered by the WB funding.

4.2.1 Conclusion

The UR and its partners are commended for developing the Electric Power System Programme. It is unique, timely and relevant and will address some of the skills gaps identified in the previous skills audits on the job market. The proposed Masters Programme will be offered under the African Center of Excellence in Energy for Sustainable Development (ACEESD). However, the sustainability of the Programme should be planned accordingly.

The proposed Electric Power System Programme should be accredited.

However, before launching the Programme, UR should:

- Incorporate the power system dynamics module in the Programme and fully consider the external expert recommendations and comments and make mandatory seminars/workshops for discussing state of the art and emerging technologies in the power industry.
- Equip the electrical power system laboratory to assure quality assurance and credibility of the Programme since it is major component in academic delivery for hands on skills.
- Address the issue of some Professors appear in many modules and the risk is that the overloading would compromise quality in terms of time to concentrate on the subject but also the relevancy of delivery which would suffer as one person cannot specialize in everything.
- Consider the mini library with few books for the masters Programme and enhance internet connectivity for accessing digital resources.
- Think of facilitating people leaving with disabilities for accessing some of the infrastructure.

4.3 Master of Science in Energy Economics

Summary of Programme Details as provided by UR[9]

Programme Title: Master of Science in Energy Economics

Host College/Faculty/Centre/Department: UR College of Science and Technology (CST). African Center of Excellence in Energy for Sustainable Development

Duration: Two (2) years.

Award: Master of Science in Energy Economics

Entry Requirement and Students profiles:

a) BSc in Mechatronics, Mechanical Engineering, Electrical Engineering, Electromechanical Engineering or Renewable Energy Engineering and other related fields.

b) Second class upper division

c) Second class lower division with at least two year relevant working experience

d) Ability in English to undertake Masters' level work.

Summary of Program Details as provided by UR[10]

Justification of the Program: The University of Rwanda is proposing to offer the Master's program in **Energy Economics** with the aim to build a critical mass of African engineers in the field of Energy sector. The programme will provide students with in-depth understanding of a blend of economics, finance, policy and basic engineering principles and their application to the resolutions of problems in the energy sector. At the completion of the program the exit award is "Master of Science in Energy Economics.

The proposed new programs follow the classical structure of face-to-face course work and dissertation. The program will be offered on a full-time basis for a period of two academic years. The first year will focus on the face-to-face course work. The dissertation will be conducted in the second. Gender balance has also been taken into consideration. The first intake will be composed of 20 students from both Rwanda and East and South African region.

Programs Development and Approval: The programs development teams were composed of the Program Leader and academic staff from UR-CST, regional and international experts from Research labs and Universities. The academic qualifications, area of expertise and experience of program development team members have been specified in the CVs submitted to HEC. In addition, the proposed program was designed and developed in line with the Higher Education Council's guidelines and national qualification frame work. Also, the program went through the entire University procedure for internal validation and approval.

The proposed Energy Economics program went through internal verification in UR and was approved by relevant institutional organs up to the Senate level. External expert reviewed the program and made strong recommendations that must be full considered to avoid the case where the programme would pure teach

[9] *Additional information about the program is Annexed.*
[10] *Additional information about the program is Annexed.*

pure economics. The Center should consider some key modules such as Electrical Power Market (regulation, tariff modelling, power purchase agreements, and energy law), Energy and Environment in the programme specification and module descriptions.

Resources required to implement the proposed new academic program

The program will be supported by the existing resources of the College of Science and Technology Campuses. The Center has its own building that will accommodate classrooms, staff offices and labs. The library is shared with other schools. The Center should have its own mini library that combines physical library and digital resources given the benefits and drawbacks of each of them.

Academic and Technical Staff

According to the evidence provided to the HEC Expert Assessment Team, UR has enough human resources available to run the new program. It will be of high value addition to augment the proposed teaching staff with highly qualified experts from energy industry. The Table 4 shows the plan for academic planning and the workload for available faculty staff.

Table 4: UR Academic Staff Listed for MSc in Energy Economics

Academic Staffing	2017/18	2018/19	2019/20	2020/21	SOURCE OF FUNDS
Full professors	0	1	1	2	UR/ACE-ESD
Associate professors	0	1	3	3	UR/ACE-ESD
Senior lecturers	1	2	3	4	UR/ACE-ESD
Lecturers	2	3	4	5	UR/ACE-ESD
Support Staff	2	2	4	5	UR/ACE-ESD
Technical & Other Staff	2	2	2	2	UR/ACE-ESD

Infrastructure and Laboratories: The evidence on the reported planned procurement or ongoing procurement of the laboratory facilities; however the Center may launch the programme in September 2018. The installation of the power system laboratory is not the key requirement before launching the programme. The launch of the Energy Economics program shouldn't be subject to the availability of that laboratory. The key requirement which would facilitate students in their studies is the **high speed internet connectivity**. UR provided the list of existing resources to HEC Experts. The following is list of existing facilities to start the proposed program. They are fit-for purpose.

- Two (2) classroom spaces
- One (1) Computers Lab
- One (1) electric power system Lab space
- Contract for Lab Equipment is ready for signature by both parties
- Library space.
- Digital Books and papers.

Funding: Government of Rwanda and African Center of Excellence in Energy Economics program through World Bank.But, UR did not clearly spell-out what GoR is going to fund in this program and what activities/items will be covered by the WB funding.

4.3.1 Conclusion

The UR and its partners are commended for developing the Energy Economics program. It is unique, timely and relevant and will best fit with high demand on job market and will address some of the gaps identified in the previous skills audits. The proposed Masters programme will be offered under the African Center of Excellence in Energy for Sustainable Development (ACEESD). However, the sustainability of the programme should be planned accordingly.

The proposed MSc in Energy Economics programme should be accredited.

However, before starting to teach the programme, UR should:

- Incorporate Electric Power Market Analytics (regulation, tariff modelling, power purchase agreements, energy law) and consider additional modules such as Energy Policy, and Energy & Environment. The Center should also make mandatory seminars/workshops for discussing the latest trends in the power industry.
- In the light of the above new proposed modules to be considered time allocated to the Dissertation Module should be adjusted accordingly.
- To have in place a mini library with some books/journals for the masters programmes and enhance internet connectivity for accessing digital resources.
- To be ready to facilitate people with disabilities to access some of the infrastructure.

4.4 Master of Science in Data Science

Summary of Programme Details as provided by UR[11]

Programme Title: Master of Science in Data Science

Host College/Faculty/Centre/Department: UR College of Business and Economics/African Centre of Excellence in Data Science (ACE-DS). Department is not notified.

Duration: Two (2) years.

Award: The Master of Science in Data Science proposes the following specialisations:

1) Data Science in Econometrics,
2) Data Science in Biostatistics
3) Data Science in Demography
4) Data Science in Data mining,

[11] *Additional information about the program is Annexed.*

5) Data Science in Actuarial Sciences

Entry Requirement and Students profiles:

To be a Bachelor's degree holder with at least upper second class in: Mathematics, Statistics, Economics, Computer Science and other related disciplines.

Funding: Government of Rwanda and African Center of Excellence in (ACE-DS) through World Bank. However, UR did not clearly spell-out what GoR is going to fund and what activities/items will be covered by the WB funding.

Justification of the Program: The proposed Master of Science in Data Science in Econometrics has five specializations (Data mining, Econometrics, Biostatistics, Demography and Actuarial Sciences). The aim is to build a critical mass of African experts in Data Science, a growing area that involves inter-disciplinary collaboration between Statistics, Economics, Business, Computer Science and Engineering. This aligns with recent developments in Africa where focusing on data science has demonstrated rapid and sustained economic growth over the last decade.

However, it has been demonstrated that there is absence of Data Scientists for big data, bioinformatics, data mining, reliability modeling, research design, evidence-based policy analysis is one of regional priority areas. To respond to this challenge, the MSc in Data Sciences under the African Center of Excellence (ACE-DS) has been developed. It is envisaged that the programme will strengthen the University of Rwanda, to deliver quality post-graduate education and build collaborative research capacity in the regional priority areas and address specific development challenges among others: (i) offering a research hub for postgraduate students, attracting international expertise and practitioners; (ii) stimulating collaboration between academia, government and the private sector; (iii) demonstrating the relevance of the center for innovation, job creation and economic prosperity; and (4) securing resources to stimulate multidisciplinary collaborative international research projects.

The MSC in Data Science under the ACE-DS will transform the appeal and relevance of applied research by showcasing studies and real world solutions with direct benefits for stakeholders in the region. The programme will also serve an important role of helping the region to satisfy the aims of Science Technology Innovation Strategy for Africa (STISA) 2024 by collecting, sharing and analyzing data. It will also provide expertise to measure and monitor the United Nation's new Sustainable Development Goals and the African aspirations for 2063. At the end of the five year World Bank program, ACE-DS at the University of Rwanda aims to have achieved the following: (i) international accreditation for a MSc and PhD program in data science; (ii) enrolled 100 MSc students and 40 PhD students of which at least 20% will be regional and 50% female; (iii) trained 150 professional data scientists, (iv) published 40 peer-reviewed research publications, (v) attract an average of $0.5m per year in externally mobilized funds, (6) improved research and teaching environment achieved through a Data Lab and cloud-based computing facility.

The programme's course work will focus on self-motivated learning and effective use of electronic material, allowing classes to be devoted largely to discussion, analysis, problem- solving and applications. Students will receive training in critical thinking about information from scientific literature, reports and websites. Data laboratory training will provide knowledge of both the strengths and limitations of different data analysis techniques. ACE-DS will provide the expertise and skills for undertaking a range of practical applications such as descriptive statistics, exploratory data analysis and business intelligence. This will involve the process of collecting, cleaning, interpreting, transforming, exploring, visualizing, analyzing and modeling data with the goal of discovering useful information, communicating insights and supporting decision-making.

The programme is completed with a dissertation, lasting at least eight months, which is concerned with data science for decision-making, policy formulation and complex data set by using statistical methods. Industry attachment will be conducted in an organization where big data are used or UR. Arrangements have to be made to ensure adequate and real involvement in the internship from the point of view of the company (i.e. research laboratories of multinationals, national research institutes, statistical consultancy offices, etc.). Both the company and the university shall contribute to the supervision and the assessment of the student. Acting as the "client", the industrial supervisor will take care of the industrial relevance of internship from the beginning to the end. The university supervisor will guarantee that the statistical analysis is relevant and appropriate.

Resources required to implement the proposed new academic programme

The African Center of Excellence in Data Science has administration unit composed of Director of the Center, Deputy Director, Head of PhD studies and research, Head of Masters studies, Administrative Assistant, two research assistants, one Webmaster/IT. The recruitment of the laboratory engineer is in the process.

UR provided the list of existing resources to HEC Team of Experts. The following is list of existing facilities to start the proposed program. They are fit-for purpose.

- Classroom space are there
- Computers Lab with 1 Smart board have been provided
- Two computer Labs one for master students with 32 computers and another one for PhD students with 32 computers.
- Lab Equipment (Non-objection from RPPA), process for procuring laboratory equipment ongoing: List of lab equipment in procurement process.
- Library space.
- Books and papers.

The procurement process for additional facilities, including the lab equipment and textbooks in undergoing and a non-objection letter from the Rwanda Public Procurement Agency (RPPA) was presented to during the assessment.

Academic and Technical Staff: According to the evidence provided to the HEC Expert Assessment Team and the attached documents of academic staff, UR has adequate staff to implement the new programme. Also for sustainability purposes, during implementation of the ACE-DS five year project funded by the World Bank, different activities related to staff development will be undertaken including:

- Assistant Lecturers in the Department will be admitted as PhD students.
- The Centre will train in four years around 10 PhD students among University of Rwanda academic staff.
- All PhD holders' staff will receive training on thesis supervision.
- Creation of partnership with other institutions in order to exchange staff for reciprocal experiences;
- Participation in national and international conferences
- Conducting faculty development programs/workshops to deepen knowledge;

- Facilitate staff to take up research and consultancy in order to sharpen their expertise in the field of energy.
- Organization of short courses for senior staff and PhD for junior staff.

4.4.1 Conclusion on MSc in Data Science

The proposed academic of Master's of Science in Data Science with five specialization in: Data mining, Econometrics, Biostatistics, Demography and Actuarial Sciences should be accredited. However, before starting to teach the programme, UR should implement the following assessment recommendations for HEC's verification and approval:

i. To make sure the computer laboratory to be used by the students is equipped in terms of: number of computers to the project number of students; the required software and tools installed in computers, including software which will help students to analyse data in their simulation results and computing such as Maple a general-purpose to computer algebra system, MapleSim-a multi-domain modeling and simulation tool, a computational software program which is based on symbolic mathematics and Oracle software; installation of a smart board; Blade servers should be isolated Rack servers should well installed; a Management software that is ERP for the purpose of administration, Accountability Control, and Monitoring of the program.

ii. To avail the required facilities in the classrooms, including Smart Boards (direct link to e-resources).

iii. To implement the following recommendations related to the content of the proposed programme and related specializations:

   a) The current content for specialization in Biostatistics is almost similar the specialization in Statistics. UR should revise the content by considering the following: Research in Biostatistics; Problems or special topic in Biostatics; Analysis of categorical data Advanced clinical trial; Survival data analysis; Theory of Biostatistics; Bayesian methods and design; Statistical machine learning for biological and public health data; Introduction to biostatistics; Biostatistics computing; Bio statistical method laboratory; and Development of bio statistical and research.

   b) Research skills for meaningful applications in health related to the field including public health, medicine and biology be taken into consideration. Providing practical training opportunities, health science and research will be also very important to be considered accordingly.

   c) The content for specialization in Econometrics are standard on the international market. However, before starting to teach the programme, UR to consider 'Statistical methods 'which can help in balancing the programme.

   d) To consider the following additional content for the specialization in Demography: Introduction to Demography; Basic methods of demography, Quantitative methods in sociology, Demography, economics and social interrelations

   e) To make sure the computer laboratory to be used by the students is equipped in terms of: number of computers to the project number of students; the required software and tools installed in computers, including software which will help students to analyse data in their simulation results and computing such as Maple a general-purpose to computer algebra system, MapleSim-a multi-domain modeling and simulation tool, a computational software program which is based on symbolic mathematics and Oracle software; installation of a smart board; Blade servers

should be isolated Rack servers should well installed; a Management software that is ERP for the purpose of administration, Accountability Control, and Monitoring of the program.

5.0 Conclusion and Recommendation on the four (4) new programmes

Based on the relevance at the national, regional and continental level of the proposed programmes to train experts in Energy for Sustainable Development and Data Science, evidence of available funding under the World Bank African Centers of Excellence Project II, availability of existing and quality of resources, facilities, including relevant laboratories, equipment and textbooks, advanced phases of ongoing procurement process of additional resources and facilities, existing academic staff at the University of Rwanda and the arrangements to access and share academic staff under the Centers of Excellence Project, including the sustainability plans for capacity building of academic staff upon completion of the African Center of Excellence project the Assessment Team is satisfied that, UR can effectively implement the four (4) new academic programmes namely (i) MSc in Electrical Power Systems (ii) MSc in Energy Economics (iii) MSc in Renewable Energy (iv) MSc in Data Science with specializations in Data mining, Econometrics, Biostatistics, Demography, Actuarial Science and Econometrics.

However, before teaching the programmes, the University of Rwanda submit an report to HEC to verify implementation of recommandations related to improving the content of the new programmes and availability of the facilities that are reported to be under procurement.

Annex i: Analysis of the application for Accreditation the Master of Science in Renewable Energy

Institution: University of Rwanda

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
1	Program Title in full	Master of Science in Renewable Energy	Title is clear
2	Program Leader	Prof. Etienne NTAGWIRUMUGARA	The programme leader is suitable
3	Award (s)[12]	Master of Science in Renewable Energy	Award is clear
	Exit award(s)[13]		
4	First year of enrollment	2018	
5	Mode of attendance	Full time	
6	Faculty		
7	College		
8	School		
9	Centre	African Center of Excellence in Energy for Sustainable Development (ACE-ESD)	The center is operational
10	Department		
11	Entry requirement/Admission criteria	Bachelor Degree with Second Class Honours Upper Division in Electrical, Mechanical, Electromechanical, Mechatronics, Energy or Renewable Energy Engineering.	Acceptable
12	Program duration	2 years	
13	Justification of the program (Aim and Rationale)	o The program will meet the needs of Renewable Energy (RE) Engineering skills in line with National Commission of Science and Technology (NCST) and United Nations Economic Commission for Africa (UNECA) 2014 Energy Access and Security in Eastern Africa report	The programme is aimed at not only meeting the national skills needs in Renewable Energy, but also the region and the continent.
14	Program development and approval	o Program externally reviewed and the comments given were incorporated o The curriculum was submitted to HEC for review and accreditation o However, seminars and workshops not given/allocated time/contact hours. Recommended to specifically allocate contact hours and as well as assessment credits. o According to Luis Berga (2016), Hydropower is a clean, renewable, and environmentally friendly source of energy. It produces 3930 (TW.h).a−1, and yields **16%** of the world's generated electricity and about **78% of renewable** electricity generation (in	The programme development and approval process implemented

[12] *Issued upon successful completion of a programme*

[13] *These are in built in a programme. Issued during the training process prior to completion of the intended award. For instance when there are reasons for a student not to progress e.g. a student suspends studies for different reasons or when a student fails to progress towards completion of the intended award e.g. Master's programme where a student successfully completes the coursework phase but fails to complete the Dissertation.*

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
		2015). o In Rwanda, RE contributes **52%** of the total electricity generation (216 MW) and among existing the RE generation assets, Hydropower contributes **88%** of the RE generation o Based on the above importance, the MSc. RE modules should reflect the importance of hydropower to well prepare students for this important RE technology engagement in the market in the country and the region in general. o Relevant hydropower/hydrology computer softwares/models should be sought o Propose the following for redistribution of credits for consideration as follows: o ENE 6262 – 11 credits o REE 6261 – 12 credits o REE 6262 – 20 credits o REE 6263 – 12 credits	
15	Academic and Technical Staff	o Number of teaching staff allocated considered fairly balanced except in Module ENE 6165 where only one academic staff has been earmarked/identified o One teaching staff appears to be overloaded i.e. in too many modules and the teaching load may hamper his efficiency and effectiveness o Proposed teaching staff can be augmented with highly qualified practicing experts from the RE industry within the country and the region for the modules as they will make value addition w.r.t industrial experience sharing with students.	
16	Infrastructure (classrooms, labs, library, etc.)	o 2 class rooms, 1 lab, offices, shared UR general library space is available o Mini physical library (to be stocked with relevant reference resources) should be considered. o Internet connectivity should be enhanced o Relevant hydropower/hydrology computer software should be sought (see comments on item 14) o Commencing on September 2018 (in 2 months' time) may too optimistic to achieve as Lab equipment supply and installations not yet completed i.e not in place. o Delivery date as per negotiation meeting dated February 23, 2018: 60 days after contract signing by both parties. o The team was informed that the laboratory equipment will be supplied from Germany firm called Lucas-Nulle GmbH and	

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
		installation will take about two weeks. o UR/ACE-ESD should seek and incorporate in the supply contract the "after sales services" to ensure the equipment will be properly maintained and kept in functional order.	
17	Other resources required for the program	o Hydropower/hydrology models	
18	Program funding	o World Bank funding under the African Center of Excellence (ACE) Project II	
19	Students	o 15 students per intake hence 40 per year	The projected numbers acceptable

Annex ii: Analysis of the application for Accreditation the Master of Science in Electrical Power Systems

Institution: University of Rwanda

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
1	Program Title in full	MSc in Electrical Power Systems	**The title is clear**
2	Program Leader	Prof. Dr Etienne NTAGWIRUMUGARA	The programme leader is suitable
3	Award(s)[14]	Master of Science in Electrical Power Systems	The award is clear
	Exit award(s)[15]		
4	First year of enrollment	2018	
5	Mode of attendance	Full Time	
6	Faculty		
7	College		
8	School		
9	Centre	African Centre of Excellence in Energy for Sustainable Development	
10	Department		
11	Entry requirement/Admission criteria	-BSc in Mechatronics, Mechanical Engineering, Electrical Engineering, Electromechanical Engineering or Renewable Energy Engineering and other related fields -Second class upper division -Second class lower division with at least two year relevant working experience -Ability in English to undertake masters level work.	Acceptable
12	Program duration	Two (2) years	
13	Justification of the program (Aim and Rationale)	The programme will bridge some of the gaps identified in different skills audits in energy sector conducted recently.	The programme is aimed at not only meeting the national skills needs in the Energy sector, but also the region and the continent.
14	Program development and approval	The proposed Electric Power System programme went through internal verification in UR and approved by relevant institutional organs like the Senate. External experts reviewed the programme and made some recommendations.	The programme development and approval process

[14] *Issued upon successful completion of a programme*

[15] *These are in built in a programme. Issued during the training process prior to completion of the intended award. For instance when there are reasons for a student not to progress e.g. a student suspends studies for different reasons or when a student fails to progress towards completion of the intended award e.g. Master's programme where a student successfully completes the coursework phase but fails to complete the Dissertation.*

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
			implemented
15	Academic and Technical Staff	The potential teaching and support staff proposed are relevant and of high caliber.	
16	Infrastructure (classrooms, labs, library, etc.)	2 class rooms, 1 electric power system laboratory consisting different modules and stations, staff offices, shared library, sanitation facilities, digital resources	To avail the yet to be purchased facilities
17	Other resources required for the program	High speed internet connectivity Three phase supply to run some of the equipment of electric power system laboratory.	
18	Program funding	Government of Rwanda and African Center of Excellence (ACE) Project II.	
19	Students	15 students/ intake. Eventual population, all years" 40 students.	

Annex iii: Analysis of the application for Accreditation the Master of Science in Energy Economics

Institution: University of Rwanda

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
1	Program Title in full	Master Science in Energy Economics	Title is clear
2	Program Leader	Prof. Dr Etienne NTAGWIRUMUGARA	
3	Award(s)[16]	Masters of Science in Energy Economics	
	Exit award(s)[17]		
4	First year of enrollment	2018	
5	Mode of attendance	Full Time	
6	Faculty		
7	College		
8	School		
9	Centre	African Centre of Excellence in Energy for Sustainable Development	
10	Department		
11	Entry requirement/Admission criteria	- BSc in Economics, Finance, Accounting and Business Administration with a strong interest in energy sector with working experience in energy sector. - Graduates in Engineering with interest in energy sector or have a working experience in energy sector. - Second class upper division - Second class lower division with at least two year relevant working experience - Ability to speak English to undertake master's level work.	To ensure that implementation of the programmes takes into consideration the diversity in the entrance profile
12	Program duration	Two (2) years	
13	Justification of the program (Aim and Rationale)	The aim is to build a critical mass of African experts in Data Science, a growing area that involves inter-disciplinary collaboration between Statistics, Economics, Business, Computer Science and Engineering. This aligns with recent developments in Rwanda, the region and the entire continent where focusing on data science has demonstrated rapid and sustained economic growth over the last decade.	
14	Program development and approval	- The proposed Energy Economics program went through internal verification in UR and was approved by relevant institutional organs like the Senate. External expert reviewed the program and made some recommendations. - ENE 6262: Corporate Finance should be expanded to include "Project finance" so that the student can be equipped with different	To implement the recommendations

[16] *Issued upon successful completion of a programme*

[17] *These are in built in a programme. Issued during the training process prior to completion of the intended award. For instance when there are reasons for a student not to progress e.g. a student suspends studies for different reasons or when a student fails to progress towards completion of the intended award e.g. Master's programme where a student successfully completes the coursework phase but fails to complete the Dissertation.*

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
		financing approaches/tools available. - Seminars and Workshops not given/allocated time/contact hours. Team recommends to specifically allocating appropriate contact hours and should be given assessment credits.	
15	Academic and Technical Staff	The potential teaching and support staff proposed are relevant and of high caliber.	
16	Infrastructure (classrooms, labs, library, etc.)	2 class rooms, staff offices, shared library, sanitation facilities, digital resources, etc	To avail the facilities yet to be procured
17	Other resources required for the program	High speed internet connectivity	
18	Program funding	Government of Rwanda and World Bank under the African Center of Excellence (ACE) Project	
19	Students	20 students/ intake. Eventual population, all years" 40 students.	

Annex iv: Analysis of the application for accreditation the MSc in Data Science

Institution: University of Rwanda

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
1	Program Title in full	Master of Science in Data Science	**The title is clear**
2	Program Leader	Dr. Charles Ruranga	The team leader is qualified and suitable to lead the programme
3	Award(s)[18]	i. Master of Science in Data Science in Data mining, ii. Master of Science in Data Science in Econometrics, iii. Master of Science in Data Science in Biostatistics, iv. Master of Science in Data Science in Demography, v. Master of Science in Data Science in Actuarial Science	The intended specializations are relevant to the aims of the programmes
	Exit award(s)[19]		
4	First year of enrollment	2018/2019	
5	Mode of attendance	Full-time	
6	Faculty		
7	College	College of Business and Economics (CBE)	
8	School		
9	Centre	**School / Centre:** African Centre of Excellence in Data Science at CBE	
10	Department	Department of Applied Statistics	
11	Entry requirement/Admission criteria	- Bachelor Degree with Second Class Honours Upper Division in Electrical, Mechanical, Electromechanical, Mechatronics, Energy or Renewable Energy Engineering.	
12	Program duration	- Two (2) academic years	
13	Justification of the program (Aim and Rationale)	- The programme is aimed at meeting the needs of Renewable Energy (RE) Engineering skills in line with National Commission of Science and Technology (NCST) and United Nations Economic Commission for Africa (UNECA) 2014	
14	Program development and approval	- The Programmes development teams were composed of a Programme Leader and 18 academic staff from UR-CST, 1 regional and 1 international expert from Research labs and Universities. Also, the team was composed of 2 people from industry Rwanda Utilities Regulatory Agency (RURA). The programme was also externally reviewers. The external reviewers provided recommendations. UR implemented some of the recommendations	To implement the recommendations that were made by external reviewers that were not implemented as well those that have been given by the current assessment team indicated in the assessment report and

[18] *Issued upon successful completion of a programme*

[19] *These are in built in a programme. Issued during the training process prior to completion of the intended award. For instance when there are reasons for a student not to progress e.g. a student suspends studies for different reasons or when a student fails to progress towards completion of the intended award e.g. Master's programme where a student successfully completes the coursework phase but fails to complete the Dissertation.*

S/N	Program details	Analysis of application (as per application)	Remarks by HEC
			annex v.
15	Academic and Technical Staff	- Number of teaching staff allocated considered fairly balanced. However in a some of the Modules, only two Academic staff have been earmarked/identified - Proposed teaching staff can be augmented with highly qualified practicing experts from the RE industry within the country and the region for the modules as they will make value addition	To increase the number of academic staff
16	Infrastructure (classrooms, labs, library, etc.)	**Available resources:** - 1 Lecture hall of capacity of 30 students - 2 Labs available newly built all in good condition. However, no smart boards. - One Main Server (Ahnlmed) supplied by BSC a Korean Company well installed - One Minor Server is installed with stable ISP provider: KET (Korean Company), MTN(ISP) and Microsoft Which runs the Fiber optics. It is an optimum start and stable supply.	
17	Other resources required for the program	**There need for installation of :** - A smart board - Blade servers should be isolated -Rack servers should installed on the Mini-Servers -To implement a Management software for Data Science Department i.e. ERP For the purpose of Administration, Accountability Control, and Monitoring of the program.	
18	Program funding	-Government of Rwanda and African Center of Excellence in Data Science (ACE-DS) through World Bank. But, UR did not clearly spell-out what GoR is going to fund in this Programme and what activities/items will be covered by the WB funding.	UR did not clearly spell-out what GoR is going to fund in this Programme and what activities/items will be covered by the WB funding.
19	Students	Project to enroll in academic year 2018	

Annex v: Observations and recommendations to improve the content of the MSc in Data Science

The Developer will have to Consider Areas based on Common Module: Probability And Statistical Models, Programming For Data Scientists Models, Machine Learning And Computational Statistics, Machine Learning and Computational Statistics Probability And Statistical Models:

Indicative Content: Basic concepts and theorems of probability theory, e.g., Random variable, Density Function, and the law of large numbers; Variety of sampling - *There need for Varies types of Sampling, certify their operations, Why, how and when*) Hypothesis tests of parameters ;(- *Strongly establish TWO types testing techniques for the Hypotheses since* testing of hypothesis by ,''Chi-square tests'' may not achieve the results ; consider Regression analysis or SEM , *appreciate the originality of hypothesis generated i.e models*).Other than Kruskal Wallis test , consider Krustal tai a ,b ,c which may handle depending on the sample sizes. The learners are expected to develop a number of models: to support such a move provides an approach of structure Equation model (SEM) by AMOS, RISREL or Eq. More Indicative Resources are required specifically with new Editions.

Programming For Data Scientists Model:

R and Python programming language should be accompanied with a Data base or otherwise consider *Java programming language* which is key, since it will easily link, user friendly and highly applicable.

Data collection methods : There is need to narrow down on Modern tools used for data collections i.e laptops, GPS, Digital Cameras, sound capturing machine, Bar code Reader. Use of Epidata software

Cognitive/ Intellectual skills/Application of Knowledge

Having successfully completed this module, students should be able to: Generate random numbers on a computer by computer programming language i.e Java or Python; Assess the quality of pseudo and Flowcharts for random number generators;

Students should **not only** study statistical models via simulation. But should practically demonstrate and appreciate model techniques in developing, formulating, applicability.

Indicative contents:

While driving: errors, finite population correction, variance estimation, confidence intervals, proportions, domains, ratio estimation, Horvitz-Thompson estimator, and design based inference.

The learner should be able to apply Bootstrapping or Jackknifing to achieve:

'' variance estimation, confidence intervals, proportions, domains, ratio estimation''

Machine Learning and Computational Statistics:

The Specialization in *Data Mining* was identified with the correction on Advanced Data Mining Such Corrections include: The Brief description has no content summary of the module; the '' lecturer'' to teach this module may not be able to develop the course outline or if anything there is need for adjustment.

The course description *should cover:* Advanced modeling techniques, Advanced Machine Learning techniques including ensemble learning, extended linear models, probabilistic graphical models, mixture and latent variable models, matrix factorization and link analysis; theoretical foundations of these techniques will be presented and augmented, the state-of-the-art research related to these techniques , strong highlight practical applications on advanced data mining techniques. Applications on popular domains, including social computing and health informatics.-Predictive modeling: Classification, Regression (decision trees, neural networks, statistical models,-Association rules and Link analysis–Clustering -Anomaly Detection – Interpretations.

The developer is advised to consider correction on Advanced data mining course Content Such will include general theory, concept, and techniques related to intelligent database design. Many programming techniques to allow students to integrate intelligent database systems with web-based applications are covered in detail.

Additional topics to be covered include expert systems, neural networks, hypermedia, and text retrieval. These additional topics are used as supplementary entities to be integrated into database reasoning components. A moderate-size semester project needs to be developed and demonstrated for the practice of the design of an intelligent database. This course project is a purely web-based and practical database system that is capable of handling high-level intelligent queries.

Module of Cloud Computing and Web Programming:

The Brief description has no content summary: It will be of great help to beef up the with

Introduction to domain, cloud infrastructures, virtualization, networks and storage, cloud storage, and programming models. Discuss the motivating factors, security. Data science concepts, techniques, and tools to support big data analytics, cloud computing, parallel algorithms, non-relational databases, and high-level language support.

Map Reduce programming model, Indicative Content on Cloud computing, web programming and virtual machine utility computing environments to data-driven discovery and scalable data processing for scientific applications. overview of web programming exposing ,tools and knowledge to create a website, programming languages for web, programming the browser, manipulating windows, security pitfalls and basic solutions. All content developed on specialization in Actuarial science and Demography.