



THE
OPERATIONAL
RESEARCH
SOCIETY

Annual Report and Accounts

for the year ended 31 December 2018

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Foreword from the President

It is a great pleasure to introduce this report, which describes The Operational Research Society's achievements during 2018 and sets out our plans for the future.

This has been a year in which major reports from the Bond review of knowledge exchange in the mathematical sciences and the Blackett review of computational modelling have emphasised the importance of operational research (OR), modelling and the mathematical sciences generally in delivering the government's industrial strategy and in enhancing UK competitiveness. In addition, with the increasing emphasis across industry and government on artificial intelligence (AI) and big data it is as important as ever that OR demonstrates its role at the heart of these developments.

This report describes some of The OR Society's key achievements during 2018 in responding to the opportunities and challenges presented by a fast-changing world. These have included: the launch of our new *Journal of Business Analytics*; our diamond jubilee OR60 conference in Lancaster; the establishment of the trailblazer group for our level 7 OR apprenticeship scheme; and the relaunch of our analytics network and Soft OR special interest group.

This has been a year of impressive growth for The OR Society, with income up by 21% from that in 2017. This supported a 17% growth in expenditure and an increase in staff numbers from 14 to 17 FTEs, with particular enhancement to our professional marketing and communications capability. These additional resources enabled us to carry out more activities than ever in support of our charitable objects. But it is the commitment and dedication of all our staff members, together with our great many volunteers, that makes the real difference in enabling us to achieve all we do. We are greatly appreciative of all the work they do and, in addition the support our volunteers receive from their employers in industry, government and academia.

In 2019 we will be building on our strategic priorities relating to visibility, reach, engagement, capability and research. Key developments will be: the launch and deployment of our new website; the opening of our museum-based OR exhibition; and work with Taylor & Francis to maximise the value of our current publications contract. We will continue to advance the society's diversity programme and ensure that we support the OR community in responding to the challenges of artificial intelligence and Brexit. There is much to do and I am sure there will be many challenges along the way; but we are in a better position than ever to achieve our strategic aims.

John Hopes
OR Society President 2018-2019

Introduction

The Operational Research Society is a charity set up to advance knowledge, interest and education in operational research (OR). Our vision is of a world improved by rigorous analysis and better, evidence-based decision-making: “OR providing world class analysis for world class decisions”. In this world OR would be seen as indispensable – not just a ‘nice to have’ but a ‘must have’ – and be used and acknowledged widely in all areas of industry, business, government and the third sector.

As a charity, we must work for the public benefit, but we also aim to work for the good of our members, because without active, able and well-supported researchers and practitioners, students and supporters, OR would not exist. We disseminate learning; promote awareness of OR; support OR professionals and standards; and aim to ensure that UK OR has a ‘voice at the table’, both in the international OR world and in wider UK arenas. This represents a broad programme of activities and services, that has been growing year on year and that we continue to maintain and develop.

With the continuing dramatic changes in the world around us – such as rapid advances in data and technology and the unsettled social, economic and political environment – our activities and services must adapt and expand accordingly, as these changes offer great opportunities for the OR discipline, OR professionals and The OR Society, as well as great challenges.

Review of the Year 2018

2018 was the third year of our 3 to 5-year strategic planning period, during which we are pursuing five main priorities on top of the ‘Business as Usual’ services and activities. These are: building the reach of the ORS, so that our products and services are accessed by a wider audience; building the visibility of OR, the holy grail of OR professionals for many years; strengthening the community, fostering activity and interaction amongst OR professionals; nurturing research; and building OR capacity (‘the people pipeline’).

Highlights of the Year

This has been a year of many highlights, but it was particularly pleasing to have cemented the relationship with our new publisher, Taylor & Francis, by launching our new *Journal of Business Analytics*. This is a worthy sixth addition to our stable of academic journals that positions the ORS at the heart of research, as well as practice, in the growing field of analytics and data science.

Another highlight was our diamond jubilee OR60 conference at Lancaster University in September. This not only exceeded our attendance target with 487 delegates (compared to 412 at OR50); but it also delivered a high quality and very enjoyable programme with innovations that included a linked early career researchers’ workshop and a meeting that brought our journal editors together for the event. We are confident that the success of this conference provides a springboard for OR61 and beyond.

There was an important breakthrough this year in addressing the OR people pipeline challenge. A trailblazer group of employers was established for a level 7 (masters equivalent) OR apprenticeship scheme. In 2019 we hope to take this through to implementation as well as explore the potential for a level 8 (doctorate level) scheme.

Finally, one of the key roles of the society is in providing networking opportunities, both for our members and the wider community. This year we relaunched our Soft OR special interest group in order to help revitalise this important part of the UK OR landscape. We also relaunched our analytics network, which is now holding

regular well-attended meetings focused on key issues in the world of data science and is attracting much of its attendance from outside the society's membership. In addition, two important new networks were launched in 2018. These were Women in OR and Early Careers (in OR). We expect both of these to grow and flourish in 2019 and beyond.

Achievements during the year

Conferences and Events

We ran a full programme of conferences and events, designed to enable OR and associated professionals to share developments at the cutting edge of our rapidly-developing fields and to connect with colleagues. The flagship event was our 60th anniversary conference, held appropriately at Lancaster University – the home of the very first OR academic department. This was the largest annual conference for many years, with nearly 500 participants. Plenary speakers included Peter Checkland, founding father of SSM; Anna Nagurney, director of the influential Supernetworks group in the US; and John Hopes, giving The OR Society Presidential Address. The remainder of the programme included 38 parallel streams, the Making an Impact day for practitioners and other sessions. We are very grateful to Graham Rand for leading the conference committee and organisation.

Other events included:

- The biennial Simulation Workshop, organised by the Simulation Special Interest Group. The attendance of around 70 people was slightly lower than hoped, but the quality of the programme and the participant experience was outstanding;
- The Annual Analytics Summit, run in June during London Technology Week in combination with the Royal Statistics Society, which attracted a record attendance of around 200 delegates from industry, government and academia. The summit comprised a combination of plenary presentations and associated discussion together with more hands-on workshops;
- The AGM, kindly hosted by SWORDS (South Wales OR Discussion Society) in Cardiff. This was well-attended, with talks from two significant locally-based OR users, ONS and Aneurin Bevan Continuous Improvement (ABCi), alongside report-back from the society's President, Treasurer and others. Holding the AGM in the Regions has so far proved to be a good way of generating attendance and 2019's is planned to be held in Portsmouth;
- The second conference on Scenario Planning and Foresight, organised jointly by the Strategy SIG and the British Association of Management (BAM). This attracted 78 people from 18 countries, a significant increase on the first conference held three years ago;
- Our annual Careers Open Day, attended by a record 30 exhibitors and 370 students;
- An event for MSc project coordinators at different universities, giving them a unique opportunity to compare notes on procuring and managing summer projects for MSc students, a crucial part of the OR ecology in the UK.

Two half-day events complete the society's collection of regular offerings: the annual Beale and Blackett lectures. Both were well-attended in 2018. At the Beale Lecture, 2016 Beale medallist Professor Richard Ormerod reviewed *The fitness and survival of the OR profession in the age of artificial intelligence* (accompanied by a lecture from Dr Çağrı Koç, winner of the 2015 Doctoral Award, on his work on vehicle routing, taking pollution into account). The Blackett Lecture by Professor Sir Alan Wilson, Director of Special Projects and recently-retired Chief Executive at the Alan Turing Institute, was similarly titled *OR in the age of AI*. Both are available to view on the society's YouTube channel, alongside the President John Hopes' Presidential Address at OR60, *New challenges for operational research in the age of AI and big data*. These three talks, while all dealing with the topical issue of AI, cover quite different aspects of this very important subject.

The ISMOR Defence conference, jointly organised by the Defence Special Interest Group and the UK Ministry of Defence (MoD), was held at Royal Holloway University in July. This has been, for some years, a very successful event and a key date in the calendar for those involved in military OR. The ultimate responsibility has been with ISMOR, a charitable foundation with the sole purpose of running the conference. ISMOR now plans to dissolve itself and, as a consequence, the ORS Board has agreed to take over responsibility. From 2019 this will be fully an OR Society event, operated by the Defence SIG and with support from the MoD.

The Special Interest Groups (SIGs) and Regional Societies continue to operate at the roots of the society and have increased the level of activity compared to the previous year. 11 SIGs have had active meetings programmes this year (with 38 being organised), while others have taken an active role in streams at the annual conference. Eight of the ten Regional Societies have been active during the year, holding some 26 meetings.

None of this would be possible without the hard work of the office staff and a great many volunteers – especially our conference chairs and committees – and we greatly appreciate their support.

Publications

2018 was the year when our new publishers, Taylor & Francis, took over from Palgrave/Springer. Although there were some production issues to address, the transition was successful and the society has continued to promote its family of publications.

The established academic journals continued to be published regularly. These are the *Journal of The Operational Research Society (JORS)*, *European Journal of Information Systems (EJIS)*, *Knowledge Management Research & Practice (KMRP)*, *Journal of Simulation (JOS)* and *Health Systems (HS)*. It was pleasing to note that *JORS*, *EJIS* and *JOS* all achieved their highest impact factors for at least five years.

2018 also marked the launch of a new journal, the *Journal of Business Analytics*, under the editorship of Dursun Delen and Sudha Ram. It is hoped that this will become an influential journal providing academic insight grounded in practical applications for the analytics community. An article by analytics guru Tom Davenport was published online towards the end of the year and will appear in the next issue early in 2019.

Helped by the new financial arrangements with Taylor & Francis, the society sponsored a special meeting of editors-in-chief of our journals at our annual conference (OR60) in Lancaster. This gave the opportunity for this group to discuss and share ideas and best practice, as well as being able to attend the conference and network with other participants. In addition, there was also support to enable members of the *Health Systems* editorial board to attend the conference and meet together. These were valuable initiatives and it is hoped that similar arrangements may be supported in the future.

Impact magazine continues to be published twice a year. Its editor, Graham Rand, has continued to ensure a high standard of articles showing how OR can be applied in practice in a form that can readily be shared with those in a position to sponsor OR research or consultancy.

John Crocker has continued to edit *Inside OR*, which has been produced monthly according to schedule throughout the year. It continues to provide information on upcoming meetings and events while the “news in brief” and other features provide plenty of interesting reading for members.

Thanks go to all the editors of society publications, their editorial teams, members of staff and our new publishers for the work they have done to produce the society’s publications which do so much to promote the use and understanding of OR in the world.

Education & Research

During this last year, the Education and Research Committee (ERC) has taken forward the development of a Level 7 Apprenticeship Standard for 'Operational Research Specialist', working closely with HORAF (the Heads of OR and Analytics Forum) to bring OR employers together within a "Trailblazer" group. The motivation for this is that apprenticeships at level 7 are emerging as an attractive route that enable OR and analytics employers to leverage their Apprenticeship Levy payments to provide employees with MSc-level education and training. The Trailblazer group is now set up including employer representatives from GORS, BT, Atkins, RBS, DSTL and London Ambulance and is chaired by Alec Waterhouse (BEIS). This is an exciting initiative that should enable graduate employees to have access to fully-financed part-time postgraduate-level education while working for an OR employer and not incurring further student debt.

The Research Panel organised an inaugural Early Career Researcher (ECR) workshop during the two days immediately preceding the society's national conference (OR60) and in the same location (Lancaster University). This was an exciting opportunity for close to 40 ECRs in OR to network with their peers, articulate their personal research ambitions in a supportive environment and to learn more about key opportunities available to them in establishing successful research careers. Attendance was restricted to finishing PhD students, postdocs and academics with up to five years of service from first appointment. Highlights included an inspiring presentation of personal experiences by Professor Anna Nagurney (University of Massachusetts) who went on to give a plenary at OR60. Attendees also learnt about what makes for success in applying for research funding by participating in mock panel sessions where they assessed and ranked research proposals. Participant feedback was very positive.

During the last year, the panel has also inter-alia gathered evidence about the OR research people pipeline, supported the development of strong research-focussed content for the new OR Society website and led a semi-plenary on its work at OR60.

Training

During 2018, the society delivered 32 courses covering a range of OR topics, attracting a total of 241 delegates, up from 196 in 2017. The courses were well-received by participants with the average score being over 8.9 out of 10 for course content and teaching. The society has a slightly more extensive offering in its 2019 programme, representing the first year of our long term strategy to expand our training through improved targeting of suitable topics and making more use of a variety of training approaches.

OR in Schools (ORiS) and OR careers

Our ORiS programme made 24 individual visits to schools, 35 extra curricula visits (such as big bang fairs etc.) and 37 university visits. We attended and presented at numerous teacher conferences and sponsored an exhibit at The Big Bang National Fair at the NEC, which had 70,000 visitors. 80 individuals were trained to use the OR in Schools resources, but we still find it challenging to provide enough volunteers to fulfil all visit requests. However feedback from all visits was very positive – with comments from students who had received a school visit saying:

- "I liked making the different combinations and it showed what maths you need in the real world"
- "It was very interesting to find out what the company was all about and learning about maths in the real world. PS Loved the keyrings".

Additionally, teachers also provided very positive feedback from visits and events:

- "Very well run workshop which students took a lot from, particularly seeming to enjoy the competitive element to the task"
- "The students got a lot out of the talk and the activity. I'm sure they will be a bit closer to choosing a maths based degree."

This shows that activities in the various forms are all being well received by both educators and the students themselves.

Pro Bono OR

The Pro Bono OR scheme provides a showcase for OR and its benefits, opportunities for members to engage in exciting and novel work and the chance for our profession to make a positive difference to a wide variety of charities and their beneficiaries. Despite a staff change in early June 2018, 20 Pro Bono OR projects were started and 10 projects were completed for organisations as varied as Royal National Institute of Blind People, Education Business Partnership for the South and the Royal Female School of Arts. Over 100 volunteer-days were supplied and feedback from charities and volunteers continues to be good.

We presented and exhibited at eight events in Q3 and Q4 and doubled the amount of generated project leads during this time compared to the same period in 2017.

We trailed a pilot partnership with the Coalition for Efficiency's 'Measuring the Good' programme and increased the number of websites and newsletters our Pro Bono OR scheme is advertised in, including the Greater Manchester Centre for Voluntary Organisation and Community Southwark.

Pro Bono OR helped organise and run the first ever Data4Good conference (held in Birmingham) alongside Dataorchard, NCVO, Pro bono economics, Datakind and 360Giving. The conference sold out with 230 attendees and aimed to bring together non-profit leaders to inspire and build confidence in the possibilities of data. Finally, we provided advice to INFORMS (our US equivalent) to help them develop their Pro Bono scheme to improve their evaluation processes and encourage participation.

Other items

The Bond review of knowledge exchange in the mathematical sciences, to which the ORS and the OR community contributed, reported early in 2018, with recommendations including enhanced research funding and the establishment of an academy of mathematical sciences. The Council for Mathematical Sciences (CMS) is taking the recommendations forward by setting up two new committees. Through our research panel and our membership of the Board of the CMS we have ensured that OR remains fully involved in this important initiative as it moves forward in 2019.

The Blackett review of Computational Modelling also reported in 2018, once again having had input from the ORS and the OR community. The ORS is following this up with BEIS and others by engaging decision makers on the importance of effective modelling when making major decisions.

Work was completed in the spring to ensure that the society is compliant with the new GDPR data privacy legislation. This included the development and publication of our data privacy policy.

A number of new working groups were established during 2018 to help the society move forward on key elements of its strategic agenda. One is helping us move forward our diversity strategy while two others are focused on the very different challenges and opportunities of artificial intelligence and Brexit for the OR community.

The society's major project during 2018 was the development of the new website under the direction of a project board of staff and volunteers. This has been carried out in collaboration with an external supplier and will be launched in 2019. It will provide significant enhancements to the society's ability to support members, market the society's activities and services and promote OR to the wider world.

Members, Affiliates and Fellows

At the end of the year, The OR Society had 3,178 members. The Analytics Network boasted approximately 1,605 members, the society's LinkedIn group had 4,598 members and we had 3,908 Twitter followers. In addition, there were nine corporate partners – CORDA (part of BAe Systems), Royal Bank of Scotland, Ministry of Justice, Home Office, AWE, NATS, Office for National Statistics, Ministry of Defence and NHS Wales – representing 424 affiliates.

There were 328 accreditees, comprising 147 Fellows, 74 Associate Fellows, 63 Associates and 44 Candidate Associates.

Awards

- **Goodeve Medal** (awarded for best paper published in *JORS* in 2017): Awarded to Agha Iqbal Ali and Guven Ince "Distress among disaster-affected populations: delay in relief provision", *Journal of The Operational Research Society* (2017) 68, 533–543.
- **Stafford Beer Medal** (awarded for best paper published in *EJIS* in 2017): Awarded to Rachida Parks, Heng Xu, Chao-Hsien Chu and Paul Benjamin Lowry "Examining the intended and unintended consequences of organisational privacy safeguards", *European Journal of Information Systems*, 26 37-65.
- **Cook Medal** (awarded for best paper published in *KMRP* in 2016/2017): Awarded to Fausto Di Vincenzo and Daniele Mascia "Knowledge development and advice networks in professional organizations", *Knowledge Management Research and Practice*, 15 201-213.
- **Doctoral Award** (awarded for the most distinguished body of research leading to the award of a doctorate in the field of OR in 2017): Awarded to Jeeu Fong Sze, University of Kent.
- **President's Medal** (awarded for the best practical application of O.R): Awarded to Robert Leese, Jakob Blaavand, Claudia Centazzo and Andrei Bejan (Smith Institute) and Paul Munday (Bank of England) for "Repurposing the Radio Spectrum: Delivering on the Promise of Next-Generation Mobile Services".
- **Beale Medal** (awarded for a sustained contribution to the theory, practice, or philosophy of OR): Awarded to Russell Cheng.
- **Companionship of OR** (awarded for sustained support and encouragement for the development of operational research or for those in influential positions who are in broad sympathy with the subject area): Awarded to Paul Harper.

Structure of the Funds

The society's funds are unrestricted but are organised into:

- the General Fund, through which the ongoing operations of the society are conducted;
- the Reserve Fund, comprising the Seymour House property together with investments and cash on deposit to cover potential risks of a general nature, the most significant of which would arise if the society were forced to move quickly to a financial regime in which its publications income was significantly reduced; and
- the Designated Award Fund which represents a bequest received from Mrs May Hicks in 2002 and which is used for purposes consistent with her wishes, by providing awards for the best student OR projects undertaken for a client organisation.

Review of Operations

The society's income and expenditure account showed a deficit of £113k during the year, on a turnover of just under £1.4m. This compares with a deficit of £144k in 2017. This deficit was £47k lower than that planned in the budget, principally due to improved performances of publications and conferences and lower than planned expenditure on other charitable expenditure.

The publications income was almost £100k above the 2017 level, largely as a result of the beneficial terms of our new publishing contract with Taylor & Francis. It is anticipated that in 2019 publications income will improve further under the new contract.

The conference income, which was £35k above budget and £125k above the 2017 level, reflects the extra strategic attention given this year after the disappointing 2017 outcome. The annual conference in Lancaster exceeded our expectations both financially and in impact terms

Most operations to support the charitable aims of the society – such as conferences, special events, regional societies, special interest groups, education, publicity and outreach initiatives, the monthly Inside OR magazine and special charitable projects – result in deficits to the society. To support them the society relies primarily on subscriptions and income from its academic journals – particularly the latter which in 2018 contributed over £606k net of all associated costs. This serves as a reminder of the society's current financial dependence on the academic publication system; see the section on 'Risk' below. The society contributed more than ever to editorial support, providing financial assistance for its editors-in-chief and *Health Systems'* editorial board to attend our annual conference, OR60.

The society employed 18.6 members of staff during 2018 (averaged over the year, 17.2 full-time-equivalents), compared to 15.7 (13.2 FTE) during 2017.

Assets, Reserves and Investments

The total net assets of the society decreased to £2.413m over the year, with the deficit on income and expenditure being exacerbated by a drop in investment values and a net £108k capital loss (realised and unrealised) on our investment funds. This loss reflects the turbulent movements in stock markets during the year in line with Brexit worries and global uncertainty of growth and trade wars.

It is important that the society maintains an appropriate level of reserves in relation to perceived financial risks. During the year the Board reviewed the society's reserves policy. In setting its reserve policy, the Board distinguished between the funds held in the General Fund, which arise from the normal operating activities of

the society, and the Reserve Fund held to ensure that the society can continue long-term operations in the event of financial risks materialising. The policy review considered the minimum and maximum levels for the amount required in the Reserve Fund. It was agreed that this steadier approach to reserves, based on the costs of the society rather than the (publications) income, remained valid.

Based on the annual costs of running the society, one year's costs of £900k should be a minimum value for the reserves and the maximum value would then be two years' costs giving a value of £1.8 million. This would cover any growth of the society over the next few years and release funds to further the society's aims.

At 31 December 2018, the society's reserves – its investments and cash held within the Reserve Fund – amounted to £1.53m. The reserves are therefore within their prescribed limits. The Board will bear this in mind when considering opportunities for spending on worthwhile one-off projects that further the society's objectives.

The society's investments and their performance are kept under review by the Investment Committee in accordance with policies decided by the Board. The Committee is chaired by the Treasurer and, in addition to other members of the society, includes representatives from the society's investment managers.

Risk

The society's dependency on journal income is the most significant material risk. Our new contract with Taylor & Francis to a large extent mitigates this risk for the society, for the five years of the contract (finishing in December 2022), by transferring much of it to the publisher. The risk has not disappeared though, and we could never be wholly insulated from any impact that might result from this risk on our publisher. In addition, beyond the contract period our exposure to the risk is unchanged and the risk may in fact have increased following moves to ensure that EU-funded research is, in future, made available via the open-access business model.

A key strategic risk is that OR could be seen as less relevant in the rapidly changing environment, as big data and increasing computing power drive technical developments and as new discipline descriptions compete for attention and funding. We have been mitigating this through a number of initiatives led by our Analytics Development Group and are also actively promoting the relevance of OR to data science, robotics and artificial intelligence as well as other overlapping fields. More generally, we aim to raise the visibility of OR and support outward-looking practice and membership through outreach to other professional societies and to organisations and businesses who may benefit from what OR has to bring and through the variety of topics and speakers at our events.

A further key risk is that The OR Society could be seen as less relevant to OR professionals. We have been mitigating this through the whole range of activities addressing our strategic goals and described elsewhere in this report.

The Board regularly reviews the risk register covering a wide range of operational risks, including IT risks, and, where feasible, puts mitigating action in place.

Brexit Position

The impact of an exit from the EU by the UK has been considered from two perspectives: on the society itself and on the wider OR community. Whilst the trustees expect the likely direct impact on the society to be low, the greatest threat would be that of a UK recession brought on by a disorderly exit. This could impact all sources of income as might happen during any period of economic downturn. The terms of its current publications contract gives it considerable protection from such risks. It faces no threat in terms of the origin of its employees.

The threats to the community could be more widespread, from the number of EU citizens working in the field through to access to funding and collaboration on EU research projects.

Key Management Personnel

The Key Management Personnel for the society comprise the trustees (its Board of Directors) and the Secretary & General Manager. No remuneration is payable to trustees for service on the Board.

Basis for Remuneration

The President, Treasurer and President Elect or Immediate Past President review the S&GM's salary and, when agreed by Finance Committee, a written recommendation is made to Board. The S&GM leads the process for other staff which is again initially discussed by Finance Committee before the recommendations go to Board for final approval.

Voluntary Contributions

The society's work in 2018 benefited from voluntary contributions of time, from members and others, through these principal lines of work: refereeing of journal papers; editing of journals; conference organisation; authorship and delivery of talks to regional societies and special interest groups; organisation of regional societies and special interest groups; the work of the society's officers; contributions to the administration of the society, its Awards and its accreditations through service on Board and the society's committees.

In addition to this, more than two hundred members have volunteered, or offered to volunteer, with our two main outreach projects, OR in Schools and Pro Bono OR. Their work benefits the OR community, the future development of the profession and the wider society and is a fine contribution to The OR Society's charitable objectives.

It is estimated that a total of 5,000 person-days were contributed in 2018. If this time is valued at £500 per day, its value is £2.5M. The society is most grateful to all who contributed voluntary effort, without which the society could not accomplish its goals.

Objectives for 2019

In high level terms our objectives for the next one to three years are the same as for 2016 to 2018: to build the society's **reach** (the number of people aware of or benefiting from the society's activities), the **visibility** of OR itself and the **engagement** of OR people in the profession and wider community; to help develop the **people pipeline**; and to nurture OR **research**.

Work has already started on many of the initiatives that we hope will come to fruition in the next year or so:

- working with Taylor & Francis to develop a strategy to maximise the value of our current publications contract;
- ensuring that OR is fully represented in the implementation of the recommendations of the Bond review of knowledge exchange in the mathematical sciences and the Blakett review of computational modelling;
- implementing the recommendations of the artificial intelligence task-and-finish group;
- supporting the full establishment and growth of the Women in OR and Early Careers networks;
- preparing a suite of materials providing an accessible guide to OR methodology;
- launching the new website, which will offer a better user experience and will improve our ability to develop web-based services;
- deploying the new website, social media campaigns and other marketing activity to raise the brand profile of OR itself;
- responding to recommendations from the working group that is assessing the potential impact of Brexit on OR Society members and the OR community;
- launching a museum-based travelling exhibition to raise public awareness of OR;
- moving forward the level 7 OR apprenticeship scheme in collaboration with HORAF and COPIOR and exploring the potential for a level 8 scheme;
- moving forward with plans to offer Registered Scientist as a stepping stone to full chartered status;
- finalising and implementing new training, events, member recruitment and retention, communications and marketing strategies;
- finalising and implementing our diversity plan based on recommendations from the diversity task-and-finish-group;
- pilot the offer of Care Bursaries, to support people with caring responsibilities who would like to attend one of our conferences;
- developing a plan to support the OR 'people pipeline', following an external review of the supply chain;
- developing a national database of academic communities related to OR;
- taking actions to foster the development of research capabilities in OR communities.

These developments will be on top of our existing broad sweep of services: conferences, events, lectures and training; publications; Pro Bono OR and OR in Schools; representing The OR Society on bodies including The Council for Mathematical Sciences, the Science Council, EURO and IFORS; and our more inward-looking activities to improve sustainability, efficiency and effectiveness.

For a relatively small professional body in an uncertain world, there are many challenges to overcome. By undertaking these activities, we aim not just to meet the challenges, but to grow the profession and The OR Society's contribution and make the most of the opportunities awaiting us.

Information about the society

- (1) The Operational Research Society is a company limited by guarantee (no. 663819). It is also a charity registered in accordance with the provisions of the Charities Act 2011 (registration no. 313713)
- (2) The objects of the society are given in its Memorandum and Articles and can be summarised as:
 - (a) the advancement of knowledge by fostering, promoting and furthering interest in operational research; and
 - (b) the advancement of education by providing facilities for and, by subsidising it, endowing, organising or supporting scholarships or educational or training schemes; and conducting examinations or advising on their content.
- (3) The society is empowered to do all proper things in pursuit of these objectives.
- (4) The affairs of the society were managed during 2018 by the elected officers and members of the Board listed below. Together they constitute the Board of Directors of the limited company and Trustees of the charity and the members of its management committee. Specific matters are delegated to particular committees of the society by resolution of the Board and in accordance with the society's Articles.

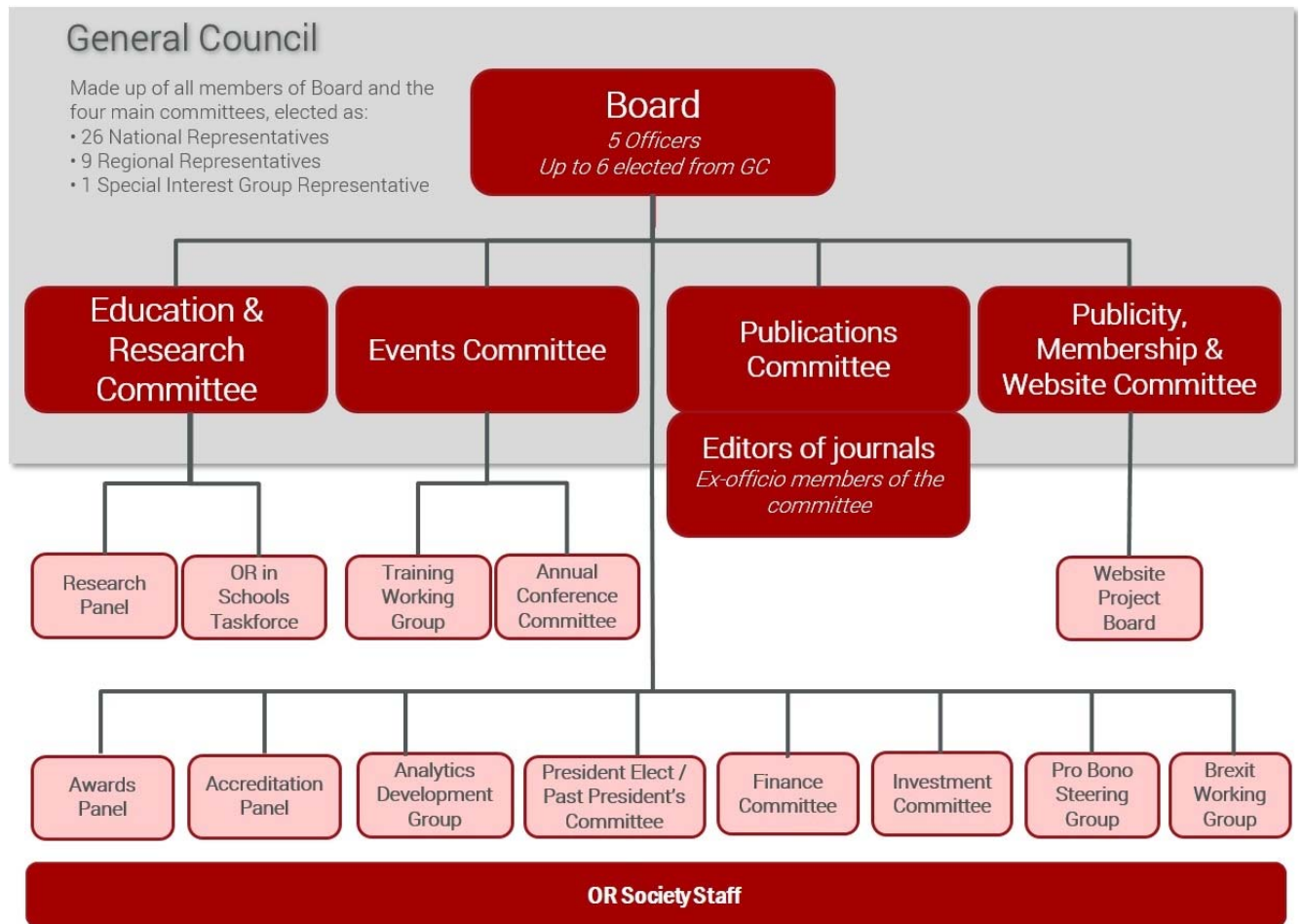
The following served as members of the Board in 2018

J R HOPES President	P ALBORES
R A KAUFMAN Past President	J BATSON
S PETROVIC Vice President	S BEG
A P ROBINSON Vice President	A R CLARK
J E WILLIAMS Hon. Treasurer	R W EGGLESE

Unless otherwise stated, changes in the membership of the Board occur at the end of a calendar year.

The Board is supported by a General Council with a maximum membership of thirty-six. These two bodies assist the society in its ongoing commitment to involve as many members as possible in its affairs. The Board of Directors is responsible for governance and strategy and the General Council, with its wide representation, provides advice, feedback and challenge and monitors the Board's activity. Members of General Council have also, in all cases, been assigned to one of the society's four main committees: Publications; Publicity, Membership and Website; Education and Research; and Events and the Chairs of those committees are currently Board members.

The structure is set out in the diagram below.



(5) The committees are established to implement policies of Board & General Council with respect to meeting the society's objectives and to controlling expenditure. The names of the committees are set out as follows, together with the object ((a) or (b) as above) towards the achievement of which they contribute:

Accreditation Panel	(a)
Analytics Development Group	(a)
Awards Panel	(a)
Education & Research	(b)
Events	(a), (b)
Finance	Management of financial aspects
Investment	Management of investments
Past President's/President Elect's	Elections, planning & administrative reviews
Pro Bono Steering Group	(a)
Publications	(a)
Publicity, Membership & Website	(a)
Research Panel	(a)
Training Working Group	(b)

(6) Other Committees are set up from time to time for specific purposes, but they are given no delegated powers. In addition, the society has a large number of active Special Interest Groups which are listed in the Journal of the society. They contribute particularly to object (a).

(7) The registered address of the society is:

Seymour House
12 Edward Street
BIRMINGHAM
B1 2RX

Its Secretary & General Manager is:

I G Blakett
The OR Society
12 Edward Street
BIRMINGHAM
B1 2RX

Its Bankers are:

The Co-operative Bank
Delf House
Southway
SKELMERSDALE
WN8 6WT

Its Solicitors are:

Sydney Mitchell and Co
Cavendish House
Waterloo Street
BIRMINGHAM
B2 5PU

Its Auditors are:

Mazars LLP
45 Church Street
BIRMINGHAM
B3 2RT

Its Investment Adviser is:

Tom Quicke
Investec
30 Gresham Street
LONDON
EC2V 7QN

Its Stockbrokers are:

Investec
30 Gresham Street
LONDON
EC2V 7QN

(8) The society's investment policy is governed by the legislative provisions relating to charity investments, but the society is not otherwise restricted in the way in which it can invest. However, it is the society's policy not to invest in tobacco shares.

(9) These particulars are published in compliance with Accounting and Reporting by Charities: Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102) (effective 1 January 2015).

Public Benefit

The OR Society is a charity and meets the public benefit test as set out in the Charities Act 2011 in various ways:

Advancement of education:

Through the OR in Schools initiative, its many networking, training and conferencing activities in schools, universities and workplaces and extensive on-line resources, The OR Society promotes the understanding of OR and how it can be applied for the wider benefit. The OR Society is a participating society (with voting rights) on the Joint Mathematical Council of the UK.

Advancement of science:

Through its publications, conferences and networking activities; representation on the Council for Mathematical Sciences, Science Council, funding bodies and international federations; and on-line materials and facilities, The OR Society supports, promotes and publicises research; raises standards of research and practice; and promotes the effective application of OR for wider social benefit. Through its accreditation and awards schemes, The OR Society recognises and promotes engagement, effectiveness and development in its members, further raising standards.

Advancement of community development:

The OR Society encourages volunteering and involvement through its Pro Bono OR initiative, involvement of members in outreach to schools and universities and networks of Regional and Special Interest Groups.

The OR Society funds educational, development and research projects that are in line with its charitable aims of advancing knowledge and education through fostering OR

All OR Society events and training are open to all who may be interested. In addition, it minimises barriers to access by:

- (1) ensuring that many of its on-line resources are publicly and freely available;
- (2) keeping membership fees low and offering reduced fees for unwaged groups; and
- (3) supporting Regional and Special Interest Group networks which offer free meetings.

In governing The OR Society, the Trustees have had regard to the Charity Commission's public benefit guidance.

Statements as to disclosure of information to auditors

In accordance with Company Law, as the charity's trustees, we certify that:

- so far as we are aware, there is no relevant audit information of which the Charity's Auditor is unaware; and
- we have taken all the steps that we ought to have taken in order to make ourselves aware of any relevant audit information and to establish that the Charity's Auditor is aware of that information.

Statement of responsibilities of the elected officers and members of the Board

Company law requires the elected officers and members of the Board to prepare financial statements for each year which give a true and fair view of the state of affairs of the society and of the surplus or deficit of the society for that period. In preparing those financial statements, the elected officers and members of the Board are required to:

- select suitable accounting policies and then apply them consistently;
- make judgements and estimates that are reasonable and prudent;
- state whether applicable accounting standards have been followed, subject to any material departures disclosed and explained in the financial statements;
- prepare the financial statements on the going concern basis unless it is inappropriate to assume that the society will continue in business.

The elected officers and members of the Board are responsible for keeping proper accounting records which disclose with reasonable accuracy at any time the financial position of the society and to enable them to ensure that the financial statements comply with the Companies Act 2006. They are also responsible for safeguarding the assets of the society and hence for taking reasonable steps for the prevention and detection of fraud and other irregularities.

Appointment of trustees

The officers and other members of the Board are elected by secret ballot of the society's membership and the members of General Council respectively, to serve for a three-year term (except for the President, who serves one year as President-Elect, two years as President and a further year as Immediate Past-President). A member of the Board, other than the President, whose first term of office has expired may stand for election for one further term. At the end of 2018, two members of the Board completed their terms of office: R A Kaufman and S Petrovic.

Induction of new trustees

New trustees receive a comprehensive information pack, setting out details of their role and responsibilities as both trustees and company directors, the nature of a charity, the society's constitution, its policies on members' interests and expense claims and including the Charity Commission's 'welcome' leaflet.

Members' interests

In accordance with Article 46 of its constitution, the society requires that members of Board or committees having an interest in a matter to be debated should declare that interest and leave the room whilst the matter is discussed and decided. Members of the Training Working Group are drawn from organisations which have no interest in bidding for courses and wherever appropriate, recommendations on major charitable projects are made by a special expert committee comprised entirely of disinterested parties.

Approval of report

We approve this report and the audited accounts for the year 1 January to 31 December 2018 and recommend their adoption by the society at its Annual General Meeting.

J R HOPES President

J E WILLIAMS Hon Treasurer

P ALBORES

J BATSON

E K BURKE

A R CLARK

R W EGGLESE

S HOWICK

A P ROBINSON

R A SCOTT

Being the elected officers and members of the Board of The Operational Research Society as at 15 May 2019.

I G Blackett

Secretary & General Manager

15 May 2019

Accounts

for the year ended 31 December 2018

INDEPENDENT AUDITOR'S REPORT TO THE MEMBERS OF OPERATIONAL RESEARCH SOCIETY

We have audited the financial statements of The Operational Research Society (the 'charity') for the year ended 31 December 2018 which comprise the Statement of Financial Activities, Balance Sheet, Statement of Cash Flows and notes to the financial statements, including a summary of significant accounting policies. The financial reporting framework that has been applied in their preparation is applicable law and United Kingdom Accounting Standards, including FRS 102 "The Financial Reporting Standard applicable in the UK and Republic of Ireland" (United Kingdom Generally Accepted Accounting Practice).

In our opinion, the financial statements:

- give a true and fair view of the state of the charity's affairs as at 31 December 2018 and of its income and expenditure for the year then ended;
- have been properly prepared in accordance with United Kingdom Generally Accepted Accounting Practice; and
- have been prepared in accordance with the requirements of the Companies Act 2006.

Basis for opinion

We conducted our audit in accordance with International Standards on Auditing (UK) (ISAs (UK)) and applicable law. Our responsibilities under those standards are further described in the Auditor's responsibilities for the audit of the financial statements section of our report. We are independent of the charity in accordance with the ethical requirements that are relevant to our audit of the financial statements in the UK, including the FRC's Ethical Standard and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

The impact of uncertainties due to Britain exiting the European Union on our audit

The Trustees' view on the impact of Brexit is disclosed on page 10.

The terms on which the United Kingdom may withdraw from the European Union are not clear and it is therefore not currently possible to evaluate all the potential implications to the Company's trade, customers, suppliers and the wider economy.

We considered the impact of Brexit on the Company as part of our audit procedures, applying a standard firm wide approach in response to the uncertainty associated with the Company's future prospects and performance.

However, no audit should be expected to predict the unknowable factors or all possible implications for the Company and this is particularly the case in relation to Brexit.

Conclusions relating to going concern

We have nothing to report in respect of the following matters in relation to which the ISAs (UK) require us to report to you where:

- the trustees' use of the going concern basis of accounting in the preparation of the financial statements is not appropriate; or
- the trustees have not disclosed in the financial statements any identified material uncertainties that may cast significant doubt about the charity's ability to continue to adopt the going concern basis of

accounting for a period of at least twelve months from the date when the financial statements are authorised for issue.

Other information

The trustees are responsible for the other information. The other information comprises the information included in the annual report, other than the financial statements and our auditor's report thereon. Our opinion on the financial statements does not cover the other information and, except to the extent otherwise explicitly stated in our report, we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit or otherwise appears to be materially misstated. If we identify such material inconsistencies or apparent material misstatements, we are required to determine whether there is a material misstatement in the financial statements or a material misstatement of the other information. If, based on the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact.

We have nothing to report in this regard.

Opinions on other matters prescribed by the Companies Act 2006

In our opinion, based on the work undertaken in the course of the audit:

- the information given in the Trustees' Report which includes the Directors' Report prepared for the purposes of company law, for the financial year for which the financial statements are prepared is consistent with the financial statements; and
- the Directors' Report included within the Trustees' Report has been prepared in accordance with applicable legal requirements.

Matters on which we are required to report by exception

In light of the knowledge and understanding of the charity and its environment obtained in the course of the audit, we have not identified material misstatements in the Directors' Report included within the Trustees' Report.

We have nothing to report in respect of the following matters in relation to which the Companies Act 2006 requires us to report to you if, in our opinion:

- adequate and proper accounting records have not been kept, or returns adequate for our audit have not been received from branches not visited by us; or
- the financial statements are not in agreement with the accounting records and returns; or
- certain disclosures of trustees' remuneration specific by law are not made; or
- we have not received all the information and explanations we require for our audit; or
- the trustees were not entitled to prepare the financial statements in accordance with the small companies regime and take advantage of the small companies' exemption in preparing the Trustees' Report and from the requirement to prepare a Strategic Report.

Responsibilities of Trustees

As explained more fully in the trustees' responsibilities statement set out on page 17, the trustees (who are also the directors of the charitable company for the purposes of company law) are responsible for the preparation of the financial statements and for being satisfied that they give a true and fair view and for such internal control as the trustees determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the trustees are responsible for assessing the charity's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the trustees either intend to liquidate the charity or to cease operations, or have no realistic alternative but to do so.

Auditor's responsibilities for the audit of the financial statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with ISAs (UK) will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

A further description of our responsibilities for the audit of the financial statements is located on the Financial Reporting Council's website at www.frc.org.uk/auditorsresponsibilities. This description forms part of our auditor's report.

Use of the audit report

This report is made solely to the company's members as a body in accordance with Chapter 3 of Part 16 of the Companies Act 2006. Our audit work has been undertaken so that we might state to the company's members those matters we are required to state to them in an auditor's report and for no other purpose. To the fullest extent permitted by law, we do not accept or assume responsibility to anyone other than the company and the company's members as a body for our audit work, for this report, or for the opinions we have formed.

Ian Holder FCA
(Senior Statutory Auditor)
for and on behalf of Mazars LLP
Chartered Accountants and Statutory Auditor
45 Church Street
Birmingham
B3 2RT

OPERATIONAL RESEARCH SOCIETY

STATEMENT OF FINANCIAL ACTIVITIES FOR THE YEAR ENDED 31 DECEMBER 2018

		-----Unrestricted Funds-----			2018	2017
		General	Reserve	Designated	£	£
	Note	Fund	Fund	Award	Total	Total
				Fund	Funds	Funds
INCOME FROM :						
Charitable activities :						
Subscriptions		142,127	-	-	142,127	137,801
Events and Conferences		255,477	-	-	255,477	130,728
Training		114,755	-	-	114,755	85,313
Publications	3	860,350	-	-	860,350	768,194
Accreditation		7,516	-	-	7,516	8,851
Websites / Digital Services		6,560	-	-	6,560	4,875
			-	-		
		1,386,785	-	-	1,386,785	1,135,762
Investment Income	7	0	49,080	1,816	50,896	50,282
Total Income		1,386,785	49,080	1,816	1,437,681	1,186,044
EXPENDITURE ON :						
Raising Funds						
Investment Management Costs		-	11,645	-	11,645	11,318
Direct charitable expenditure :						
Subscriptions		105,740	949	-	106,689	103,771
Events and Conferences		343,639	673	-	344,312	241,905
Training		100,669	214	-	100,883	80,740
Publications	3	261,147	917	-	262,064	245,056
Accreditation		4,339	31	-	4,370	3,765
Websites / Digital Services		180,681	1,113	-	181,794	153,286
Other Charitable Expenditure	4	352,883	1,914	1,500	356,297	348,349
Governance and Support Costs	5	150,777	2,801	-	153,578	112,855
		1,499,875	8,612	1,500	1,509,987	1,289,727
Total Expenditure	6	1,499,875	20,257	1,500	1,521,632	1,301,045
Net gains/(losses) on Investments	18	-	(103,692)	(4,052)	(107,744)	123,075
NET INCOME/(EXPENDITURE) and NET MOVEMENT IN FUNDS FOR THE YEAR						
		(113,090)	(74,869)	(3,736)	(191,695)	8,074
Reconciliation of funds :						
Total funds brought forward		782,630	1,764,254	57,970	2,604,854	2,596,780
Total funds carried forward		669,540	1,689,385	54,234	2,413,159	2,604,854

The notes on pages 26 to 33 form part of these accounts.

The statement of financial activities includes all gains and losses recognised in the year. All income and expenditure derive from continuing activities.

OPERATIONAL RESEARCH SOCIETY
 (A company limited by guarantee. No. 663819)

BALANCE SHEET - 31 DECEMBER 2018

	<u>Note</u>	<u>2018</u> £	<u>2017</u> £
FIXED ASSETS			
Fixed Assets : Tangible	8	220,829	192,649
Intangible	8	172,586	108,009
Investments :			
Listed at Market Value	9	1,480,746	1,554,759
Cash Deposited with Investment Brokers		54,510	48,999
Charities Aid Foundation	10	67,439	69,675
		<u>1,996,110</u>	<u>1,974,091</u>
CURRENT ASSETS			
Debtors	11	1,118,266	686,669
Cash at Bank and In Hand		406,664	108,268
		<u>1,524,930</u>	<u>794,937</u>
CREDITORS (amounts falling due within one year)	12	1,107,881	164,174
NET CURRENT ASSETS		<u>417,049</u>	<u>630,763</u>
TOTAL ASSETS LESS CURRENT LIABILITIES		<u>2,413,159</u>	<u>2,604,854</u>
FUNDS			
General Fund		669,540	782,630
Reserve Fund	15(1)	1,689,385	1,764,254
Designated Award Fund	15(2)	54,234	57,970
TOTAL FUNDS		<u>2,413,159</u>	<u>2,604,854</u>

These financial statements have been prepared in accordance with the special provisions relating to companies subject to the small companies regime within Part 15 of the Companies Act 2006.

J. E. WILLIAMS
 Honorary Treasurer

J. R. HOPES
 President

The notes on pages 24 to 32 form part of these accounts.

OPERATIONAL RESEARCH SOCIETY

STATEMENT OF CASH FLOWS FOR THE YEAR ENDED 31 DECEMBER 2018

	<u>2018</u> £	<u>2017</u> £
Reconciliation of net incoming resources to net cashflow from operating activities :		
Net Movement in Funds	(191,695)	8,074
Depreciation Charge - Tangible Assets	18,547	15,019
Depreciation Charge - Intangible Assets	10,320	20,008
Loss on Disposal of Fixed Assets	0	0
Decrease/(Increase) in Debtors	(431,597)	191,301
Increase/(Decrease) in Creditors	943,707	43,737
(Gains)/Losses on Investments	107,744	(123,075)
Investment Income	(50,896)	(50,282)
Cash Flows from Operating Activities	<u>406,130</u>	<u>104,782</u>
Investment Income	49,080	48,299
Purchase of Tangible Assets	(46,727)	(9,590)
Purchase of Intangible Assets	(74,897)	(110,754)
Purchase of Investments	(201,701)	(151,710)
Proceeds on Disposal of Investments	172,022	136,662
Cash Flows from Investing Activities	<u>(102,223)</u>	<u>(87,093)</u>
Increase/(Decrease) in Cash and Cash Equivalents in the Year	303,907	17,689
Cash and Cash Equivalents at the Beginning of the Year	157,267	139,578
Cash and Cash Equivalents at the End of the Year	<u><u>461,174</u></u>	<u><u>157,267</u></u>

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018

1 ACCOUNTING POLICIES

(1) **Basis of preparation**

The accounts have been prepared in accordance with the Companies Act 2006, the Charities Act 2011, the Charities Statement of Recommended Practice (FRS 102), the Financial Reporting Standard applicable in the UK and Republic of Ireland (FRS 102) and under the historical cost convention in accordance with applicable Accounting Standards as modified by the accounting policy for investments quoted on a recognised stock exchange, which are stated at market value (see 1(8) below).

The Operational Research Society meets the definition of a public benefit society under FRS 102.

(2) **Preparation of the accounts on a going concern basis**

The Operational Research Society operates as a going concern and the trustees are of the view that it will continue to do so for the foreseeable future.

(3) **Key estimates and judgements**

When preparing the financial statements, management makes a number of judgements, estimates and assumptions about the recognition and measurement of assets, liabilities, income and expenses. The estimate that has the most significant effect relates to intangible fixed assets.

The company amortises fixed assets over their estimated useful lives. The estimation of the useful lives of assets is based on historic performance as well as expectations about future use and therefore requires estimates and assumptions to be applied by management. The actual lives of these assets can vary depending on a number of factors, including the maintenance and level of upkeep of the software systems.

(4) **Designation of funds**

Income and expenditure arising from the normal charitable activities of the Society is included within the General Fund.

The Reserve Fund consists of resources of the Society which are represented by land and buildings, fixed asset investments and cash deposited with the Society's investment brokers.

The Designated Award Fund represents a legacy received in 2002 which will be used to fund an annual award.

(5) **Dividends and investment income**

Dividends and investment income are recognised when receivable.

(6) **Other income and expenditure**

Income and expenditure other than dividends are accounted for on an accruals basis.

(7) **Value added tax**

The Society has partial exemption status for Value Added Tax and Value Added Tax on apportionable costs which cannot be reclaimed is disclosed separately within administration costs. This item was £Nil in 2018.(2017 - £Nil).

(8) **Investments**

Investments quoted on a recognised stock exchange are included in the accounts at their market value.

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018

1 ACCOUNTING POLICIES (continued)

(9) **Tangible and Intangible fixed assets**

Tangible and intangible fixed assets costing more than £1,000 and with a useful economic life in excess of 3 years are capitalised and included at cost including any incidental expenses of acquisition.

Depreciation of tangible fixed assets is charged on a straight line basis at the following rates :

Long leasehold building	-	2%
Office machines and computer equipment	-	25%
Fixtures and fittings	-	10%

Amortisation of Intangible fixed assets is charged on a straight line basis at the following rate :

Software systems	-	25%
------------------	---	-----

The amortisation rate charged is based on management's best estimate of the useful life of the software systems.

(10) **Debtors**

Trade and other debtors are recognised at the settlement amount due after any trade discount offered. Prepayments are valued at the amount prepaid net of any trade discounts due.

(11) **Cash at bank and in hand**

Cash at bank and cash in hand includes cash and short term highly liquid investments.

(12) **Creditors and provisions**

Creditors and provisions are recognised where the charity has a present obligation resulting from a past event that will result in the transfer of funds to a third party and the amount due to settle the obligation can be measured or estimated reliably. Creditors and provisions are normally recognised at their settlement amount after allowing for any trade discounts due.

(13) **Pensions**

The Society contributes to individual pension schemes established for each eligible employee.

(14) **Allocation of costs**

Salaries, depreciation, websites / digital services expenditure and other central and establishment overheads are allocated to appropriate cost categories using consistently applied ratios based on estimates of actual time and costs expended in each area.

(15) **Financial instruments**

The Society only has financial assets and financial liabilities of a kind that qualify as basic financial instruments. Basic financial instruments are initially recognised at transaction value and subsequently measured at their settlement value.

2 LEGAL STATUS OF THE SOCIETY

The Society is a company limited by guarantee, has no share capital and is a registered charity. The objectives of the Society are the advancement of knowledge and education in operational research.

The liability of each member in the event of a winding-up is limited to £1.

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018 (continued)

3 PUBLICATIONS	<u>2018</u>	<u>2017</u>
	£	£
Incoming resources :		
Journal / KMRP / JOS	643,724	550,623
Inside OR	3,738	1,868
EJIS / Health Systems	208,567	212,869
Other Publications	4,321	2,834
	<u>860,350</u>	<u>768,194</u>
Resources used :		
Journal / KMRP / JOS	72,495	75,263
Inside OR	106,225	103,660
EJIS / Health Systems	72,542	56,488
Impact Magazine	10,169	6,198
Other Publications	633	3,447
	<u>262,064</u>	<u>245,056</u>

4 OTHER DIRECT CHARITABLE EXPENDITURE

Non-revenue earning activities in pursuit of charitable aims

IAOR Online - Members access	9,624	7,011
Library	0	10,908
Foreign Affairs Expenses	7,504	5,543
Regional Societies	9,608	7,576
Special Interest Groups	15,325	8,087
Public Information about OR :		
Science of Better	16,307	13,016
Learn about OR	82,890	106,258
General Publicity	45,902	37,420
Third Sector Pro Bono	33,340	31,010
Sponsorship of OR Conferences	0	0
Medals, Awards and Scholarships	23,231	24,098
Strategic Initiatives	108,497	93,371
Other Costs	4,069	4,051
Total	<u>356,297</u>	<u>348,349</u>

5 GOVERNANCE AND SUPPORT COSTS

Board and Committees	128,922	85,330
Auditors' Fees :		
for audit	6,950	6,550
for other services	1,056	1,044
Other Legal and Professional Fees	16,650	19,931
	<u>153,578</u>	<u>112,855</u>

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018 (continued)

6 TOTAL RESOURCES EXPENDED

Expenditure analysed by type of cost :

	Staff Costs £	Other Costs £	Deprecn.& Amortisation £	Total 2018 £	Total 2017 £
Investment Management Costs	-	11,645	-	11,645	11,318
Subscriptions	82,164	23,508	1,017	106,689	103,771
Events and Conferences	81,054	261,146	2,112	344,312	241,905
Training	26,523	74,119	241	100,883	80,740
Publications	107,555	153,370	1,139	262,064	245,056
Accreditation	3,004	886	480	4,370	3,765
Websites	144,048	17,239	20,507	181,794	153,286
Other Charitable Expenditure	223,719	129,208	3,370	356,297	348,349
Governance and Support Costs	81,838	71,740	0	153,578	112,855
	<u>749,905</u>	<u>742,861</u>	<u>28,866</u>	<u>1,521,632</u>	<u>1,301,045</u>

Staff costs :

Wages and Salaries	629,643	495,846
Social Security Costs	59,317	38,578
Pension Costs	60,945	55,550
	<u>749,905</u>	<u>589,974</u>

The average number of employees of the Society, calculated on a full time equivalent basis, during the year was :

	<u>2018</u>		<u>2017</u>	
	FTE	Headcount	FTE	Headcount
Charitable activities	13.8	14.3	10.1	11.9
Management and administration	3.4	4.3	3.1	3.8
	<u>17.2</u>	<u>18.6</u>	<u>13.2</u>	<u>15.7</u>

During this and the previous year one employee of the Society earned between £70,000 and £80,000, excluding pension contributions. Contributions of £8,609 were paid to their pension scheme (2017- £8,359).

The key management personnel of the Society comprise the trustees and the Secretary and General Manager. The total employee benefits of the key management personnel of the Society were £85,869 (2016 - £84,575)

Included within staff costs above are termination payments amounting to £13,500 (2017- £NIL)
No remuneration was paid or is payable to Trustees for service on the Board for the year (2017 - £Nil)

During the year 10 Trustees (2017 - 10 Trustees) received a total of £7,939 (2017 - £8,509) in reimbursement of expenses incurred on Society business .

Other external costs include :	<u>2018</u> £	<u>2017</u> £
Other Operating Leases	<u>3,655</u>	<u>3,655</u>

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018 (continued)

7 INTEREST RECEIVABLE AND SIMILAR INCOME

	<u>2018</u>	<u>2017</u>
	£	£
Income from Listed Investments	49,080	48,299
Interest on Bank Deposits	0	0
Distributions - CAF	1,816	1,983
	<u>50,896</u>	<u>50,282</u>

8 FIXED ASSETS

	-----Tangible-----				Intangible
	Long Leasehold Land and <u>Buildings</u>	Office <u>Equipment</u>	Fixtures & <u>Fittings</u>	<u>Total</u>	<u>Software Systems</u>
	£	£	£	£	£
Cost					Cost
At 31 December 2017	314,306	114,588	53,353	482,247	862,014
Additions	-	9,888	36,839	46,727	74,897
Disposals	-			0	
At 31 December 2018	<u>314,306</u>	<u>124,476</u>	<u>90,192</u>	<u>528,974</u>	<u>936,911</u>
Depreciation					Amortisation
At 31 December 2017	150,864	100,680	38,054	289,598	754,005
Charge for the Year	6,286	9,174	3,087	18,547	10,320
Disposals	-			0	
At 31 December 2018	<u>157,150</u>	<u>109,854</u>	<u>41,141</u>	<u>308,145</u>	<u>764,325</u>
Net Book Value					Net Book Value
At 31 December 2018	<u>157,156</u>	<u>14,622</u>	<u>49,051</u>	<u>220,829</u>	<u>172,586</u>
At 31 December 2017	<u>163,442</u>	<u>13,908</u>	<u>15,299</u>	<u>192,649</u>	<u>108,009</u>

Capital expenditure authorised but not contracted for at 31 December 2018 and not provided for in the accounts amounted to £57,750 (2017 - £74,391).

The Trustees consider the market value of the Long Leasehold Land and Buildings to be materially in excess of the book written down value shown above.

The Trustees do not consider that the difference can be accurately defined without the benefit of a professional valuation.

Included under software systems and fixtures and fittings are assets in development for which amortisation or depreciation will not be charged until the asset completion date.

The value of assets in development at 31 December 2018 is £179,606 (2017 - £85,609). Amortisation is allocated across the various expenditure categories within the Statement of Financial Activities. Please see Note 6 for further information.

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018 (continued)

9 LISTED INVESTMENTS AT MARKET VALUE

	<u>2018</u> £	<u>2017</u> £
Market Value at 1st January	1,554,759	1,416,429
Additions at Cost	201,701	151,710
Proceeds on Disposal	(172,022)	(136,662)
Net Investment Gain /(Loss)	(103,692)	123,282
Market Value at 31st December	<u>1,480,746</u>	<u>1,554,759</u>
Cost	<u>1,258,067</u>	<u>1,182,108</u>

All the above investments are either listed on a recognised stock exchange in Great Britain or are represented by unit trusts which are traded on a daily basis in the UK, and fall within the wider range of investments as defined by the Trustees Act 1961.

The Society's narrower range of investments as defined by the Trustees Act 1961 is covered by deposits held at Investec.

10 CHARITIES AID FOUNDATION

At 31 December 2018 this investment is represented by 56,058 (2017 - 56,058) shares in the FP CAF Fixed Interest B Accumulation Fund, having a market value of £67,439 (2017 - £69,675).

	<u>2018</u> £	<u>2017</u> £
Market Value at 1st January	69,675	67,899
Net Investment Gain /(Loss)	(4,052)	
Distributions not remitted	<u>1,816</u>	
	(2,236)	1,776
Market Value at 31st December	<u>67,439</u>	<u>69,675</u>
Cost	<u>56,060</u>	<u>56,060</u>

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018 (continued)

11 DEBTORS

	<u>2018</u>	<u>2017</u>
	£	£
Trade Debtors	1,037,577	45,238
Taxation Recoverable	9,112	11,104
Prepayments	54,912	24,324
Accrued Income	16,665	606,003
	<u>1,118,266</u>	<u>686,669</u>

12 CREDITORS

	<u>2018</u>	<u>2017</u>
	£	£
Trade Creditors	13,572	52,003
Other Creditors	12,580	20,374
Taxation and Social Security	136,294	27,576
Accruals	90,048	32,620
Deferred Income	855,387	31,601
	<u>1,107,881</u>	<u>164,174</u>

<i>Deferred income brought forward</i>	31,601
<i>Released to incoming resources during the year</i>	(31,601)
<i>Deferred income arising in the year</i>	<u>855,387</u>
<i>Deferred income carried forward</i>	<u>855,387</u>

Deferred income consists of 2019 subscription income paid in advance and income relating to 2019 publications income and Journalist expenses invoiced in advance.

13 FINANCIAL COMMITMENTS

At 31st December 2018 the Society had commitments under other non-cancellable operating leases as follows :

	<u>2018</u>	<u>2017</u>
	£	£
Expiry date :		
Under one year	3,655	3,655
Two to five years	6,228	9,882
Over five years	-	-
	<u>9,883</u>	<u>13,537</u>

The Society has a commitment to a service charge on the car park of the leasehold property over the next 90 years estimated at £269,670 (Under one year £3,030; Two-five years £12,120; Over five years £254,520). These items are not shown in the above table.

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018 (continued)

14 RELATED PARTY TRANSACTIONS

A member of Key Management Personnel is a Director of Edward Street Management Limited, the company that manages the Society's buildings car park. During the year the Society paid rent to the company of £3,636 (2017 - £3,636). As at 31 December 2018 there was a creditor balance owing to Edward Street Management Limited of £3,787 (2017 - £Nil).

The wife of a member of key management personnel is employed by the Society. This employee received remuneration of £24,971 (2017 - £22,392) (including employers pension contributions) during the financial year.

15 DESIGNATED FUNDS

The funds of the charity include the following designated funds which have been set aside out of unrestricted funds by the trustees for specific purposes :

(1) Reserve Fund

The reserve fund consists of resources of the Society which are represented by land and buildings, fixed asset investments and a cash deposit with the Society's investment brokers. The Society operates a reserves policy that reflects its critical dependence on journal income.

(2) Designated Award Fund

The Designated Award Fund represents a legacy received in 2002. The Legator, Mrs May Hicks, expressed a non-binding wish that the Society uses its bequest to fund an annual award to be determined by the Council of the Society. The legacy is currently invested in the Charities Aid Foundation Fixed Interest B Accumulation Fund.

16 STATEMENT OF FINANCIAL ACTIVITIES : COMPARATIVE FIGURES BY INDIVIDUAL FUND

	<u>General Fund</u>		<u>Reserve Fund</u>		<u>Designated Award Fund</u>	
	<u>2018</u> £	<u>2017</u> £	<u>2018</u> £	<u>2017</u> £	<u>2018</u> £	<u>2017</u> £
INCOME FROM :						
Charitable activities	1,386,785	1,135,762	-	-	-	-
Investment income	0	0	49,080	48,299	1,816	1,983
Total	<u>1,386,785</u>	<u>1,135,762</u>	<u>49,080</u>	<u>48,299</u>	<u>1,816</u>	<u>1,983</u>
EXPENDITURE ON :						
Raising funds	-	-	11,645	11,318	-	-
Direct charitable expenditure	1,499,875	1,279,726	8,612	8,501	1,500	1,500
Total	<u>1,499,875</u>	<u>1,279,726</u>	<u>20,257</u>	<u>19,819</u>	<u>1,500</u>	<u>1,500</u>
Investment Gains/(Losses)	-	0	(103,692)	123,282	(4,052)	(207)
Net Income/(Expenditure)	<u>(113,090)</u>	<u>(143,964)</u>	<u>(74,869)</u>	<u>151,762</u>	<u>(3,736)</u>	<u>276</u>

OPERATIONAL RESEARCH SOCIETY

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31 DECEMBER 2018 (continued)

17 ANALYSIS OF NET ASSETS BETWEEN FUNDS

	General Fund £	Reserve Fund £	Designated Award Fund £	Total £
Tangible Fixed Assets	63,673	157,156	-	220,829
Intangible Fixed Assets	172,586	-	-	172,586
Investments	-	1,480,746	67,439	1,548,185
Cash Deposited with Investment Brokers	-	54,510	-	54,510
Net Current Assets/Liabilities	433,281	(3,027)	(13,205)	417,049
Total Net Assets	<u>669,540</u>	<u>1,689,385</u>	<u>54,234</u>	<u>2,413,159</u>

18 RECONCILIATION OF MOVEMENTS IN UNREALISED (GAINS)/LOSSES ON INVESTMENT ASSETS

	Reserve Fund	Designated Award Fund £	Total £
Unrealised gains at 31 Dec 2017	372,647	1,308	373,955
Realised investment (gains) / losses during the year	5,772	-	5,772
Net unrealised investment gains/ (losses) arising during the year	(155,740)	(4,053)	(159,793)
Unrealised (losses)/gains included in net assets at 31 Dec 2018	<u>222,679</u>	<u>(2,745)</u>	<u>219,934</u>

DISPOSAL OF INVESTMENTS

	Cost £	Proceeds £	Book Gain/(Loss) on Disposal £	Realised Revaluation Gain/(loss) £
Reserve Fund	<u>125,746</u>	<u>172,022</u>	52,048	<u>(5,772)</u>
Net unrealised investment gains/ (losses) arising during the year as above			(155,740)	
Per Statement of Financial Activities			<u>(103,692)</u>	

19 PENSION FUND

The Society contributes to individual pension schemes established for each individual employee. The assets of these schemes are held separately from those of the Society in independently administered funds. The pension charge represents contributions payable by the Society to the schemes and amounted to £60,945 (2017 - £55,550). Pension payments outstanding at the end of the year were £11,672 (2017 - £20,374).

History

In the autumn of 1947, at a dinner discussion convened at the Athenaeum Club in London, it was decided to form the Operational Research Club. The club was inaugurated in April 1948 with an initial membership of 50, under the chairmanship of Sir Charles Goodeve and with Mr J A Jukes as the first secretary. The exclusivity associated with the word “club” was deliberately chosen for the initial period, to ensure clarification of what was meant by operational research and to attempt to develop a wholeness in what was otherwise a somewhat vague field. The club met regularly in the rooms at the Royal Society for technical discussions. By 1953 the initial objectives had been achieved and the pressure to form a normal “learned and professional” society had become strong. Therefore, the club was transformed into The Operational Research Society and its first president was Sir Owen Wansbrough-Jones and the hon secretary Mr B H P Rivett.

Presidents of the society

Sir Owen Wansbrough-Jones	1954/55
Sir William K Slater	1956/57
Professor M G Kendall	1958/59
The Earl of Halsbury	1960/61
Professor B H P Rivett	1962/63
Professor G A Barnard	1964/65
Professor R T Eddison	1966/67
Mr E C Williams	1968/69
Mr S Beer	1970/71
Professor K D Tocher	1972/73
Mr R C Tomlinson	1974/75
Mr A M Lee	1976/77
Professor M G Simpson	1978/79
Mr G H Mitchell	1980/81
Professor K B Haley	1982/83
Dr R S Stainton	1984/85
Professor J V Rosenhead	1986/87
Dr J C Ranyard	1988/89
Mr P N Thornton	1990/91
Professor C B Chapman	1992/93
Professor L C Thomas	1994/95
Mr I J Disley	1996/97
Professor R G Dyson	1998/99
Professor M Pidd	2000/01
Mr J Gibb	2002/03
Professor V Belton	2004/05
Professor J D Griffiths	2006/07
Mrs S M Merchant	2008/09
Professor R W Eglese	2010/11
Dr G H Royston	2012/13
Professor S L Robinson	2014/15
Ms R A Kaufman OBE	2016/17
Mr J R Hopes	2018/19

OR Society Awards

Companion of Operational Research

Sir Hermann Bondi	1983	Professor M Pidd	2011
Mr D Hicks	1983	Professor P H Millard	2012
Professor R V Jones	1983	Professor D M Ryan	2013
Professor B H P Rivett	1983	Professor R M Davies	2014
Mr H R W Watkins	1984	Mr C R Humby	2014
Professor Sir David Cox	1985	Mrs S M Merchant	2015
Lord Ezra	1985	Professor S C Brailsford	2016
Mr P Hughes	1985	Professor J D Griffiths	2016
Lord Zuckerman	1985	Professor E K Burke	2017
Sir John Kingman	1986	Professor P R Harper	2018
Sir Dennis Rooke	1986		
Sir Charles Carter	1987		
Mr T P Frost	1987		
Professor H.Muller-Merbach	1988		
Mr D A Quarmby	1989		
Professor R C Tomlinson	1990		
Mr R A Showell	1991		
Mr G H Mitchell	1992		
Professor P Whittle	1994		
Mr J Plymen	1994		
Professor S Vajda	1995		
Professor K B Haley	1996		
Professor M F Shutler	1996		
Professor D J White	2001		
Professor K C Bowen	2001		
Dr R A Forder	2005		
Professor F Kelly	2005		
Mr G K Rand	2005		
Dr J C Ranyard	2005		
Professor J V Rosenhead	2005		
Dr J F Miles	2006		
Professor R G Dyson	2007		
Mr E K G James	2007		
Professor J Friend	2008		
Dr G Royston	2008		
Professor R J Paul	2009		
Professor A Mercer	2010		
Mr T O'Connor	2010		
Professor V Belton	2011		
Ms R A Kaufman	2011		

Goodeve Medal

B H Mahon	1976	J Sonander	2003
R J M Bailey	1976	R Hartley	2004
N R Tobin	1977	G Lanot	2004
I Sanderson	1979	S C Brailsford	2005
A J Williams	1980	V Lattimer	2005
J G Shepherd	1981	P Tarnaras	2005
F K Lyness	1982	J Turnbull	2005
L P Fatti	1984	K Taylor	2006
A H Christer	1985	B Dangerfield	2006
W M Waller	1985	S C Brailsford	2007
G Best	1987	D Evenden	2007
G Parston	1987	V Harinda	2007
J V Rosenhead	1987	P Harper	2007
D Rowland	1988	A Medina-Borja	2008
I R Turner	1989	K S Pasupathy	2008
R Bandyopadhyay	1990	K Triantis	2008
S Datta	1990	D Ronen	2009
D Schrady	1992	C A Goodhart	2009
D Wadsworth	1992	S Kumar	2010
A Bouzaher	1993	D A Nottestad	2010
S Offutt	1993	E E Murphy	2010
D W Bunn	1994	L C Thomas	2011
E R Larsen	1994	F R Johnston	2012
K Vlahos	1994	E A Shale	2012
G M Campbell	1995	S Kapoor	2012
C F Davis	1995	A Sheth	2012
M Carey	1996	R True	2012
D Lockwood	1996	P Kemmer	2013
C M Yeats	1997	A Strauss	2013
T Rehman	1997	T Winter	2013
D-W Tcha	1998	J Bengtsson	2014
T-J Choi	1998	D Bredstrom	2014
Y-S Myung	1998	P Flisberg	2014
F Duckworth	1999	M Ronnqvist	2014
A J Lewis	1999	S Crowe	2015
J Banasik	2000	P Bennett	2015
J N Crook	2000	M Daraktchiev	2015
L C Thomas	2000	M Utley	2015
K Korporaal	2001	S C Brailsford	2016
A Ridder	2001	D De Silva	2016
P Kloprogge	2001	A Backiel	2017
R Dekker	2001	B Baesens	2017
S Howick	2002	G Claeskens	2017
C Eden	2002	A I Ali	2018
J E Beasley	2003	G Ince	2018
H Howells	2003		

Stafford Beer Medal

JJ Jahng	2003	R Lederman	2012
H Jain	2003	R Johnston	2012
K Ramamurthy	2003	H Koch	2013
R Lindgren	2004	E Gonzalez	2013
D Stenmark	2004	D Leidner	2013
J Ljungberg	2004	D Denyer	2014
S Sarker	2005	M Hall	2014
S Sahay	2005	E Kutsch	2014
S Madon	2006	E Lee-Kelley	2014
C Middleton	2007	P Tallon	2015
W Cukier	2007	J Gerow	2016
S K Sia	2008	J Thatcher	2016
C Soh	2008	V Grover	2016
C Ashurst	2009	A Utesheva	2017
N Doherty	2009	J Simpson	2017
J Peppard	2009	D Cecez-Kecmanovic	2017
F Thiesse	2010	R Parks	2018
J Al-Kassab	2010	H Xu	2018
E Fleisch	2010	C-H Chu	2018
P O'Reilly	2011	P Lowry	2018
P Flanagan	2011		

Tocher Medal

K Kotiadis	2009	J Xu	2017
T Pitana	2011	E Huang	2017
E Kobayashii	2011	L Hsieh	2017
C Boer	2013	L H Lee	2017
Y Saanen	2013	Q Jia	2017
K-H Chang	2015	C Chen	2017
A-L Chang	2015		
C-Y Kuo	2015		

Cook Medal

P Jackson	2014	F Di Vincenzo	2018
J Klobas	2014	D Mascia	2018
D Pentland	2016		
K Forsyth	2016		
D MacIver	2016		
M Walsh	2016		
R Murray	2016		
L Irvine	2016		

Griffiths Medal

H Witteman	2015	P Smet	2017
J Stahl	2015	W Van Den Noortgate	2017
M Mihaylow	2017	G Vanden Berghe	2017

Doctoral Award

K Kaparis	2008	T Lidbetter	2013
A Strauss	2009	M Takac	2014
F Liberatore	2010	C Koc	2015
R Wood	2011	I Megiddo	2016
K Rustogi	2012	J F Sze	2017

Beale Medal

J V Rosenhead	1992	K H Haley	2010
D J White	1993	F Kelly	2011
A H Christer	1995	M D Elder	2012
G H Mitchell	1998	K D Glazebrook	2013
H P Williams	1999	R Fildes	2014
R C Tomlinson	2005	J Friend	2015
P Checkland	2006	R Ormerod	2016
C Eden	2007	M Jackson	2017
L C Thomas	2008	R Cheng	2018
J D Griffiths	2009		

Silver Medal

Sir Charles Goodeve	1964	Sir Geoffrey Vickers	1975
Professor P M Morse	1965	Mr E.K.G.James	1979
Professor K D Tocher	1967	Professor E M L Beale	1980
Professor B H P Rivett	1968	Professor S Eilon	1982
Professor R T Eddison	1969	Professor G Dantzig	1986
Mr A M Lee	1970	Mr L V Kantorovich	1986
Professor R L Ackoff	1971		

Bronze Medal

R M Adelson	1965	M F Cantley	1969
J Stringer	1967	F K Lyness	1970
T A Burgin	1967	A M Duguid	1972
A R Wild	1967	C G Moss	1972
D J Chambers	1968		

President's Medal

D R Corkindale	1976	P Loader	2004
M L Chambers	1977	M Bryant	2004
R G Dyson	1977	P Bates	2004
M Sloman	1978	C McGuckin	2004
J V Rosenhead	1979	D Kelly	2004
P Doyle	1980	P Loucopoulos	2005
J Fenwick	1980	KG Zagafos	2005
G P Savage	1980	Y Pyrgiotis	2005
D B Gilding	1981	D Beis	2005
C Lock	1981	A Swain	2006
B Fokkens	1982	A Ross	2006
M Puylaert	1982	A Lewins	2007
R S Hambleton	1983	M Sykes	2007
A W Nimmo	1984	A Moon	2007
C B Chapman	1985	M Allwright	2008
D F Cooper	1985	J Ball	2008
A B Cammaert	1985	D Pankhurst	2008
P Doyle	1987	I Wright	2008
J Saunders	1987	P Frangos	2010
M Pidd	1988	S Hughes	2010
S R Clarke	1989	S Hammond	2011
A H Christer	1990	K Slater	2011
K A H Kobbacy	1990	C Marston	2012
B C Dangerfield	1991	P Rose	2012
C A Roberts	1991	S Mardle	2013
M B Wright	1992	L Fildes	2013
C P Thunhurst	1993	A Lewins	2013
C J Ritchie	1993	E Husemann	2014
A Khakee	1994	D Lane	2014
K Stromberg	1994	E Munro	2014
J J Glen	1996	G Owusu	2016
H Tsoukas	1997	S Shakya	2016
D B Papoulias	1997	R Dorne	2016
J H Powell	1998	A Mohamed	2016
G Laporte	1999	A McCormick	2016
F Semet	1999	A Liret	2016
V V Dadeshidze	1999	O Buhlinger	2017
L J Olsson	1999	C Henzel	2017
F Vasko	2000	M Clocherty	2017
H Gilles	2000	M Knapton	2017
D Bright	2000	H Papachristou	2017
V Kocatulum	2000	C Legge	2017
E Wolf	2000	R Leese	2018
J Moffat	2000	J Blaavand	2018
J J Race	2001	C Centazzo	2018
D Burnell	2001	A Bejan	2018
M Neighbour	2002	P Munday	2018
M Acutt	2003		



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