



University College Dublin

REVIEW GROUP REPORT

Periodic Quality Review

UCD School of Mechanical and Materials Engineering

January 2023

Accepted by the UCD Governing Authority at its meeting on 24 October 2024

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Key Findings of the Review Group

The Review Group has identified a number of key findings in relation to areas of good practice operating within the UCD School of Mechanical & Materials Engineering and also areas which the Review Group would highlight as requiring improvement.

Examples of Good Practice

The Review Group identified a number of commendations in particular:

1. The RG commend the School for its hard-working and dedicated staff delivering high class education and research. (Commendation 3.14)
2. The gender distribution in the student body is 30% female, which is excellent for an engineering subject and the position here has been improving over time. This has been driven by good, sensibly targeted outreach activities such as promoting careers in science and engineering in both primary and secondary schools and is to be commended. (Commendation 4.12)
3. Internships (compulsory for Master of Engineering, but not for Bachelor of Engineering offerings) are a huge strength and are highly valued by students and employers alike. The scheme provides significant opportunities for students to see engineering in practical application and has also encouraged additional interactions in research and project work between the School and industry partners. (Commendation 5.10)
4. Graduates from the School are highly sought after by employers who identified good understanding of fundamental principles and independent problem solving as key distinguishing features of the School's graduates. (Commendation 5.11)
5. The RG commend the School for the significant growth in the School's research activities including postgraduate research and postdoctoral numbers and increased international collaborations. For example, the Horizon 2020 Marie Skłodowska-Curie Innovative Training and the joint UK and Science Foundation Ireland (SFI) PhD programme on Metallurgical Challenges for the Digital Manufacturing Environment. (Commendation 6.14)
6. All newly recruited members of the School's faculty have strong research focuses, strengthening research initiatives at the School. (Commendation 6.16)

Prioritised Recommendations for Improvement

The Review Group suggest that the following recommendations be prioritised:

1. Given the growth in size and complexity of the School since the last Periodic Quality Review, the RG recommend the School revises its management and organisational structure to reflect the growth and increase effectiveness and efficiency. (Recommendation 2.15)
2. The RG recommend that the School prepares a school plan that covers a 3-to-5-year cycle. The plan should concisely consider strategic aims and operational approaches. This plan should then be monitored and progressed in the context of the annual university strategy and planning cycle. (Recommendation 2.16)
3. The RG recommend the School develop an internal mentoring scheme to support early career academic staff with mentors, ideally allocated from the same research area. Mentoring for postdoctoral students should also be considered. (Recommendation 3.18)
4. The RG recommend the School, supported by the College and the University, should develop a sustainable capital programme for procurement or upgrade of undergraduate laboratory equipment. (Recommendation 3.23)
5. The RG recommend the School engage in greater review and oversight of student workload, assignment weightings and deadlines across all modules. As part of this regular review, the RG recommend that where adjustments to assessments are made, this is communicated back to the student body. All module assessment timelines and assignments should also be made available to students as early as possible through the Brightspace VLE to allow them to plan their workload. (Recommendation 5.13)

1. Introduction and Context

Introduction

- 1.1 This report presents the findings of a quality review of the UCD School of Mechanical & Materials Engineering University College Dublin, which was undertaken in October 2022. The School response to the Review Group Report is attached as Appendix 1.

The Review Framework

- 1.2 Irish Universities have collectively agreed a framework for their quality review and quality improvement systems, which is consistent with both the legislative requirements of the Qualifications and Quality Assurance (Education and Training) Act 2012, and international good practice (e.g., Standards and Guidelines for Quality Assurance in the European Higher Education Area, 2015). Quality reviews are carried out in academic, administrative and support service units.
- 1.3 The purpose of periodic review is to assist the University to assure itself of the quality of each of its constituent units, and to utilise learning from this developmental process in order to effect improvement, including:
- To monitor the quality of the student experience, and of teaching and learning.
 - To monitor research activity, including management of research activity, assessing the research performance with regard to research productivity, research income, and recruiting and supporting doctoral students.
 - To identify, encourage and disseminate good practice, and to identify challenges and how to address these.
 - To provide an opportunity for units to test the effectiveness of their systems and procedures for monitoring and enhancing quality and standards.
 - To encourage the development and enhancement of these systems, in the context of current and emerging provision.
 - To inform the University's strategic planning process.
 - The output report provides robust evidence for external accreditation bodies.
 - The process provides an external benchmark on practice and curriculum.
 - To provide public information on the University's capacity to assure the quality and standards of its awards. The University's implementation of its quality procedures enables it to demonstrate how it discharges its responsibilities for assuring the quality and standards of its awards, as required by the Qualifications and Quality Assurance (Education and Training) Act 2012.

The Review Process

1.4 Typically, the review model comprises four major elements:

- Preparation of a self-assessment report (SAR)
- A visit by a Review Group that includes UCD staff and external experts, both national and international. The site visit normally will take place over a two- or three-day period
- Preparation of a review group report that is made public
- Agreement of an action plan for improvement (quality improvement plan) based on the Review Group report's recommendations. The University will also monitor progress against the improvement plan

Full details of the review process can be found on the UCD Quality Office website: www.ucd.ie/quality.

The Review Group

1.5 The composition of the Review Group for the UCD School of Mechanical & Materials Engineering was as follows:

- Professor Alexander Evans, former Dean of Agriculture and Head of the School, School of Agriculture & Food Science, Chair
- Dr Rob Sands, Deputy Head of School, UCD School of Archaeology, Deputy Chair
- Professor Ekaterina Pavlovskaja, Professor of Engineering and Head of School of Engineering, University of Aberdeen
- Professor Angus Wilkinson, Professor of Materials, Department of Materials, University of Oxford

1.6 The Review Group visited the School in person from 11 to 13 October 2022 and held meetings with School staff, undergraduate and postgraduate students, graduates, employers, other University staff, and also visited School facilities in the Engineering building. The site visit schedule is included as Appendix 2.

1.7 In addition to the Self-assessment Report, the Review Group considered documentation provided by the School and the University during the site visit.

1.8 This Report has been read and approved by all members of the Review Group.

Preparation of the Self-assessment Report (SAR)

1.9 Following a briefing from the UCD Quality Office, a Self-assessment Report Coordinating Committee (SARCC) was established by the School.

1.10 The SAR was prepared in the period September 2021 – January 2022. Staff were consulted during the process with specific aspects of the report discussed in various fora. The final draft report was developed by the SAR Co-ordinating Committee reflecting the various inputs with individual members taking responsibility for chapters of the report. All staff were given the opportunity to comment and contribute to the final report.

- 1.11 The Review Group site visit, originally planned for Spring 2022, was postponed to Autumn due to Covid-19 challenges. A document providing a brief update to the SAR was provided in October 2022.
- 1.12 The Review Group found the SAR to be of high quality and very important in preparing them prior to the site visit. It provided both factual content on the School and also analysis and commentary that assisted the Review Group in their understanding of the School.
- 1.13 The Review Group appreciated the quick and helpful responses by the School in providing additional data upon request during the review process.

The University

- 1.14 University College Dublin (UCD) is a large and diverse university whose origins date back to 1854. The University is situated on a large modern campus about 4 km to the south of the centre of Dublin.
- 1.15 The University Strategic Plan (2020 to 2024) states that the University's mission is: "to contribute to the flourishing of Dublin, Ireland, Europe and the world through the excellence and impact of our research and scholarship, the quality of our graduates and our global engagement; providing a supportive community in which every member of the University is enabled to achieve their full potential".

The University is currently organised into six colleges and 37 schools:

- UCD College of Arts and Humanities
- UCD College of Business
- UCD College of Engineering and Architecture
- UCD College of Health and Agricultural Sciences
- UCD College of Social Sciences and Law
- UCD College of Science

- 1.16 As one of the largest universities on the island of Ireland, UCD supports a broad, deep and rich academic community in Science, Business, Engineering, Health Sciences, Agriculture, Veterinary Medicine, Arts, Law, and Social Sciences. There are currently more than 33,000 students on our UCD campus, with approximately 18,000 undergraduates, 12,600 postgraduates and 2,200 Occasional students. This includes over 9,500 international students from 152 countries. In addition, UCD has almost 5,200 students studying UCD degree programmes on campuses overseas. Undergraduate degree students have the choice of 38 entry routes on offer via the CAO system, while UCD offers many other options at graduate level.

UCD School of Mechanical and Materials Engineering

- 1.17 The UCD School of Mechanical & Materials Engineering has been in existence in its current form since a restructuring in September 2011. The SAR notes prior to this, the School's activities were carried out under the auspices of the UCD School of Electrical, Electronic and Mechanical Engineering .
- 1.18 The UCD School of Mechanical & Materials Engineering (SMME) is one of six that comes under the umbrella of the College of Engineering and Architecture. SMME is the largest of the five engineering Schools.
- 1.19 The School's staff FTE profile includes Full Professor (6.8), Professor (4), Associate Professor (6), Lecturer/Associate Professor (13), Other Academic/Teaching (1). The overall FTE total of 30.8 has a gender distribution of 90% male and 10% female (March 2022 School Profile data provided by the School).
- 1.20 The School has a professional staff FTE of 1.5 and technical staff FTE of 8 (data provided by the School, October 2022).
- 1.21 The School's student FTE has grown from 491 (2016/17) to 575 (2020/21) and has 26% of the total FTE across the five engineering programmes and other UCD schools contributing modules to the various degree programmes (data provide by the School).
- 1.22 The School offers taught programmes at both undergraduate (Bachelor of Engineering (BE)) and postgraduate (Masters Engineering (ME), Masters Engineering Science (MEngSc)) level. Programmes include BE Biomedical Engineering, BE Mechanical Engineering, ME Biomedical Engineering, ME Energy Systems, ME Mechanical Engineering, ME Manufacturing Engineering, ME Management (part time), MEngSc Materials and Science, MEngSc Engineering Management and Postgraduate Diploma.
- 1.23 The School is also a key contributor to the newly formed Advance Centre for Professional Education and also offers a BE programme as part of a newly established joint college in Xi'an, China known as the Chang'an - Dublin International College (CDIC).

2. Organisation and Management

General Comments and Context

- 2.1 The RG noted considerable growth of the School since the last Quality Review in 2014. In the last five years, the School has grown from overall staff FTE of 72.1 (March 2018) to FTE 84.3 (March 2022). (Data provided by the School).
- 2.2 The School is loosely organised by Subjects (Mechanical, Materials, Systems, and Biomedical (with SEEE)) however this is not a management structure. The RG noted, as was commented on by a number of staff during the site visit, that the now large School is managed using a small school structure.

- 2.3 The School is led by a Head of School with a number of other Heads (e.g. Teaching & Learning (T&L), Research, Impact, & Innovation (RII), Equality, Diversity & Inclusion (EDI), as well as Subject Heads and Programme Directors.
- 2.4 The School Executive is described as the key governance and decision-making committee for the School. It has a large membership and meets monthly.
- 2.5 The School Council meetings are held monthly and all members of staff in the School are invited. The RG noted that these meetings not only inform staff about issues of the day, they also serve as a forum where all issues for the School are discussed.
- 2.6 The School has a number of committees (e.g. Research Innovation & Impact, Equality, Diversity & Inclusion, Health & Safety), however the RG understood from meetings with the School that much of their work is operational rather than strategic and that there are no specific terms of reference for the committees.
- 2.7 The School has an Industry Advisory Board which was established in 2019, consisting of 10 members, five from industry and five from the School. While the School notes the potential of the Board from a strategic perspective and have good ideas on how to best leverage it, the Board has not convened since the start of the Covid-19 pandemic. The RG found equal willingness from industrial stakeholders they met during the visit to contribute and support the School. The RG noted that it would be important to ensure engagement at the correct level and for the Board to have clear terms of reference.
- 2.8 The RG found the overall financial position of the School to be good. A small deficit is projected for this academic year with significant surpluses projected for future years.
- 2.9 The School engages in the University strategy and planning cycles that take place in Q1 each year and summarises the School's achievements to date. The RG found that the process works to mainly satisfy budgetary planning for the next financial year with a five-year look ahead. The RG noted opportunities for the School to also focus on long-term planning.
- 2.10 The SAR noted that "workload is broadly uniform for each academic staff member" and the RG understood from discussions there is currently no accepted workload model in place in the School.
- 2.11 The School, in collaboration with six other Schools with the College of Engineering and Architecture, was awarded an Athena Swan Bronze award in 2018.

Commendations

- 2.12 There has been very good and committed leadership in the School which is commendable.
- 2.13 The RG commend the School faculty and staff at all levels who are collectively committed to ensuring the success of the School.
- 2.14 The RG commend the School for the Athena SWAN Bronze award, which is a great achievement.

Recommendations

- 2.15 Given the growth in size and complexity of the School since the last Periodic Quality Review, the RG recommend the School revises its management and organisational structure to reflect the growth and increase effectiveness and efficiency.
- 2.16 The RG recommend the School prepares a school plan that covers a 3-to-5-year cycle. The plan should concisely consider strategic aims and operational approaches. This plan should then be monitored and progressed in the context of the annual university strategy and planning cycle.
- 2.17 The RG recommend that the School reconsider the membership of the School Executive to comprise members with posts of responsibility (mainly directors) and elected members (one representing each of the faculty, technical and professional staff). Members with posts of responsibility should then chair sub-committees of the School Executive.
- 2.18 The RG recommends that specific Terms of Reference are created for each of the School committees (subcommittees of the School Executive or Programme Board). These need not to be long however they should include both operational and strategic roles.
- 2.19 The RG recommend the School reactivate the School Industry Advisory Board with a brief Terms of Reference.
- 2.20 The RG recommend the School establish and use a workload model for academic staff.

3. Staff and Facilities

General Comments and Context

- 3.1 The School has recruited a significant number of additional faculty since the last periodic Quality Review, with an increase from FTE of 62.6 (Mar 2018) to FTE of 73.8 (Mar 2022) (data provided by the School).
- 3.2 This significant growth was not fully supported by the increase in professional (0.5 FTE increase from last review to 2.5 FTEs) and technical staff (increase of 1 FTE from 7 in 2016/17 to 8 FTEs). Additional professional and technical posts were recently approved and the School is currently recruiting 3 academic, 2 professional (1 replacement) and 2 technical members of staff to be in place before the end of 2022.
- 3.3 The School managed to maintain the student:staff ratio below 20 despite the significant growth in the student numbers from 491 in 2016 to 575 in 2021. Several new appointments were made since the last quality review in 2014 including two new Full Professor appointments (1 female) and 3 female appointments to Lecturer/Assistant Professor posts in 2021. 2022 (data provided by the School).

- 3.4 10 Occasional Lecturers, recruited from senior industry practitioners, deliver specialised material primarily for the part-time ME Management programme to enhance the student learning experience. The appointment of adjunct faculty also helps to reduce pressure on the School's academic staff and is important to building and maintaining strong strategic alliances with external universities, research institutes and business partners.
- 3.5 The RG noted that a significant number of the School's faculty have leadership roles at the College and the University level. These include, College Head of Safety, College representative on UCD's Graduate Research Board, Academic Council Executive, Academic Council Student Conduct Panel, Academic Council Quality Enhancement Committee, Board of Studies.
- 3.6 There has been a sustained increase in the number of research staff in recent years from 36 in 2017 to 47 in 2021 (data provided by the School).
- 3.7 The RG noted that while the School engages with the University P4G system it does not have a formal mentorship scheme.
- 3.8 The School has been locally supported by 2.5 FTEs of professional staff, shared between two Schools, however the staffing numbers have recently been temporarily reduced (due to the recent departure of one person).
- 3.9 The split of responsibility between the Schools seems to work well and has historically arisen as a result of the two Schools who were originally merged into one thereby aligning processes and responsibilities. Although the Schools have once again been separated the impression from the SAR and the RG meetings is that the processes and responsibilities of the office have remained aligned.
- 3.10 The RG found clear evidence that the School Office staff are very well regarded and the function of the office is highly valued. However, based on their meetings and the SAR, the RG found that the current staffing level has left the School Office over stretched.
- 3.11 While it was apparent to the RG the good cooperation between technical staff, it was also noted their limited numbers relative to the growth of the School and consequent impact on overall workload.
- 3.12 As noted in the introduction to this report, the RG visited School facilities in the Engineering building, including laboratory and teaching spaces. Overall, the RG found the facilities in the School are satisfactory; however the RG identified a diversity of quality in the equipment and facilities available to staff and students in the School. In particular, the RG noted:
- outstanding state-of-the-art and one-of-a-kind equipment for research and projects.
 - some of the equipment for undergraduate teaching needs to be upgraded.
- 3.13 The RG were therefore pleased to note that since completion of the SAR, the School was able to secure substantial funds in the internal UCD Equip funding round for equipment and also allocated significant internal funding to improve the School's lab facility and equipment (with commitment to be spent in 2022).

Commendations

- 3.14 The RG commend the School for its hard-working and dedicated staff delivering high class education and research.
- 3.15 The RG commends the School's professional staff for their role in supporting the School, especially during a period of major School growth and through the disruption caused by the Covid-19 pandemic.
- 3.16 The RG commend the very skilled technical staff and it was evident to the RG they are carrying a high workload serving both students and researchers.
- 3.17 The RG commend the good cooperation between technical staff members in sharing expertise.

Recommendations

- 3.18 The RG recommend the School develop an internal mentoring scheme to support early career academic staff with mentors, ideally allocated from the same research area. Mentoring for postdoctoral students should also be considered.
- 3.19 The RG encourage the School to work with the College and University to increase the number of technical staff to reflect the recent growth in teaching and research activities following the increased academic staff and student numbers.
- 3.20 The RG recommend that the Schools that are sharing the professional staff urgently increase the number of professional staff to at least their current full complement (i.e. replace those leaving). Their roles and responsibilities should be clearly defined allowing for an appropriate cover during sickness and holiday absences.
- 3.21 Following on from above, the RG recommend that the School might reflect on how it best supports the staff in the School office so that the expectations of faculty are managed and the workload of School office staff balanced. This is particularly important in the context of a rapidly growing school.
- 3.22 The RG understood there are plans for reconfiguration of the School Office space and recommend this be acted upon as soon as it is possible
- 3.23 The RG recommend the School, supported by the College and University, develop a sustainable capital programme for procurement or upgrade of undergraduate laboratory equipment.
- 3.24 Given the growth in size, the RG encourage the School to work with the University to address the shortage of lab and office space, potentially ensuring allocation of additional space in the planned new buildings in the medium/long term. In the short term, the use of the currently available space should be further optimised to make better use of centrally available collaborative provision for student group work and centrally timetabled teaching spaces.

4. Teaching, Learning and Assessment

General Comments and Context

- 4.1 As noted in the Introduction of this report, the School delivers a broad range of taught programmes with offerings at BE, BSc, ME, MEngSc levels, covering Mechanical Engineering (BE & ME), Biomedical Engineering (BE & ME), Materials Science and Engineering (ME & MEngSc), Engineering Management (ME & MEngSc), Engineering with Business (ME), Energy Systems Engineering (ME), with Manufacturing Engineering (ME) starting in 2022.
- 4.2 The SAR also notes that the School has both the largest Stage 1 intake of any Engineering course in Ireland, and the highest proportion of students at undergraduate and postgraduate taught masters level across the five engineering Schools in the College. (FTE 566.1 – 26.4% overall FTE November 2021, data provide by the School).
- 4.3 The SAR also noted that the standard of undergraduate students entering the DN150 programme has consistently required the highest number of CAO points for entry to their programmes (with the average student scoring around the top 95th percentile of CAO points). Also, all students entering via CAO must achieve a minimum of H4 in Higher-Level Mathematics.
- 4.4 New initiatives started since the last quality review are contributions to the Advance Centre for Professional Education and the delivery of a BE programme in Automotive Engineering through the joint college in Xi'an, China known as the Chang'an – Dublin International College (CDIC). These have not yet seen a cohort complete their studies, however intake at CDIC in the first two cohorts is strong (115 students each year).
- 4.5 As with most higher education institutes, the usual delivery mechanisms for teaching, learning and assessment have been disrupted by Covid-19 restrictions. A significant proportion of module content is delivered through lectures (now moved back to in-person for the most part), and this is supported by hands-on practicals and demonstrations in laboratories. Group project work is also used.
- 4.6 End of semester written examinations form the major component of assessment in most modules. There is continuous assessment through reports on laboratory work and other written assignments, which vary in number and length, and also contribute to varying extents in different modules.
- 4.7 A number of the School's academics are strongly engaged with college-wide activities for developing and deploying innovative teaching methods that are coordinated by the College's Educational Technologist. Examples include university-wide meetings of School Heads of Teaching & Learning (SHTL) and College Vice-Principal of Teaching & Learning (VPTL). Given growth in student numbers and pressure on laboratory and teaching space, further adaptation in teaching modes could bring large benefits.
- 4.8 Data provided by the School on any gender gap in outcomes for undergraduate and postgraduate education indicate opportunities for improvement.

Commendations

- 4.9 Staff across academic, technical and professional support functions all show commendable commitment to providing a high-quality learning environment for their students. This is reflected in the excellent end of module student survey responses.
- 4.10 The RG commend the School for maintaining the highest academic record within the intakes of new students while making significant growth in student numbers.
- 4.11 The numbers continuing from a general stage one provision into educational pathways provided by the School have grown and is commendable.
- 4.12 The gender distribution in the student body is 30% female, which is excellent for an engineering subject and the position here has been improving over time. This has been driven by good, sensibly targeted outreach activities such as promoting careers in science and engineering in both primary and secondary schools and is to be commended.

Recommendations

- 4.13 The School's success in growing student numbers presents challenges and the RG recommend the School continue to adopt innovative ways to extract the most impact from physical and human resources in its delivery of practical work in the laboratories. The challenge here is to innovate in how labs are delivered. The implemented pre-recorded video introductions is a good initial step however the RG recommend the School consider use of more simulation and team-based projects.
- 4.14 Increased student numbers may also place strain on communications. The RG recommend the School consider ways it can benefit more strongly from the excellent student body by better capturing their voice and communicating back the outcomes of their engagement. For example, giving students greater representation on formal committees and the establishment of a staff:student liaison committee.
- 4.15 The RG recommend the School consider ways in which female members of academic staff could be more visible to the student body. Recent hires have improved the gender balance in academic staffing however ensuring these role models are visible to students regardless of modules selected is important. Any such activities must be reflected significantly in workload models.
- 4.16 The RG recommend that possible gender gaps in marks and any possible root cause in modes of content delivery and assessment should be assessed on a regular basis. This may also feed into the Athena SWAN action plan.

5. Curriculum Development and Review

General Comments and Context

- 5.1 As noted in Chapter 4, the School has established multiple taught degrees delivered on the Belfield campus with BE programmes at level 8, and ME programmes at level 9 of the National Framework of Qualifications. The BE in Automotive Engineering is delivered only at CDIC to Chinese nationals.
- 5.2 Following the 2014 quality review, a new core module Introduction to Engineering Computing was made available. This provides students with skills in use of Excel and Matlab, which are used in subsequent modules.
- 5.3 Senior leadership in the School articulated a clear vision behind the programmes recently launched and the RG found this to be well-aligned to the national landscape and needs expressed by government and industrial stakeholders.
- 5.4 The SAR notes overall oversight and governance of each of the undergraduate programmes rests with a Programme Board in line with UCD Academic Regulations. Programme Steering Committees also exist for each programme and deal with academic management, though it appears that many decisions are devolved down to module coordinators.
- 5.5 Students who met with the RG during the site visit expressed preference for reduced weighting of final examinations, which echoes the views expressed in the last quality review of the School in 2014. Such a move might contribute positively to student well-being and may also reduce the reward available for last minute revision which is often not retained as embedded deep learning. The RG also noted concerns about student workload.
- 5.6 External Examiners are encouraged to provide detailed commentary on module development and delivery, in addition to marks moderation and grade boundaries. This leads to frequent and regular discussion of curriculum among faculty.
- 5.7 From a curriculum development perspective, the RG noted the School's positive engagement with the Athena SWAN College bronze award in 2019.
- 5.8 The RG found evidence in the SAR and in meetings with stakeholders that the School's graduates are highly sought. For example, employers noted good understanding of fundamental principles and independent problem solving as key distinguishing features of SMME graduates from UCD.

Commendations

- 5.9 The RG commend the School's good knowledge of Engineers Ireland policies and initiatives which was evident from discussions and data provided, as was the School's significant effort in ensuring that accreditation requirements are met or exceeded.
- 5.10 Internships (compulsory for Master of Engineering, but not for Bachelor of Engineering offerings) are a huge strength and are highly valued by students and employers alike. The scheme provides significant opportunities for students to see engineering in practical application and has also encouraged additional interactions in research and project work between the School and industry partners.
- 5.11 Graduates from the School are highly sought after by employers who identified good understanding of fundamental principles and independent problem solving as key distinguishing features of the School's graduates.
- 5.12 The RG commend the School's engagement with Equality Diversity and Inclusion in module and programme development – embedding this throughout the curriculum rather than as an 'add on' is a strong approach.

Recommendations

- 5.13 The RG recommend that the School engage in greater review and oversight of student workload, assignment weightings and deadlines across all modules. As part of this regular review, the RG recommend that where adjustments to assessments are made, this is communicated back to the student body. All module assessment timelines and assignments should also be made available to students as early as possible through the Brightspace VLE to allow them to plan their workload.
- 5.14 Although the large number of modules available to students provides them flexibility, it also contributes to increased loading on physical and human resources. With growing student numbers the RG recommend consideration of a school-wide policy on modules with small student numbers so that resources can be concentrated on adding value to core elements, and/or used to enhance research activities.

6. Research Activity

General Comments and Context

- 6.1 The School has made two key hires at full professorial level through the Senior Academic Leadership Initiative (SALI) and the UCD Ad Astra initiative, both European Research Council (ERC) grant recipients. This follows the strategic hire of a Full Professor through the SFI Research Professor funding scheme in 2016.
- 6.2 The School's main research themes are Manufacturing and Materials, Energy, and Biomedical Engineering, however the School also has very broad expertise in a range of other disciplines.

- 6.3 The School houses the Science Foundation Ireland (SFI) Research Centre for Advanced Manufacturing I-Form and several UCD Research Centres, including the UCD Centre for Biomedical Engineering, UCD Centre for Adhesion & Adhesives, UCD Centre for Inclusive Design, UCD Centre for Mechanics, UCD Centre for Micro/Nano Manufacturing Technology and the Bekaert University Technology Centre.
- 6.4 100% of academic staff are classified as being research active.
- 6.5 The School's research funding has been primarily (65%) received through national funding sources which includes Science Foundation Ireland (46.8%), Enterprise Ireland (14.8%), Irish Research Council (3.9%) (data provided by the School).
- 6.6 There have been at least three spin-out companies associated with the School launched in the past three years and several patents licensed to companies.
- 6.7 Academics from the School are coordinating two Horizon 2020 Marie Skłodowska-Curie Innovative Training Networks (MCSA-ITN) funded by the European Union to train Early Stage Researchers - HEADS (Head protection: a European network for Advanced Designs in Safety) and SIMPPER_MedDev (Surface Integrity for Micro/Nano Processing of Polymers: A European Research Training Network for High-Performance Medical Devices) - and a joint UK-SFI PhD programme on Metallurgical Challenges for the Digital Manufacturing Environment.
- 6.8 UCD, represented by the School, has been a full partner in a consortium of the European Institute of Innovation and Technology (EIT) for Manufacturing.
- 6.9 There has been a significant increase in the number of postgraduate researchers and research staff numbers (mainly postdoctoral students and research engineers) by >35% over the past five years.
- 6.10 The researchers in the School are benefitting from research support staff as well as the School Office staff. The SAR notes that the number of research support staff has been decreasing and the School Office already stretched (see also 3.20 above).
- 6.11 The School has appointed a research culture champion which should also further enhance the culture and research performance of the School.
- 6.12 There has been a significant increase of internationally-authored papers from the School (38 in 2016 to 112 in 2020). (Data provided by the School in the SAR).

Commendations

- 6.13 The multi-disciplinary research conducted in the School is excellent contributing to the overall research strength of the School.
- 6.14 The RG commend the School for the significant growth in the School's research activities including postgraduate research and postdoctoral numbers and increased international collaborations. For example, the Horizon 2020 Marie Skłodowska-Curie Innovative Training and the joint UK-SFI PhD programme on Metallurgical Challenges for the Digital Manufacturing Environment.

- 6.15 The RG commend the School's faculty for their overall research output and many are well-recognised internationally for their research.
- 6.16 All newly recruited members of the School's faculty have strong research focuses, strengthening research initiatives at the School.
- 6.17 The School has been very successful in guiding and supporting new academic staff through various external funding opportunities.

Recommendations

- 6.18 The RG recommend the School continue developing their vision for research and the future and the development of a strategic plan to achieve that vision.
- 6.19 The visibility of the School's research activities needs to be improved to further strengthen the School's academic reputation. The RG recommend an increase in staff participation and organisation of significant international scientific conferences as well as enhanced publication strategy should be considered.
- 6.20 The RG recommend the School continue focussing on the impact of their research activities including ensuring the successful development of recently established spin-off companies.

7. Management of Quality and Enhancement

General Comments and Context

- 7.1 The RG notes all engineering programmes require professional re-accreditation by Engineers Ireland every five years and that the School's programmes are fully accredited by external review until 2023 and are currently preparing for the next review.
- 7.2. Programme academic integrity and standards are also overseen by external examiner review, which the School has maintained during COVID. The RG found the School to be aware of and compliant with all formal UCD policy and procedure.
- 7.3 The quality of the programmes and the students was also evident in the employers' feedback.
- 7.4 The School Module Enhancement Committee meetings are held as required and grade distributions reviewed. Programme Steering committees also consider module enhancement for the subsequent year.
- 7.5. The RG found the School is aware of and compliant with university procedures to ensure quality in research, including PhD research processes, Research Ethics, and Research Integrity.
- 7.6. The RG notes that the School considers suitable space to match the expansion in student numbers as well as research activities to be a key challenge in enhancing the student experience of the programmes.

Commendations

- 7.7. The School is fully accredited.
- 7.8 The University external examiners process is followed and the reports reflect positively on the School.
- 7.9 The RG commend the School for the considerable efforts made to enhance the quality of their Health and Safety procedures and have developed a comprehensive School policy on this aspect. The School are proactive in promoting this at College level with a member of faculty chairing the College Health and Safety committee.
- 7.10 The RG commend the School for the feedback from employers and students which reflects well on the School's quality of provision.
- 7.11 In addressing the challenge to enhancing the quality of student experience the School has been proactive in exploring alternative uses of space through a visit to the "Diamond Building" at the University of Sheffield.

Recommendations

- 7.12 The RG noted that the School is clearly compliant with university processes and the programmes are producing excellent graduates and researchers. However, the RG recommend the School consider how its internal management could be structured to maintain and enhance these high standards in the context of the increased size and operational complexity of the School since the last Quality Review.
- 7.13 The RG recommend a review of the current remit of both the Teaching & Learning Committee and the Research Committee in maintaining, driving standards and communicating approaches, needs to be further considered and better defined. In turn the role of these committees and their heads/directors in supporting the Head of School, and the School's decision-making process, could usefully be reflected upon.
- 7.14 There is a well-established university process for monitoring grade entry and reflecting upon grade distribution, that is well followed by the School. However, the RG recommend that the School reflect on how it establishes whether the feedback to students and workload (load and timing), is sufficiently consistent that it enhances the student experience. This could be reviewed through the Teaching and Learning Committee.
- 7.15 The School has done an excellent job of enhancing Health & Safety awareness and policy as noted in the above commendations. The RG recommends the School to continue reflecting on these very positive improvements. In particular as the School is rapidly growing to make sure that the awareness of the policies and procedures is disseminated to everyone in the School.

8. Support Services

General Comments and Context

- 8.1. The support of the College of Engineering & Architecture Office is highly regarded for its efficiency and approach both from a programmatic and a financial perspective.
- 8.2. Particular mention was made of the Internship Manager and there was clear evidence in both the SAR and during the meetings that internships provide a key part of the student experience.
- 8.3. The educational technologist was also praised by the School's faculty, a role that has had particular value and challenge as a result of the pandemic.
- 8.4. The School is also supported by central university services including, UCD IT Services, UCD Research Innovation and Impact Office, UCD Human Resources, UCD Registry, UCD Estates.
- 8.5. The overall tone of the SAR and during meetings was very positive both in terms of the School's appreciation of the support and the support services appreciation of the School. However the RG noted evidence in the SAR and in the meetings that some processes cause issues. One example was the research recruitment process which involves UCD Research Innovation & Impact, UCD Finance, and UCD Human Resources.

Commendations

- 8.6. The RG commends the School for its positive and constructive approach to university support services. It notes that both the SAR and the RG meetings demonstrate many aspects that are working well, all services are generally well regarded and praised. The work required during the pandemic is particularly highlighted with respect to the key role played by Estates and the Culture and Engagement Team, in UCD HR.
- 8.7. The School's very positive mention and interactions with the Peer Mentoring programme, the Student Advisors, the Student Access Centre, and UCD Careers Network was noted.
- 8.8. The switch from Blackboard to the Brightspace VLE and how it was managed by UCD IT Services has also been well received by the School.

Recommendations

- 8.9. The RG noted both in the SAR and in meetings with the School concerns that some aspects of University service provision have become anonymous in recent years. For example, while the need for generic email contacts and digital support hubs is understood, knowing who is responding can help to reintroduce the human element into the system. Some services do respond with a name, others do not. The RG recommend some reflection on this by the University.

- 8.10 For research recruitment, the RG recommend a workflow rather than unit-based approach to avoid siloing of responsibility and unnecessary repetition of input by the Principal Investigator. It is acknowledged that the University is in the process of reviewing these issues and the RG would strongly support these approaches at a university level.
- 8.11 The RG noted the School's request for the re-introduction of the buildings facilities manager role. Given that this role was removed from buildings some while ago, the RG recommend a review of this decision by the University and UCD Estates would be timely, especially in the context of the planned new building and campus transformation plans.
- 8.12 The RG noted the suggestion of an "Opportunities Register" by UCD Estates, and others that might complement the "Asset Register" and "Risk Register". The RG recommend this idea would be worth exploring and could be something that is considered in preparing a multi-year School Plan.

9. Collaborative Educational Provision

General Comments and Context

- 9.1 The School has a number of schemes through which external collaborations contribute to teaching and learning provisions. This portfolio has elements at national and international level and is well-aligned to the core vision of the School's strategy to develop advanced manufacturing, including micro/nano manufacturing, additive manufacturing and digital manufacturing.
- 9.2 The School is a partner in the Advance Centre for which it leads the Digital Manufacturing theme with modules leading to Professional Diplomas and Masters degree awards. These are aimed at industry-based learners. This requires delivery of on-line and blended learning modules, increasing the diversity of offerings from the School and further strengthens its industrial contacts.
- 9.3 At the European level, the School will offer an ME in Manufacturing Engineering (from September 2022) as a contribution to the European Institute of Innovation and Technology (EIT) for Manufacturing. EIT is a 'double degree' offering, with students spending time at two institutes from a list of partners across Europe and is well-linked to the industrial manufacturing base. This has the potential to increase the School's visibility within Europe.
- 9.4 Another large new initiative is the Chang'an-Dublin International College of Transportation (CDIC) offering a BE in Automotive Engineering in China. Again, this is early days and no cohort has completed their degree yet intakes of 115 students in each of the first two years show strong demand for the offering. UCD are responsible for 50% of the teaching and assessment. Teaching has been on-line to date due to covid, however newly appointed staff will be expected to be based in China to teach in-person for 20-week semesters.

- 9.5 The CDIC arrangements are different to other programmes at UCD as teaching fees contribute to 'other income' and student numbers do not count for FTEs in the School. The RG noted this will generate a difference between actual and apparent staff:student ratios amongst other metrics.
- 9.6 The School's internship scheme gives work place experience and is a compulsory element for ME students. As already noted in Chapter 8 above, the internships are co-ordinated at College level and suitable placements for all students are typically found (though covid generated significant disruption). Many students secure future employment offers and the School gains additional research project interactions.
- 9.7 Despite growth in student numbers overall the number of overseas students (average of 22% in March 2022) has remained almost unchanged over the last five (based on data provided by the School). As a result, the fee level on average per student is reducing.

Commendations

- 9.8 The RG commend the School for their strong energy and drive in setting up multiple new collaborative educational initiatives. These diversify the programmes offered by the School, increase visibility and industrial contact.
- 9.9 The internship scheme has already been praised previously in 5.10 above, and the RG would like to commend the wide-ranging industrial base that engages with the School through this scheme. It is highly effective and it is important that it continues to be nurtured alongside new initiatives.

Recommendations

- 9.10 Expanding the list of offerings through multiple new initiatives immediately after Covid is impressive, however the RG recommend the School continue to monitor staff and student workloads as these programmes run through a complete cycle and bed in.
- 9.11 In addressing the reduction in fee level per student the RG recommend the School consider steps to increase the percentage of non-EU students, for example, could the presence at CDIC be used to further advantage.
- 9.12 The RG noted interactions with industrial stakeholders tend to come in the later stages of most programmes. The RG recommend the School consider earlier engagement in Stage 1 or 2 through guest lecturers (recent alumni) showing where foundational aspects are brought to bear in real applications. These might be chosen with a view to making role models visible early to students.

10. External Relations

General Comments and Context

- 10.1 School faculty are active in a wide range of organisations related to mechanical and materials engineering such as Engineers Ireland, Institute of Mechanical Engineers (IMechE), International Union of Theoretical and Applied Mechanics (IUTAM), International Fracture Society, European Council on Computing in Construction, international Building Performance Simulation Association (IBPSA), Linked Data in Architecture and Construction (LDAC), Croatian Society for Mechanics, European Structural Integrity Society, OpenFOAM Workshop international conference committee, International Academy for Production Engineering (CIRP), International Academy of Engineering and Technology (AET), Member of International Society for Nanomanufacturing (ISNM), Member of Institute of Industrial and Systems Engineering (IISE), European Orthopaedics Research Society (EORS), Irish Ambassador & Tissue Engineering and Regenerative Medicine International Society (TERMIS) and the professional association INFORMS for decision and data sciences.
- 10.2 The School academic staff are involved in editorial boards and journal review boards and roles include: Editor in Chief, Biomaterials & Biosystems (Elsevier) and Editor or Associate Editor for: the International Journal of Computer Integrated Manufacturing (IJCIM), Advanced Engineering Informatics, Journal of Orthopaedic Research (JOR), Structural Health Monitoring, Journal of Bridge Engineering and Infrastructure Asset Management; Editor of OpenFOAM Journal, Member of Editorial Board of Nanomanufacturing and Metrology [NMME], Conservation and Recycling, Experimental Results and Crystals.
- 10.3 The School has active links with most of the other Higher Educational Institutions on the island of Ireland including all of the universities, technical universities, the Tyndall National Institute and select Institutes of Technology. Activities primarily focus on research collaborations through centres such as I-Form (UCD SMME leader), the Advance Centre, the SFI Centre for Advanced Materials and BioEngineering Research (AMBER) and the SFI Research Centre for Energy, Climate and Marine research and innovation (MaREI). Also the Centre for Doctoral Training in Advanced Metallic Systems (AMSCDT) joint venture between Dublin City University, UCD, University of Sheffield and University of Manchester.
- 10.4 There are collaborations with international educational institutions including Fraunhofer IAO and RWTH Aachen, Germany; Lawrence Berkeley National Laboratory, MIT, Harvard Medical School, Yale University, University of Michigan and Rutgers, USA; Imperial College London, Oxford University and Cambridge University, UK; Indian Institute of Technology Madras, India; ETH Zurich, Switzerland; Harbin Institute of Technology, BJUT and Shanghai Jiao Tong University, China. Joint teaching programme with Chang'an University in Xi'an, China delivered through the Chang'an Dublin International College (CDIC).

- 10.5 The School has very extensive links with industry, encompassing research collaboration, consultancy work, guest lecturing, student placements and graduate employment. Industrial research collaborators include but are not limited to Hekel Bekaert, Boston Scientific, Bombardier, Apeer, PM Group, Novartis, Airbus, Volvo, Technalia, GM Engineering, ESB Networks, Integrated Environmental Solutions, Stryker, Logitech, DePuy in Cork, Sulzer in Wexford and Element 6.
- 10.6 The School also has strategic level corporate engagements with Intel and a company from the med-tech sector.

Commendations

- 10.6 The RG commend the School for its wide participation in professional and scientific organisations, editorial boards of peer-reviewed journals and organisation of scientific conferences.
- 10.7 The School's vibrant outreach programme, including events for both primary and secondary schools is commendable.
- 10.8 The RG commend the School for the excellent links with other academic institutions and industrial companies.

Recommendations

- 10.9 Once reactivated (see 2.20 above), the RG recommends the School develop and make more use of the potential of the Industry Advisory Board.
- 10.10 The wide network of industrial partners currently providing internship opportunities for ME students could be further utilised to enhance research collaboration with industry leading to development of impactful research projects.

School response to Quality Review Group report

The School of Mechanical and Materials Engineering found the Quality Review Process to be a valuable reflective exercise, particularly given the significant growth in both staff and student FTEs since the last Quality Review in 2014.

The task of developing the Self-assessment Report was a valuable reflective exercise which facilitated the School to review its position from a number of perspectives, highlight and confirm our strengths and opportunities, identify areas of good practice and evaluate our weaknesses and challenges in a systematic way. There was a high level of engagement from all staff categories and from students, both in compiling the Self-assessment Report and in interacting with the Review Group during the site visit. The School welcomes the Review Group's recognition that the SAR was "of high quality". The Review Group site visit was a positive and constructive experience, and the School wishes to thank the Review Group for their time, expertise and constructive comments, both at the visit and in their helpful Report.

We welcome the endorsement of the Review Group for our activities through its commendations. It was particularly pleasing to see among the principal commendations in the Report, recognition of the hard work and dedication of all staff (technical, professional, academic) in the School, who are all engaged in the delivery of high-class education to our students and in undertaking high quality research. We will carefully consider the recommendations in the Report during the Quality Improvement Planning process.

We have formulated a plan to address the recommendations in the Quality Review Report, and many actions are already underway. These include addressing the issues identified with putting in place management and organisational structures to support the size of the school, medium to long-term strategic planning, mentoring of academic staff, upgrade of undergraduate laboratory equipment and managing student workload.

With specific reference to the prioritised recommendations identified by the Review Group, the School's initial proposals/comments are outlined below:

1. *Given the growth in size and complexity of the School since the last Periodic Quality Review, the RG recommend the School revises its management and organisational structure to reflect the growth and increase effectiveness and efficiency. (2.15)*

Comment/proposal

The School recognises that as a result of its significant growth in staff and student FTEs since the last Quality Review in 2014, organisational and management structures need to be revised to improve the effectiveness and efficiency of the School, particularly with a new Head of School due to commence in September 2023. The School Executive began discussions on the issue of School structures in September 2022 and a number of initial changes are underway already, including reviews of a number of the School's committees' membership and terms of reference. The School Executive will further address this recommendation in the coming months.

- 2. The RG recommend that the School prepares a school plan that covers a 3-to-5-year cycle. The plan should concisely consider strategic aims and operational approaches. This plan should then be monitored and progressed in the context of the annual university strategy and planning cycle. (2.16)*

Comment/proposal

The School recognises the importance of developing a medium-long term strategic plan, particularly given its high level of growth in recent years. The School Executive will address this recommendation through the organisation of a number of strategic planning days in the coming months, initially involving members of the School Executive and then the wider membership of the School.

- 3. The RG recommend the School develop an internal mentoring scheme to support early career academic staff with mentors, ideally allocated from the same research area. Mentoring for postdoctoral students should also be considered. (3.18)*

Comment/proposal

While the annual P4G cycle provides an opportunity for staff to focus on career development and seek advice from their reviewer, the School recognises that this frequency is too low, particularly given the number of early career academic staff who have joined the School in recent years. The School believes that this recommendation can be best addressed in conjunction with prioritised recommendation number 1 above (School structures). The likely solution to the mentoring aspect will lie in the enhanced roles of Heads of Subject within the School.

- 4. The RG recommend the School, supported by the College and the University, should develop a sustainable capital programme for procurement or upgrade of undergraduate laboratory equipment. (3.23)*

Comment/proposal

The School strongly welcomes this recommendation and is acutely aware of the need to upgrade or renew teaching laboratory equipment to enhance the student learning experience. The School is of the opinion that a University level scheme similar to the research focused “Equip Fund” should be put in place for Colleges/Schools across the University who deliver teaching laboratories. While the School was able to support a small level of equipment purchase last year through the use of research overheads returned to the School, this does not cover the full needs of the School. The School will address this recommendation through the College Principal and Registrar.

- 5. The RG recommend the School engage in greater review and oversight of student workload, assignment weightings and deadlines across all modules. As part of this regular review, the RG recommend that where adjustments to assessments are made, this is communicated back to the student body. All module assessment timelines and assignments should also be made available to students as early as possible through the Brightspace VLE to allow them to plan their workload. (5.13)*

Comment/proposal

The School recognises the importance of planning student workload and its potential impact on the quality of the student learning experience. It should be noted that such an exercise in student

workload management was carried out during the 2020-2021 academic year following the requirement to deliver all modules fully online, which saw the reduction in the number of end-of-trimester examinations and consequent increase in the level of continuous assessment. This coordination was managed by the Engineering Programme Board. All Engineering programme structures contain a high number of modules from outside SMME (i.e. other Engineering Schools, Schools in the College of Science and in the College of Business). This recommendation will be considered by the School's Teaching and Learning committee. The School's initial thought is that given the range of Schools who deliver modules to programmes linked to our School, proper implementation of this recommendation may require coordination at an Engineering Programme Board level.



Quality Review School Site Visit Timetable

School of Mechanical and Materials Engineering

11-13 October 2022

Monday 10 October 2022- Boardroom 213 Tierney Building, Belfield	
17.00-19.00	RG meet to review preliminary issues and to confirm work schedule and assignment of tasks for the site visit – <u>RG and UCD Quality Office only</u>
19.30	The Welcome Dinner on Monday evening at 7.30pm. This will be hosted by the Acting Registrar/Deputy President, Director of Quality and Quality Office lead
Day 1: Tuesday 11 October 2022	
Venue: Room 206 Engineering Building	
09.00-09.30	Private meeting of Review Group (RG)
09.30-10.15	RG meet with College Principal
10.15-10.30	Break
10.30-11.15	RG meet with Head of School
11.15-11.30	Tea/coffee break
11.30-12.30	RG meet with the School Research Committee

12.30-13.00	Break – RG review key observations and prepare for lunch time meeting
13.00-14.00	Working lunch (buffet) – meeting with employers (and/or other external stakeholders)
14.00-14.30	RG review key observations
14.30-15.45	RG meet with a representative group of faculty staff – primary focus on Teaching and Learning, and Curriculum issues
15.45-16.00	RG Tea/Coffee Break
16.00-16.30	RG meet with UCD Programme Dean, Associate Dean of Engineering, Programme Coordinator Stage One Engineering; College Representative on UCD Graduate Research Board
16.30-16.40	Break
16.40-17.10	RG meet with professional administrative staff representatives
17.10-17.40	RG meet with technical staff representatives
17.40-18.30	Tour of facilities
18.30	RG depart
Day 2: Wednesday 12 October 2022	
Venue: Room 206 Engineering Building	
08.45-09.15	Private meeting of the RG
09.15-10.15	RG meet with a representative group of postgraduate research students and recent graduates
10.15-10.30	Break
10.30-11.30	RG meet with representative group of undergraduate and taught master students
11.30-11.45	RG tea/coffee break
11.45-12.30	RG meet with College Finance Manager and Head of School to outline School's financial situation

12.30-13.00	Break - RG review key observations
13.00-14.00	Lunch – Review Group only
14.00-14.45	RG meet with recently appointed (in the last 3 years) members of staff
14.45-15.00	Break
16.00-16.15	RG private meeting – review key observations/findings
16.15-17.00	RG meet with representative group of Postdocs
17.00-17.30	RG reflect and draft key conclusions/considerations in relation to their section(s) of the report
17.30	RG depart
Day 3: Thursday 13 October 2022	
Venue: Room 206 Engineering Building	
09.00-09.30	Private meeting of RG
09.30-12.30	RG draft of RG Report and feedback commendations/recommendations and prep for exit
12.30-13.15	Lunch
13.15-14.45	RG finalise first draft of RG Report and feedback commendations/recommendations
14.45-15.00	RG meet with Head of School to feedback initial outline commendations and recommendations
15.00-15.15	Break
15.15-15.30	RG meet with College Principal to feedback initial outline commendations and recommendations
15.30-15.40	Break
15.40-16.00	Exit presentation by RG to all available staff of the school –summarising the principal commendations/recommendations of the Review Group
16.00	Review Group depart