



Re-Accreditation Master in Applied Data Science – Report



General Information

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Name of President of the School (there is no parent institution):

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Programme Management:

Vera Schenderlein, Programme Manager
Prof. Dr. Gregory Wheeler, Academic Director

Study Programme:

Master in Applied Data Science (M.Sc.)

Date of Programme Audit:

19.03.2021 (programme presentation)
25.03.2021 (programme assessment)
11.05.2021 (decision on programme accreditation by the Accreditation & Continuous Improvement Committee)

Auditors:

External Faculty:	Paolo Spagnoletti, Associate Professor, Department of Business and Management, Luiss
Business representative:	Alexandre Thill, Ximalia
Student:	Brunella Barrera, Intake 2019
External Student:	Kevin Bauer, Goethe-Universität
Alumnus:	Dominik Bette

Audit Result:

In the conformity check ("formale Kriterien") not all criteria were fulfilled and one condition regarding the recognition of academic competencies was imposed. In the assessment of the curriculum and concept part ("fachlich-inhaltliche Kriterien") all criteria were fulfilled.

Master in Applied Data Science Programme Profile

Degree	Master in Science			
Type of study	Presence	<input checked="" type="checkbox"/>	Blended Learning	<input type="checkbox"/>
	Full time	<input checked="" type="checkbox"/>	Intensive	<input type="checkbox"/>
	Part time	<input type="checkbox"/>	Joint Degree	<input type="checkbox"/>
	Dual	<input type="checkbox"/>		<input type="checkbox"/>
	Extra-occupational	<input type="checkbox"/>		<input type="checkbox"/>
	distance learning	<input type="checkbox"/>		<input type="checkbox"/>
Standard period of study in semesters	4 Semesters 3 semesters for FS Bachelor students (B.Sc.)			
Number of ECTS credits awarded	120 ECTS (four semester track) 90 ECTS (three semester track FS Bachelor (B.Sc.))			
Assignment of the study programme	consecutive study programme			
Profile type	research-oriented			
Start of study on (date) first year it was offered?	07.09.2018			

First accreditation (date)	06.02.2019
Re accreditation (date)	

1. Programme Name and Degree:

Master in Applied Data Science (M.Sc.)
(Consecutive programme)

2. Qualification Goals and Learning Outcomes

Learning Goal 1

Expert Knowledge and Understanding of Applied Data Science

Graduates will have an in-depth knowledge and a critical understanding of the key theories, principles and methods in Data Science. They will be able to identify, analyse and evaluate complex data problems.

Learning Objective 1

Students will demonstrate an in-depth understanding of fundamental key theories, principles and methods in Data Science.

Learning Objective 2

Students will critically assess and reflect complex problems in data science with analytical and conceptual rigour.

Learning Goal 2

Application of Analytical Techniques and Machine Learning Algorithms to Solve Complex Data Problems in Business

Graduates will have the ability to construct and critically assess computational, data-driven models to solve complex data problems in Business.

Learning Objective 1

Students evaluate the relevance of different sources of data using quantitative and qualitative methods

Learning Objective 2

Students apply algorithms to build models to find solutions for complex data problems in business.

Learning Goal 3

Effective Communication and Cooperation

Graduates will be able to communicate effectively in academic and/or private business contexts. They will formulate technical problem solutions and represent them in discourse. They are responsible team members who address and reflect different perspectives.

Learning Objective 1

Students will be effective communicators and will write, present, discuss and defend research-based findings in interdisciplinary fields of research and application.

Learning Objective 2

Students will reach common goals by effective cooperation within a team. They will recognize conflict potentials in cooperation with others and reflect on them in the context of situation-overlapping conditions.

Learning Objective 3

Students are able to use data visualisation tools.

Learning Goal 4

Professional and Responsible Behaviour

Graduates are practiced collaborators in business environments. They have a thorough understanding of their ethical and legal responsibilities as applied data scientists. They will base their professional activities on theoretical and methodological knowledge.

Learning Objective 1

Students will understand and reflect on the ethical and societal implications of their recommendations and decisions.

Learning Objective 2

Students are knowledgeable of ethical and legal responsibilities arising from applied data science and artificial intelligence.

On February 18th 2020, the Accreditation & Continuous Improvement Committee approved the learning goals and objectives for all three pre-experience master programmes.

The aim of the Master in Applied Data Science is to equip graduates with the knowledge and skills to succeed in applying computational skills to contemporary business problems and navigate the modern data ecosystem in any field. The recently streamlined and updated learning goals reflect this ambition in specifying learning goals in the areas of Expert Knowledge and Understanding of Applied Data Science (LG1), Application of Analytical Techniques and Machine Learning Algorithms to Solve Complex Data Problems in Business (LG2), Effective Communication and Cooperation (LG3) and the development of Professional and Responsible Behaviour (LG4).

With respect to the academic qualification: the learning goals reflect students' previous academic experience by using this knowledge and skillset to further complement those with the comprehension and application data science (L.O. 1.1, L.O. 1.2, L.O. 4.2 to name but a few). This demonstrates the intended learning outcomes lead to a consecutive master's degree.

With respect to professional qualification: the learning goals clearly reflect the acquisition of specialized knowledge and the application thereof in practice in Learning Goals 3 and 4. This knowledge transfer is ensured in L.O. 3.1 and 3.1 as well as in L.O: 4.1 and 4.2 - always taking into account the achieved learning goals 1 and 2 - in order to prepare graduates for any problem-solving scenario in their professional life.

With respect to personal development: the programme recognizes that personal development and the acquisition of (new) skills is a foundation for success in this field. LG3 and LG4 explicitly measure students' ability to communicate and function in teams, and to develop a responsible, societal and ethical understanding of data science and its ramifications.

In addition to the Core Courses and Electives that cover these Learning Goals, the programmes' extra-curricular offering, such as the varied and numerous student initiatives, strengthens students' interpersonal and networking skills and development.

In summary, the Master in Applied Data Science explicitly encourages the development of academic knowledge, professional and personal skills in the curriculum, in order to generate holistic graduates that are able to succeed in their future positions.

Knowledge and understanding (broadening, deepening and understanding of knowledge)

Graduates will have an in-depth knowledge and a critical understanding of the key theories, principles and methods in Data Science. They will be able to identify, analyse and evaluate complex data problems.

This competency is particularly relevant to and developed in the core modules, such as Algorithms and Data Structures, Introduction to Data Analytics in Business or Computational Statistics and Probability and via various means of teaching, learning and assessment (e.g. projects, programming assignments or exam).

Usage and development of knowledge

Graduates will have the ability to construct and critically assess computational, data-driven models to solve complex data problems in Business.

The application of analytical techniques is at the core of almost all modules in the programme. The Master in Applied Data Science encourages not only to learn, but rather to apply models to the classroom (e.g. Machine Learning I and II, Deep Learning, Visualizing Big Data).

Communication and cooperation

Graduates will be able to communicate effectively in academic and/or private business contexts. They will formulate technical problem solutions and represent them in discourse. They are responsible team members who address and reflect different perspectives.

These competencies are practiced in many modules such as Introduction to Data Analytics in Business or Guided Studies in Financial Management in which students have to do several week-long projects in order to understand and apply the knowledge and skills they have gained in the module. This competency is furthermore at the core of the Cooperation Company Project. Our students are able to test the knowledge they have learned in previous semesters by working on real business use cases together with leading companies in the so-called Cooperation Company Project. Over a period of approx. two months, students will work closely with the company from the start to finish of the project, thus gaining end-to-end, hands-on experience professionally, personally and cooperatively.

Scientific self-image and professionalism

Graduates are practiced collaborators in business environments. They have a thorough understanding of their ethical and legal responsibilities as applied data scientists. They will base their professional activities on theoretical and methodological knowledge.

The development of these competencies is distributed throughout the curriculum and in consequence follows the natural student journey as they grow academically and professionally. The culmination of students' individual awareness of their role in Business and Society can be found in their final project, the thesis but moreover and, what's more, in the core module AI & Humanity – The Ethics of Data Science. On successful completion of this module, students will have a thorough comprehension of central legal and ethical issues surrounding information technologies, as well as the crucial legal and ethical questions we must ask about such technologies. Students will furthermore be able to identify and evaluate legal and ethical problems related to information technologies, develop and critically assess appropriate responses to such problems, and to assess their own evaluative outlook critically. Finally, students will have developed and strengthened their analytic and critical skills, as well as their ability to apply those skills to ethical and legal problems to develop solutions to those problems.

We encourage a lifelong learning mind-set by connecting our students with industry through our Cooperation Company Project and various associations (such as CFA). By participating, students become curious as well as reflective in their doing. During the recent Cooperation Company Projects, the industry partners have unanimously agreed to continue working on the projects. Both students and industry partners have seen and felt the impact and relevance of the projects but also have understood the necessity to continue working on them even after the module has officially ended. Hence, we have promoted our students with intellectual curiosity to take ownership of their learning and to continue, after university or after modules have ended.

Starting from this year Semester 2, PEM students (MoF, MiM and MADS) are taking a specially tailored Entrepreneurship elective with 12 ECTS (88 academic hours) again to focus on developing innovative business ideas and turn their ideas into a business by the time they graduate from the programme. The module continues over three semesters and uses the space of the Electives and thesis period to launch their businesses. Frankfurt School is engaging experts from TechQuartier to provide more hands on mentorship and guidance by engaging successful entrepreneurs relying on TechQuartier's well-established network but the modules are taught by internal expert Faculty in entrepreneurship.

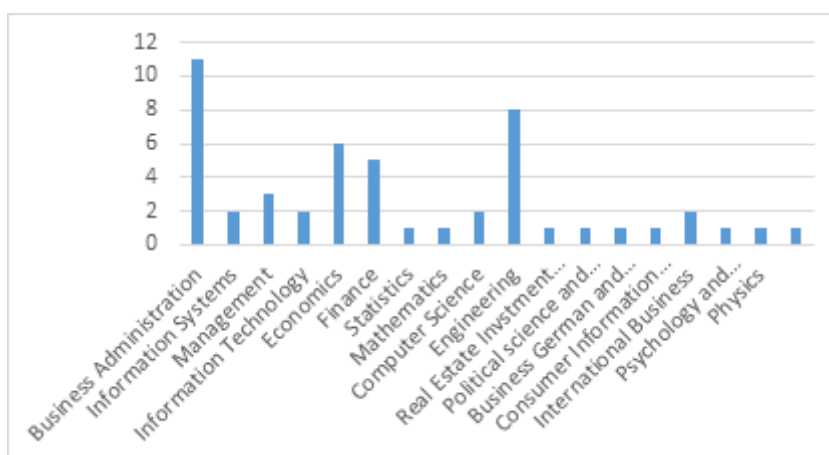
3. Target Group/Student Profile

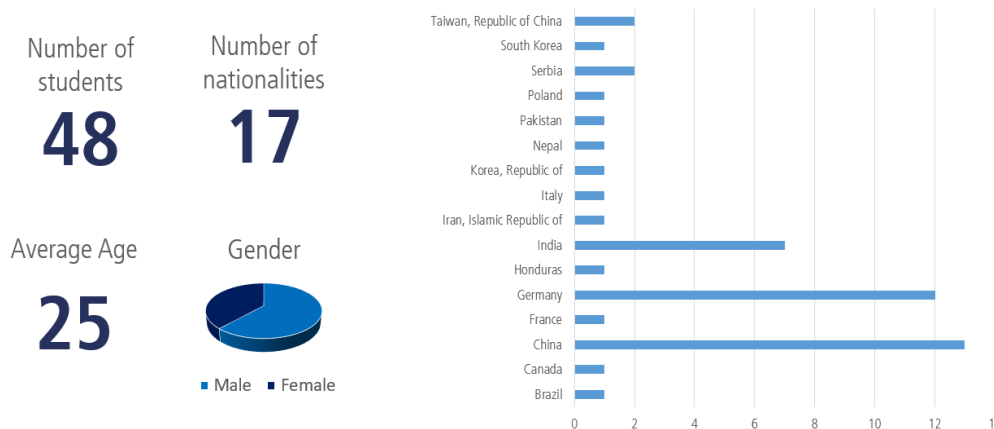
The Master in Applied Data Science is a programme for young, mathematically inclined graduates who wish to build a career in data science. Building on your solid quantitative foundations, you will learn the fundamentals of data science, how to apply cutting-edge methods to solve real-world business problems and assess the ethical and legal implications of applied data science to become responsible practitioners in the field. The programme aims at promoting a combination of quantitative research and analytical skills, as well as cross-functional business collaboration skills, flanked by theoretical knowledge. It prepares students to face the demands from across different industries. As knowledgeable data scientists, our students/graduates will be able to apply computational skills to contemporary business problems and navigate the modern data ecosystem.

In order to be qualified for the programme, however, a bachelor's degree irrespective of discipline is required among other requirements. As such, our students come from diverse and varied perspectives, backgrounds and orientations to thrive within this FS community and the programme.

In addition, programme management together with the Academic Director has sharpened the student profile to an even more mathematical / quantitative profile based on a decision by the Executive Board to be more selective in terms of previous academic experience, however not excluding applicants with a non-data science related background.

Our student body is highly motivated and engaged in the programme and Frankfurt School likewise. We are in constant exchange on programme improvement, events and initiatives.





4. Curriculum (e.g.: main learning content, practical relevance, student mobility, specializations, for POMs and MBAs: explanation of connection between professional qualification and study program concept, etc...)

The Master in Applied Data Science focuses strongly on quantitative / mathematical skills and competences in order to, for instance, deploy machine learning algorithms for the business landscape. As pointed out in 1. Market Positioning, our curriculum is based on four pillars. Pillar one deals with the technology of data science: machine learning, algorithms, deep learning, databases, natural language processing, statistics and cloud computing to name but a few. The second pillar are the business courses on accounting, finance and management. Here, the students get to see how data science influences the business world in terms of processes etc. Ethical and legal ramifications of data science / AI constitute the third pillar. As responsible data scientists, students and graduates need to understand the societal implications of data science and AI. The last and probably most important pillar is the research/application of all three pillars. The application in the business landscape is of crucial importance to the education of our students as is the research conducted by both students and faculty within the programme to constantly push the boundaries and excel further with new ideas.

During semester three, students are able to test the knowledge they have learned in previous semesters by working on real business use cases together with leading companies in the so-called Cooperation Company Project. Over a period of approx. two months, students will work closely with the company from the start to finish of the project, thus gaining end-to-end, hands-on experience to better prepare them to enter the job market.

Currently, our students are working on project with PwC on the development of a live object recognition of the slot cars, development of new scoring methods for driver competitions and improvement of the business card OCR, the dashboard visualizations and the cloud infrastructure.

Another group is working with Deutsche Börse on the goal of using order flow data of different market participants to provide unique insights into Xetra market dynamics and sentiment.

A third group is working with Ximalia to collect, clean, and prepare satellite data that measures the vegetation health, moisture of soil and ground heating on a global scale, to analyse the data for selected regions of the world to understand the general development of the vegetation in these regions, to correlate the insights with tourism activity in these regions to understand how the tourism industry contributed to the change of the health of the vegetation and to develop a universal framework for times series prediction of future developments of the vegetation health under the influence of the tourism industry.

During their last semester, the students of the Master in Applied Data Science have the opportunity and possibility to study abroad.

Frankfurt School partners with 80+ universities worldwide that are primarily focused on business and management and giving our students the opportunity to gain comparative viewpoints, diverse cultural and study environments and to widen their international network. This gives you the chance to immerse yourself in a new environment that prepares you for a global career.

In order to ensure the qualification level, students applying for study abroad must have their chosen modules pre-approved by the international office and programme management by submitting the respective module descriptions incl. learning outcomes, assessment etc.

5. Didactic Concept

The School's approach to teaching is on student-centered learning. Teaching shall be interactive, fostering, in particular, collaborative student learning. Consequently, the intrinsic quality of the student body is a decisive factor for the quality of learning outcomes of all students. As such, Frankfurt School aspires towards attracting highly competitive student groups. The following is based on the assumption that groups are, indeed, competitive and able to utilise peer-learning. Frankfurt School applies and strives for a continuous improvement regarding the use of modern teaching methods. As the School's approach to teaching has always been interactive, the methodological focus of the majority of the degree programmes is primarily on classroom teaching, supplemented by online elements.

The School's faculty maintain an open door policy, providing for ample student/faculty interaction. Students are encouraged to learn from one another through regular group learning exercises such as group presentations, simulations and business games. Through the use of such exercises, students are able to bridge theory and practice, combining theoretical business concepts with real world business scenarios. Moreover, teamwork is to be furthered, which the School considers one of the most critical elements of education in preparation for a successful future career. At the same time, great attention is paid to analytical and methodological topics. As an example, in order to further support learning success in these fields, undergraduate students are offered real life applications in the School's Financial Lab, which utilises Reuters and Bloomberg applications. Such exercises allow students the opportunity to analyse topics using multiple – often international – perspectives, furthering their understanding of a given concept. A variety of pedagogical approaches are integrated into delivery of the pre-experience master's programmes. All learning is and should continue to be based on considerable instructor/ student interaction, as well as peer-to-peer learning. Effective problem solving is a common focus of all teaching methodologies. Compared to the undergraduate level, students should be more frequently confronted with unexpected problems, foreign contexts and issues. Students are exposed to real business situations and simulated future career challenges. An additional didactic approach pertains to the School's attention to developing students' communication skills. Modules should include structured discussions as well as single or group presentations in their delivery. Students should be strongly encouraged to learn from their peers at other schools through participating in various challenges and competitions.

6. Study Format (presence, blended-learning, 3-day module, etc...)

The duration of the programme is four semesters with 120 ECTS altogether resulting in a Master of Science (M.Sc.)
The language of instruction of the programme is English.

The lectures in the programme are organised according to the 3day model (Thursday, Friday and Saturday) which gives students the opportunity to work part-time three days a week while studying full-time. Apart from our highly qualified and esteemed faculty, high-profile practitioners and experienced specialists from the data science world teach in the programme.

Programme Accreditation at Frankfurt School

Programme accreditation at Frankfurt School is conducted by means of cluster audits, where sensible. Related academic programmes move through the audit process together. This allows for individual programme assessments, but also for cross-programme takeaways and identifying cross-programme improvement measures where necessary. The Master of Applied Data Science is part of a cluster audit, together with the Master of Finance and the Master in Management.

The aim of the audit is to assure the compliance with legal regulations and quality standards, to evaluate the programmes curriculum with its learning outcomes and to continuously improve and develop the academic programme to meet Frankfurt School's claim for excellence. It is conducted as follows:

- (1) The Quality Assurance Officer of Frankfurt School conducts one part of the audit, assessing whether the academic programme is compliant with all relevant regulations and standards.
- (2) An external auditor group assesses the programme's curriculum and concept, the programme delivery and the continuous improvement of the programme. The external auditor group is composed of relevant stakeholders and peers, taking different perspectives into account.

The assessment is based on the self-report of the respective programme, including the relevant documentation. As a result of the assessment, the following can be imposed:

- Criterion is fulfilled
- Recommendation: Criterion is overall fulfilled but there is room for thought/improvement
- Condition: Criterion is not fulfilled

An overall positive assessment leads to the accreditation of the respective academic programme.

The underlying regulations of the audit are:

- Studienakkreditierungsverordnung des Landes Hessen (Musterrechtsverordnung)
- Hessisches Hochschulgesetz (HHG)
- Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG)
- ECTS Guidelines
- Lisbon Convention
- Frankfurt School: General Course and Examination Regulations (GCER) and Specific Programme Regulations, Bylaws
- Qualifikationsrahmen für Deutsche Hochschulabschlüsse (HQR)
- Deutscher Qualifikationsrahmen/Europäischer Qualifikationsrahmen (DQR/EQR)
- AACSB 2020 Guiding Principles and Standards
- EQUIS Standards & Criteria

Due to the current COVID 19 situation, on-site visits were conducted online.

Results

(1) Conformity Check

The overall impression by the quality assurance officer was positive. In the conformity check ("formale Kriterien") not all criteria were fulfilled and one condition was imposed regarding the recognition of academic competencies. The recognition of academic competencies was not compliant with the FS procedure which is based on the Lisbon-Convention.

Recommendations concerning the following topics were made: (1) clearer recruitment and admission process, (2) review the process of updating the diploma supplement, (3) the review module description, (4) clearer template for qualification of external lectures is required.

The quality assurance officer recommended the re-accreditation of the Master in Applied Data Science.

(2) Assessment Curriculum and Concept

The overall impression of the Master in Applied Data Science was very positive and the external auditor group sees an asset for Frankfurt School in the programme. In the assessment of the curriculum and concept part ("fachlich-inhaltliche Kriterien") all criteria were fulfilled. The external auditor group imposed no conditions and highlighted the following points: the diversity and small size of the classes are a great benefit, Frankfurt School really cares about the feedback of students, the resources and the learning environment are great. In addition, it was also mentioned that the professors taking into account, that the students have different backgrounds, which can be challenging.

Recommendations concern the following topics: (1) business classes should be more related to data science, (2) workload distribution should be more balanced over the semester, (3) think about further development of content in some cases e.g. more entrepreneurship, (4) clear communication of requirements and expectations in the beginning of the programme (recruitment/admission), (5) think about actions regarding not satisfactory teaching evaluation results, (6) offer more opportunities to go abroad, (7) better/more Career Service offerings for data scientists and more exposure to business partners, (8) explore double degree opportunities, (9) improve literature resources in the library.

The external auditor group recommended the re-accreditation of the Master in Applied Data Science.

Decision of Programme Accreditation

Based on the results of

- (1) the conformity check by the Quality Assurance Officer and
- (2) the assessment of the external auditor group

the Accreditation & Continuous Improvement Committee decided on the re-accreditation of the Master in Applied Data Science on 11 May 2021.

With unanimous votes, the following decision was made:

The Master in Applied Data Science will be accredited for a period of 8 years (until 31 May 2029) and the seal of programme accreditation of the "Akkreditierungsrat" will be awarded. A "Kompaktverfahren" has to be conducted after 4 years (until 31 May 2025).

Programme Management was given 6 weeks' time (until 22 June 2021) to formally object against this decision or against conditions and recommendations. No objections were raised.

Programme Management has to define the improvement measures and their implementation. Within one year Programme Management has to present the results to the Accreditation and Continuous Improvement Committee (by May 2022).