



ANNUAL REPORT 2018

$$C(0, t) = 0 \text{ for all } t$$

$$C(S, t) \rightarrow S \text{ as } S \rightarrow \infty$$

$$C(S, T) = \max\{S - K, 0\}$$

$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS \frac{\partial V}{\partial S} - rV = 0$$

$$d_1 = \frac{1}{\sigma\sqrt{\tau}} \left[\left(x + \frac{1}{2}\sigma^2\tau \right) + \frac{1}{2}\sigma^2\tau \right]$$

$$d_2 = \frac{1}{\sigma\sqrt{\tau}} \left[\left(x + \frac{1}{2}\sigma^2\tau \right) - \frac{1}{2}\sigma^2\tau \right]$$

Developing the minds
that **shape** the financial industry
to **advance** society

DIRECTOR'S MESSAGE

AIFMRM is nearly **5** years old!

2018 has been a stimulating, thought-provoking and productive year. Two highlights stand out: Four of AIFMRM's PhD students submitted their theses and graduated this year – the first PhD graduates since AIFMRM's inception in 2014, and the launch of AIFMRM's first MOOC – Financial Regulation in Emerging Markets and the Rise of Fintech Companies, in collaboration with CILT and Coursera.

I would like to take this opportunity to express my gratitude and appreciation to AIFMRM's donors – Absa, FirstRand, Liberty, Nedbank, Old Mutual and Sanlam – and each of their representatives: Colin Iles, Miné van Zyl, Brian Kipps, Anél Bosman, Judy Faure and Nersan Naidoo, for their strategic guidance, trust and financial support as we pursue our vision and purpose together.

I would also like to express my appreciation to my colleagues in AIFMRM, the Dean of the Faculty and staff in the Faculty of Commerce who supported the Institute during this year.

Sincerely,



Professor David Taylor
Director – AIFMRM



THE PEOPLE



David Taylor
Director



Peter Ouwehand
Associate Professor



Co-Pierre Georg
Associate Professor



Abhik Mukherjee
Senior Lecturer



Obeid Mahomed
Lecturer



Thomas McWalter
Adjunct Associate
Professor



Tanja Tippett
Adjunct Associate
Professor



Billy Enderstein
Student Psycho-
Socio Welfare
Counsellor



Lizzy Starck
Administrative
Officer



Lameez Fakier
Administrative
Officer

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CHARTING 5 YEARS at AIFMRM

2013

Research Unit, **ACQuFRR** established

1st cohort – MPhil specialising in Mathematical Finance

Fundraising for AIFMRM

Financial Services Sector Assessment **research conducted**
(AIFMRM/Western Cape Government)



2014

AIFMRM launched on 31 January 2014

Founding recurrent donors: **Liberty, FirstRand and Absa**

Establishment donor: **Western Cape Government**

1st annual **Financial Mathematics Team Challenge**
(international student research challenge)

Business Risk Management **online short course introduced**

Financial Services Sector Assessment **report issued**
(AIFMRM/Western Cape Government)

MCom in Risk Management of Financial Markets
– **curriculum designed with industry**



2015

MCom in Risk Management of Financial Markets
– **curriculum developed and degree accredited**

1st annual AIFMRM **Student Careers Fair**



2016



1st cohort – MCom in Risk Management of Financial Markets

Advanced Business Risk Management online short course introduced

Foundations of Financial Markets in South Africa online short course introduced

MCom in Risk Management of Financial Markets externship programme launched

2017

21

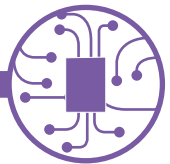
Nedbank and Old Mutual join AIFMRM as recurrent donors

MPhil specialising in Financial Technology
– **curriculum developed and degree approved**

Alumni Reunion – 21 Years of Mathematical Finance in South Africa

Women in Finance (promotional event for female students at UCT)

2018



Sanlam joins AIFMRM as a recurrent donor

1st cohort – MPhil specialising in Financial Technology

The Factory (international academic research challenge)

Financial Regulation in Emerging Markets MOOC launched

TEACHING

Targeting transformation and developing critical skills

AIFMRM's purpose is to **develop** the minds that **shape** the financial industry to **advance** society. To deliver on this, the Institute continues to grow its donor base, deliver top-quality education, attract the right calibre and diversity of students, and support them through their postgraduate experience. Teaching and research remain a core focus.

AIFMRM now offers **three specialised master's degrees**, having launched the MPhil specialising in Financial Technology in 2018. As with all AIFMRM's educational offerings, the degree was established in response to industry needs. Both the MPhil specialising in Mathematical Finance and the MCom in Risk Management of Financial Markets continue to produce high-quality graduates well-prepared for careers in all areas of financial services. Additionally, AIFMRM continues to offer **online short courses** aimed at **working professionals**, to address skills shortages in the industry.

In a departure from our customary offerings, **AIFMRM launched a new MOOC in July 2018** – Financial Regulation in Emerging Markets and the Rise of Fintech Companies, in collaboration with UCT's Centre for Innovation in Learning and Teaching (CILT) and Coursera.

3

specialised Master's degrees offered



3

online short courses offered



1st

MOOC launched (fintech)

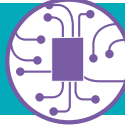
coursera

New fintech degree celebrates first cohort of graduates

12

students

in first cohort of the
**MPhil specialising in
Financial Technology**



The MPhil specialising in Financial Technology is an interdisciplinary degree offered in collaboration with the Departments of Statistical Sciences and Computer Science in UCT's Faculty of Science. The degree is designed to equip students with the necessary skills and knowledge to pursue a career in financial technology and big data. AIFMRM initiated the programme in response to the need for competency in data science and fintech in financial services, and consulted locally and internationally on the curriculum. The degree combines training in financial, statistical and computing skills with a solid understanding of financial markets and financial innovation. It also has a strong entrepreneurial component.

Three online short courses address the skills-gap

AIFMRM's non-credit bearing, online short courses, offered in collaboration with GetSmarter, are aimed at working professionals.

Business Risk Management

Provides a comprehensive overview of enterprise-wide risk management, a sound foundation of theoretical knowledge and the latest tools and techniques for practical application.

Ran **5 times** in 2018:
165 participants in total

Foundations of Financial Markets in South Africa

Designed for professionals in financial services and investment industries, both on the buy and sell side.

Ran **twice** in 2018:
20 participants in total

Advanced Business Risk Management

Provides a comprehensive simulation of the risk management process and application of industry best-practices.

Ran **twice** in 2018:
31 participants in total

MPhil specialising in Mathematical Finance

The companies employing this year's graduates are LibFin, Rand Merchant Bank, Standard Bank, Deloitte, PwC, Old Mutual, Bain, Sanlam Investments, Absa, FirstRand and EY.



What students are saying

**Dumisani
Ngwenza**

“The MPhil has been extremely challenging yet rewarding, and I recommend this degree because I walked out with personal and practical skills as well as a brand that companies notice and want to collaborate with. Over-and-above the quality of education we get at UCT, we also walk away with a brand. This department is the epitome of the brand statement due to the collaboration and exposure we get through dinners with corporates as well as the practitioner seminars.”

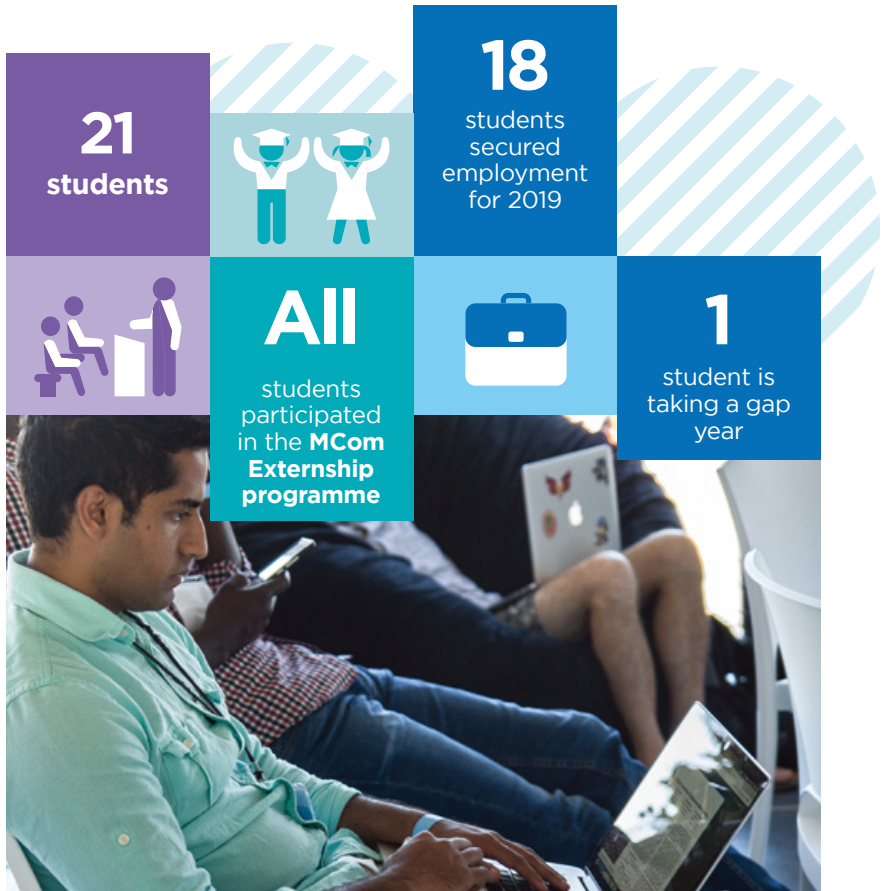
“In other larger faculties students tend to become lost in the crowd, however, in the MPhil, the individual attention and feedback was a refreshing change. This was complemented by the exceptional academic staff, with truly world-class lecturers, who generously shared their knowledge and skill. It was inspiring to see active individuals in the field of mathematical finance working on real problems and finding the best solutions. Also, the practitioner seminars were a privilege to attend, as these further broadened our knowledge and horizons.”

**Shabbirhussein
Esmail**

MCom in Risk Management of Financial Markets

The companies employing this year's graduates are Nedbank, Rand Merchant Bank, Deloitte, MMI, Standard Bank, Monocle, STANLIB, Prodigy Finance, Sanlam Investments, Riskworx, Absa and FirstRand.

Class of 2018



What students are saying about this degree:

**Mawetu
Siyotula**

“The MCom degree has certainly surpassed my expectations and prepared me well for the world of work. I was often pushed to my limit, and that helped me grow in confidence and agility. Problem-solving was interesting because you had to figure out a method to solve the problem and then actually solve the problem by modifying the method to fit the context of the problem. This is different from undergrad where you were most likely taught the method, and you just applied the method to solve a problem.”

“The MCom is unique because it elevates the process of learning above the actual content being taught. This was the only time in my studies where the emphasis was placed on learning how to learn – rather than just prescribing a syllabus. Therefore, this degree offers a substantive balance between theoretical aspects of risk management and the required technical skillset. AIFMRM has a wonderful support structure, an intimate class environment and lecturers have an open-door policy for consultations.”

**James
Fawson**

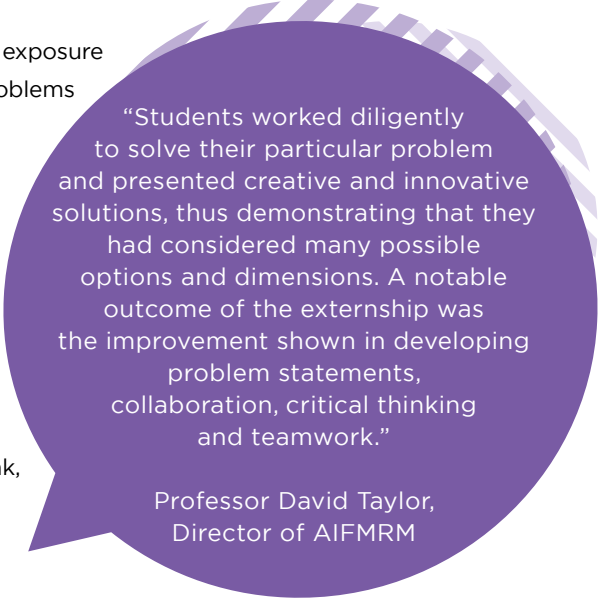
MCom Externship programme now in its third year

The MCom Externship involves extensive industry collaboration. It is a mentored problem-solving exercise where participating companies pose problems, supervise and provide mentorship for the student teams.

Each team works with a different company on one problem for four weeks – three weeks of research and problem-solving and one week for assessment and feedback. Teams produce a report detailing their analysis, approach, solutions and recommendations and present their findings.

The objective is to give students exposure to practical business or social problems – giving them an opportunity to apply innovative and inventive approaches to analysis and problem-solving and enhance their report writing and presentation skills.

In 2018, six teams worked on problems posed by FirstRand, Absa, Thomson-Reuters, Nedbank, MMI and Sanlam Investments.



“Students worked diligently to solve their particular problem and presented creative and innovative solutions, thus demonstrating that they had considered many possible options and dimensions. A notable outcome of the externship was the improvement shown in developing problem statements, collaboration, critical thinking and teamwork.”

Professor David Taylor,
Director of AIFMRRM

AIFMRM launches Fintech MOOC

42
participants
completed

Approx.
500
in progress

coursera ★★★★★

4.8/5
rating

In July 2018 AIFMRM and UCT's Centre for Innovation in Learning and Teaching (CILT) launched a new Massive Open Online Course (MOOC) called **Financial Regulation in Emerging Markets and the Rise of Fintech Companies**. The four-week course is offered on Coursera, an online learning platform, which has **33 million users**. The MOOC examines the rise of fintech companies, the technology that enabled them and the regulation they require in an emerging market environment.

AIFMRM was responsible for the course outline, content development, assessments, and provides oversight while the course runs, with Associate Professor Co-Pierre Georg as the academic lead. CILT was responsible for learning design, the filming and production of digital materials and provides ongoing technical support.

"We asked ourselves how we could make fintech inclusive, how this knowledge regarding a new area of industry can work for everyone – not just the early adopters. This is what drove us to develop the MOOC. We want to provide education around the topic for South Africa and the world."

Associate Professor Co-Pierre
Georg, AIFMRM

AIFMRM held two launch events, one in Cape Town at UCT on 26 July directly after the AIFMRM annual careers event, and another on 30 July at UCT's Graduate School of Business Campus in Johannesburg. A combined total of 122 attended the events.

Unlock the Block - Blockchain Hackathon 2018

Africa's largest blockchain hackathon

78 participants from
around the world

10 days

“The Fintech Hackathon has shown us two things; firstly that the applications of blockchain technology in improving people's lives in Africa are immense and, secondly, it is much easier to build those applications than many people think - we just need to work together.”

Paul Kohlhaas,
Founder of Linum Labs

AIFMRM and Linum Labs collaborated to host Unlock the Block, a 10-day blockchain event from 22 January to 2 February 2018.

The challenge taught participants how to develop blockchain applications in minimal time. The event commenced with a five-day intense bootcamp of blockchain and fintech training sessions by industry experts.

Teams were then given three days to develop and present their prototype blockchain applications, followed by Cape Town's first Blockchain Symposium on the final day.

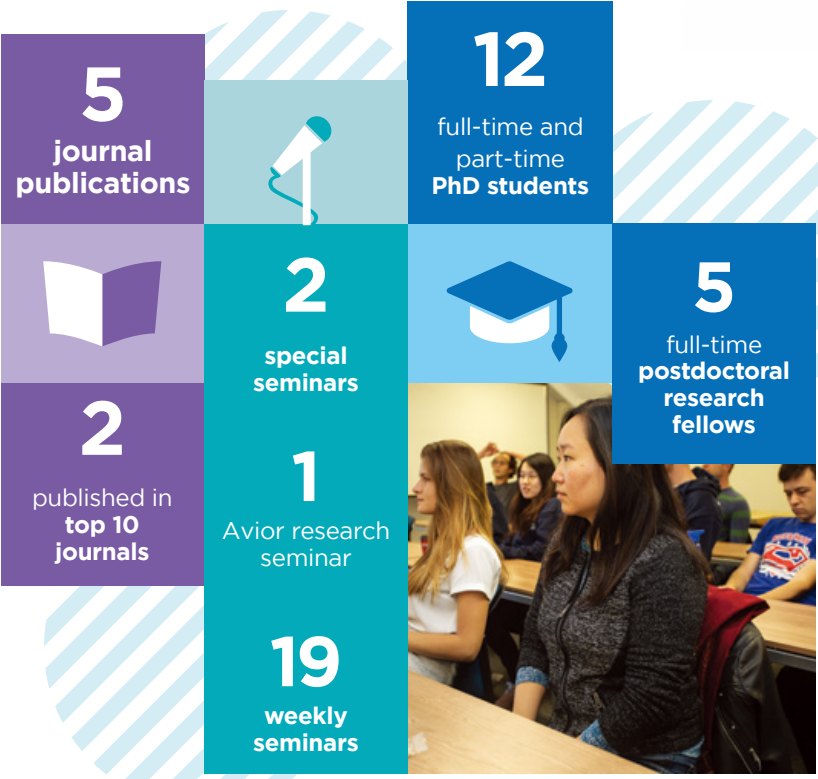
The winning applications delivered solutions to many pressing problems including using blockchain technology to save water, facilitate cattle trading and increase transparency in voting and corporate governance.

The Hackathon was sponsored by Absa, Microsoft, Old Mutual, Status, Foundry, Consensus, Citi, Pick 'n Pay, UCT and Rise.

RESEARCH

A culture of excellence

2018 research highlights



AIFMRM's research advances the theory and application of modern quantitative, statistical and mathematical techniques to the modelling and risk management of financial products and markets. AIFMRM engenders a culture of research excellence, provides research mentorship to staff and students, encourages entrepreneurial activity and develops research capacity.

The Institute hosted **the fifth annual Financial Mathematics Team Challenge**, and for the first time **"exported"** this highly successful event to **Brazil**. Another pioneering research event, **The Factory**, supported teams of international and local researchers to create novel research for publication in leading peer-reviewed journals.

Research unit members produced **five journal publications** this year, **two of these in Top 10 journals**: One in **Quantitative Finance** and the other in the **Journal of Financial Stability**.



5th FMTC: intense collaboration on industry-relevant problems

The fifth Financial Mathematics Team Challenge (FMTC) ran from 26 June to 6 July 2018, bringing together four teams of Master's and PhD students from UCT, University College London (UCL), Oxford University and ETH Zürich to develop unique solutions to the finance industry's most pressing problems. The event is a highly successful collaboration between AIFMRM's research unit and University College London.

The 2018 winning team – which included two Master's in Mathematical Finance students from UCT – worked on a problem posed by StepStone, a private markets firm in Zürich. The team used the language and mathematical techniques from public markets to solve an optimal investment-timing problem from illiquid private markets. The solution provides an initial step towards estimating the correct sequence and time for staged investment.

Each FMTC team wrote a report containing a critical analysis of their research problem and the results:

<p>1</p> <p>JIBAR Dynamics and Short Dated Caplets</p>	<p>2</p> <p>Commitment Scheduling for Private Equity Investments</p>	<p>3</p> <p>Portfolio Optimisation under Uncertainty</p>	<p>4</p> <p>An Assessment on the Appropriateness of the use of the LFMM in South Africa</p>
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“Collaborative research strengthens the scientific community, promotes peer-learning and yields creative and unexpected solutions. If industry cannot figure out the solution, then students look for improved answers that are mathematically robust.”

Dr Andrea Macrina, Co-founder of the FMTC, Director of the Financial Mathematics Programme at UCL



FMTC goes global

This year AIFMRM “exported” the FMTC idea to the rest of the world!


FMTC Brazil took place in August in Rio de Janeiro at the Fundação Getulio Vargas - Escola de Matemática Aplicada.

The Factory - research together

AIFMRM established a new research event in 2018, The Factory, supporting teams of researchers to advance knowledge in mathematical sciences on a topic of their choice. The goal is the completion of a manuscript to be submitted for publication in a leading peer-reviewed journal.

International teams began their research work several months before they travelled to The Factory, collaborating remotely through regular conference calls. Once at The Factory in Cape Town, they had just a few days to advance their working papers before undergoing two rounds of expert scrutiny and presentations to all participants. The Factory brought in an expert reviewer, Dr Marc Henrard, to help teams improve the quality of their work and increase their chances of publication.

In this inaugural event, “Team Multicurve” produced a core paper describing the consistent multi-curve framework which is now in the process of being finalised. It became clear that the scope of the project extends beyond a single research paper, and therefore two spin-off papers are also currently under development.



“The Factory teams included a mix of international and local academics and combined researchers across different stages of their careers to facilitate skills transfer through collaboration.”

Dr Andrea Macrina, Co-founder of The Factory, Director of the Financial Mathematics Programme at UCL

“Factory participants posed the right questions – taking a particular problem in the market and thoroughly examining the fundamentals that no-one has taken the time to do properly.”

Dr Marc Henrard, Head of Quantitative Research at OpenGamma and visiting professor at UCL



Two families, four doctors, one coincidence

It is a rare coincidence that two sets of brothers, who are close friends, graduate from the same two faculties – and each with the title of doctor.

AIFMRM's research unit had twelve PhD students in 2018, four of whom submitted their theses and graduated this year.

In a strange coincidence, two of these graduates – 28-year-olds Mario Giuricich and Alex Backwell both have 24-year-old brothers, Alessio Giuricich and David Backwell, who both graduated with an MBChB through UCT's Faculty of Health Sciences.

Alex and Mario have been friends since the start of their studies at UCT ten years ago and have taken mostly the same classes throughout. Alex pursued a BBusSc specialising in Quantitative Finance from 2009 to 2012, while Mario pursued a BBusSc specialising in Actuarial Science during the same period.

Both then completed the MPhil in Mathematical Finance in 2013, and both went on to pursue PhDs in Quantitative Finance from July 2014 to this year.

Alex became one of five AIFMRM Postdoctoral Research Fellows on completion of his thesis. Mario is keen on pursuing a professional career in the property and casualty insurance industry.

The pair of younger medical doctor brothers began their studies in 2013. They are good friends too, though this had nothing to do with their older siblings. The friendships were entirely coincidental.

What are the chances of this particular pairing? "You would need data to work that out," quipped Alex.

Events

JAN	22 Jan until 2 Feb	Unlock the Block: 10-day Blockchain Hackathon With co-hosts Linum Labs
FEB	13	Special Seminar: Tough Volatility Dr Jesper Andreasen (Danske Bank, Copenhagen)
	14	Avior Research Seminar: Machine Learning and Fund Strategies: Another Case of Irrational Exuberance? Dr Michael Wong (City University of Hong Kong)
	21 -23	Summer School in Mathematical Finance Held at the African Institute for Mathematical Sciences (AIMS) Dr Roger Lord (Cardano), Prof Tom McWalter (AIFMRM) and Dr Ralph Rudd (AIFMRM)
MAR	16	2nd Annual Donor Day

“Without this challenge I would never have seen how private equity firms actually work, and understood the dynamics involved through analysing real-life data.” Mbele feels the challenge has opened his eyes to postgraduate opportunities in research and has built valuable networks for the future.

Bandile Mbele, UCT Master’s student on the FMTC winning team

“Coursera had a call for proposals in fintech, and we are honoured to have been chosen to work in this area. We had something original to contribute in terms of emerging markets. This MOOC is an ideal way to engage with fast-movers and new developments in the industry. It offers an intense, short, flexible way of getting to grips with a new field.”

Speaking at the launch of the MOOC, ILT Director, Laura Czerniewicz

JUN	26 Jun until 6 Jul	5th Financial Mathematics Team Challenge (FMTC)
JUL	2-13	The Factory
	26	4th AIFMRM Careers Fair - Careers and Degrees in Financial Markets
	26	MOOC launch in Cape Town
	30	MOOC launch in Johannesburg
	AUG	8-18
OCT	4	Special Seminar: A Stylized History of Quantitative Finance Prof Emanuel Derman (Columbia University)

FUNDRAISING

A word of thanks to AIFMRM's donors

Donors at a glance

6 recurrent core donors

R25m plus

raised for scholarships and bursaries

AIFMRM is funded by prominent companies in the financial services sector, underlining the importance of collaboration between corporates and educational institutions to develop much-needed skills for the industry.

All three of AIFMRM's founding donors – Absa, FirstRand and Liberty renewed their funding commitments from 2019. AIFMRM would like to take this opportunity to thank the Board representatives for the renewed funding and for their valuable assistance in securing renewal.

“Growing support from across the sector is a recognition of the need to continue developing highly skilled finance professionals, and AIFMRM is a crucial part of that. It is essential to have an appreciation for our funders.”

Professor David Taylor,
Director of AIFMRM

AIFMRM welcomed Sanlam as a recurrent donor in 2018, joining Old Mutual and Nedbank who commenced funding in 2017. In addition to these donor commitments, AIFMRM has raised over R25 million in scholarships and bursaries for its students in the past four years, including R9 million from BANKSETA.

AIFMRM Donor Day

AIFMRM held the second annual Donor Day on 16 March 2018 in Cape Town. The purpose of Donor Day is for AIFMRM's corporate partners to meet the new cohorts of all three degrees, to introduce the students to the opportunities that this represents for them, and for students to gain an idea of what to expect after graduation when they enter the workplace.

The proceedings began with breakfast, followed by an introduction and positioning of AIFMRM and the donor relationship by Professor David Taylor. After that, AIFMRM graduates from the donor companies gave short talks on their experience of the student/workplace transition and shared advice for the year ahead.

Corporate presenters included Thabo Siko (Liberty), Daniel Maxwell (Rand Merchant Bank), Dirk van Heeswijk (FirstRand), Ndinae Masutha (Old Mutual), Marcio Lopes and Gino Engle (Absa), Boiketlo Mphahlele (Nedbank) and Shivan Sookdeo (Sanlam).



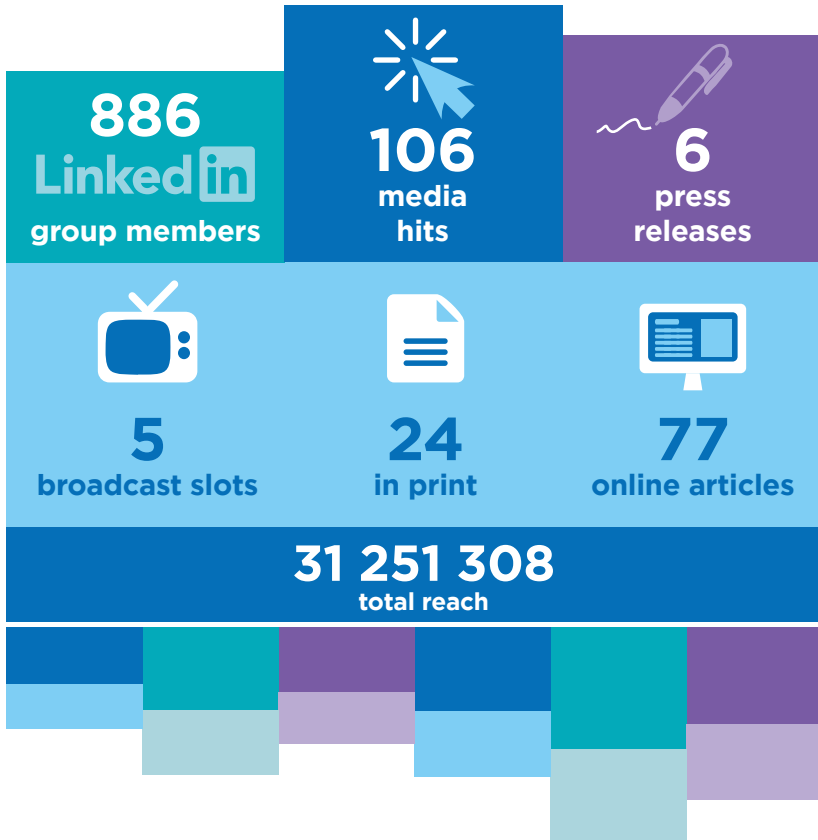
“Even though South Africa is a developing country, it has a very sophisticated financial market. AIFMRM will continue to produce graduates that drive this sophistication.”

Daniel Maxwell,
Financial Engineer at
Rand Merchant Bank

MARKETING

Reaching beyond the University

AIFMRM maintains an active media presence by providing commentary and analysis in key media channels. AIFMRM also curates a LinkedIn group to stimulate discussion among industry, academia, regulators and industry bodies and to share events and media coverage with its members.





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