



IDEMS International Annual Report

1 February 2019 - 31 January 2020

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Overview

IDEMS International ended its second year with a surplus in a year in which the organisation started growing and instigated a number of social impact investments. We had a turnover of £248,000 with a small surplus of £4,000 after impact investments and donations. Our full accounts are provided for transparency.

Most of our income has come from consultancy work, with many of our contracts this year from returning clients and some new clients gained through word of mouth. Our contracted work this year included continued research methods support for agriculture research projects in West Africa for the McKnight Foundation, and our expanding climatic work with existing partners, the UK Met Office and EUMETSAT, as well as a new collaboration with the World Meteorological Organization (WMO). A challenging and satisfying short-term contract was to support the University of Reading, PICSA (Participatory Integrated Climate Services for Agriculture) in exploring relationships with financial institutions in Kenya as an additional approach to supporting farmers.

The financial stability of paid consultancy work has created a solid foundation from which we are moving towards growth. Through our network of collaborators, we have recruited our first full time staff member, and through an open recruitment process we are looking to recruit a second. In Kenya, INNODEMS, a limited by guarantee subsidiary, was launched by our colleagues and collaborators. These are important structures to have in place as preparation for future growth.

We continued to prioritise activities related to our status as a social enterprise and community interest company. In addition to substantial staff time, we spent over £25,000 on impact investments and made donations of £9,000 to Supporting African Maths Initiatives (SAMI). This year we have attempted to establish mechanisms for community support as part of the foundation from which we are growing. These mechanisms have been opportunistic and broadly taken three forms:

- Community support. This included supporting workshops in Ghana and Kenya that brought together mathematical education experts, working across Africa, at school and university levels.
- Co-investment grant. We are privileged to be entrusted by the McKnight Foundation to support the Agroecology Hub in Kenya through a significant multiyear grant, for which our time is provided pro bono.
- Strategic social investment. We invested heavily in developing open electronic assessment resources for African schools and universities as an area of both social impact and long-term organisational growth.

Major activities

This year's major activities can be grouped into five overlapping categories.

Consultancy contracts

Our consultancy contracts continue to provide the solid financial foundation for IDEMS and are valuable and interesting work in their own right. We have continued to work with many of the same partners this year and we are pleased that our clients value the work we do and the benefit we can bring to projects. A highlight has been our climate focused work where we are now collaborating with international partners, WMO and EUMETSAT, on projects which are globally impactful and include an African development outlook.

Open products

We have ongoing involvement in the development of the open source R-Instat statistical software and Climsoft climate database software, which continue to grow their audiences and users globally. We also supported enhancements to the CAST statistics e-textbooks and helped to transition the code to officially become open source. A highlight of the year has been our extensive work developing online questions in the STACK system to support the teaching of mathematics in African universities.

IDEMS community work

We have continued to invest resources into projects we are passionate about that benefit our community. This year, many of our efforts have focussed on education projects including organising maths camps with AMI and SAMI, developing electronic resources to support lecturers in Africa, and teaching statistics to MSc students at AIMS Cameroon. A highlight has been supporting rural development. The Agroecology (AE) Hub in Kenya got off to a strong start by identifying a community of over 30 organisations in Kenyan and Uganda with common AE interests and exposing them to the CCRP FRN (Collaborative Crop Research Program Farmer Research Network) approaches.

Conferences and workshops

Engaging with wider communities is important for IDEMS and its staff. This year, IDEMS supported the organisation of two education workshop which had strong links to our community work in education. IDEMS staff presented at the World Statistics Congress and its satellite statistics education conference. A highlight was the attendance and support of the SAMI/IMU Cross Pollination in mathematics education workshop hosted by AIMS Ghana, which also saw the launch AMI Ghana.

IDEMS investment

IDEMS believes in investing in the talented people we work with around the world and we believe this is an important component of the future growth of IDEMS. This year, we have supported partners in a number of countries. This helps build our network and also supports teams to contribute to projects and work locally. We have also supported our own staff in pursuing education opportunities alongside their work. The establishment of INNODEMS as an organisation in Kenya was a high point. For Zach Mbasu and the team he is building in Kenya, this represents an important step in enabling them to build sustainable structures.

Reflection points

Writing this report enables us to reflect on what was achieved and also on the challenges faced through the year.

We are fortunate that our consultancy work is also on projects that we believe are impactful. In this sense, there is often a thin line between the work that might be done for consultancy projects and impact investment projects: the consultancy work of today could be the impact investment work of tomorrow, and vice versa. This was also a deliberate strategy, as it enables us to provide long term commitment and stability to many of our projects in a world where project funding is often short term and inconsistent.

At the end of this year our margins are tighter than we would have liked. This was partly expected, due to our impact investments and initial steps towards growth. The unplanned contributing factor was the way we adjusted

our plans for the second half of the year in preparation for a large but short-term contract that unfortunately did not materialise for administrative reasons. While we never took for granted that this work would come, on reflection, some of the adjustments made to existing work plans could have been delayed until the new project began. However, these kinds of uncertainties will be easier to deal with as we grow larger as an organisation.

Looking ahead

We are excited to see the IDEMS team growing with the recruitment of Santiago Borio as a full-time employee and the launch of an open recruitment process to support our software and app development work. The establishment of INNODEMS as an organisation in Kenya is also an important milestone. We hope that this will lead to the creation of sustainable opportunities for partners through a similar business model to IDEMS International that can support impactful projects in Kenya and beyond.

The year finished with the initial activities of the Parenting for Lifelong Health (PLH) Digital project which could become a large, impactful project for IDEMS. PLH Digital has the potential to support millions of families across the world through digital resources, as well as build IDEMS's reputation with international partners, including the University of Oxford, the WHO and UNICEF.

We are proud to be continuing our impact investment work and are constantly learning from this and conceptualising new approaches to achieving impact at scale.

Directors perspectives

After two years of IDEMS International we are now settled in our role as directors of a social enterprise. We feel more confident than ever with the choice made to move into the private sector as a route to achieving scalable impact. Although still taking small steps, we believe this path has great potential.

Over this period, IDEMS has established a solid foundation of paid consultancy work combined with impact investment projects. By maintaining a surplus in each year and increasing our turnover by two thirds in the second year, we have shown that we have a sustainable business model that allows us to grow while investing in projects that support our community. Inevitably, this approach reduces our surplus and potentially slows growth. However, ensuring that impact investment is deeply embedded in what we do from the beginning is an important part of the company ethos being established.

This solid foundation enables us to look towards achieving scalable impact and tackling bigger development challenges. To do this, we recognise the need to grow as an organisation and are conscious of doing this in ways that are consistent with our core principles. The structures put in place this year that have enabled us take on our first employee and launch an open recruitment process for a second are crucial to our long-term success in achieving these aims. Similarly, the establishment of INNODEMS as a subsidiary in Kenya is a big milestone. This structure enables our colleagues to achieve impact in their context, while following the same principles as IDEMS and provides us with experience with alternative approaches to expansion.

Looking forward, we are aiming to conceptualise ways in which the products we are responsible for can be turned into sustainable business models, without compromising on our principles such as “open by default”. We recognise that to achieve this will require a move beyond consultancy and add new components to our business model that will enable us to scale our impact. Although this entrepreneurial thinking is pushing us out of our comfort zone, we are embracing and enjoying the challenge.

We finish our second year much as we started: pleased with what has been achieved and looking to the future with both nervousness and excitement at the new set of challenges that face us in the years ahead.

Activities

Consultancy contracts

Research methods support for projects in the McKnight Foundation's Collaborative Crop Research Program (CCRP), West Africa

January 2018 – present

Funded by: Stats4SD, McKnight Foundation's Collaborative Crop Research Program

With our partner, Statistics for Sustainable Development (Stats4SD), IDEMS offers support for research methods (statistics and data) to projects funded by the McKnight Foundation's Collaborative Crop Research Program (CCRP). IDEMS leads on the support for the West African CCRP projects, a collection of agriculture research projects across Niger, Burkina Faso, and Mali. The projects we support in West Africa aim to improve access to local, sustainable, and nutritious food through collaborative research and knowledge sharing with smallholder farmers, research institutions and development organisations.

It is challenging and diverse work for our team. Our work involves supporting projects in the whole research process—from design and collection through to analysis and communication. This is often achieved through in country and regional workshops, data clinics, tailored training courses to stakeholders, and inception and community of practice meetings, and online remote support.

This year our activities started with a series of in-country workshops on data visualisation which led into the community of practice (COP) meeting. The COP meeting was an intense series of interactions, with a strong sense of progress emerging as projects deepened their reflections and synergistic collaborations with each other. Many projects started new phases this year which were supported by joint inception meetings. A cross country research methods for agroecology workshop was organised, which challenged projects to look beyond conventional research thinking as they take on the complex multidimensional and multiscale challenges that come with an agroecological approach.

This work is particularly stimulating for us because of the efforts CCRP is making to put Farmer Research Networks (FRNs) at the centre of the research programme. From a research methodology perspective this is exciting as it is leading to science that tackles more complex multi-faceted problems. This requires a reinvention of research approaches which embrace large scale farmer experimentation with highly variable social and physical contexts. In many cases we are challenged to adapt and reinvent research methodologies that can be implemented at scale while staying true to core scientific principles. This often involves letting go of many of the traditional notions of 'rigor' and embracing the power of bigger data.

Workshops on use of gridded satellite data for climate services

March 2018 – present

Funded by: Stats4SD, EUMETSAT

With our partner, Stats4SD, IDEMS supports the delivery of workshops organised by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) on the use of gridded satellite data for climatic services. The workshops are attended by staff from national meteorological services as well as researchers and university lecturers.

Vast amounts of satellite climate data for the past 30 years are freely available online through EUMETSAT. These data could have a direct impact on the climate services that meteorological services and other organisations provide. The data available include estimates of radiation, sunshine hours, land surface temperature, vegetation cover and many other parameters.

Stats4SD and IDEMS support EUMETSAT in these workshops by introducing R-Instat to participants as a way of easily working with satellite data (NetCDF files) and ground station data (various formats) to allow comparisons of satellite and ground truth data, as well as other facilities. IDEMS also supports participants in the use of R, particularly the CM SAF R Toolbox, which is tailored to CM SAF satellite data.

In 2019, IDEMS supported a five-day workshop in February/March in Krakow, Poland, attended by participants from 13 European countries, India, and Brazil. This was followed by an advanced training course in June in Mainz, Germany, attended by previous workshop participants from across Europe and Africa, working on specialised research topics with satellite data. Plans to continue training events and to engage with national and regional meteorological services in Africa and Europe are planned for 2020.

We are excited about this collaboration with Stats4SD and EUMETSAT because of the potential role of satellite data in Africa where ground measurements are sparse and often of poor quality (many missing values). Because of its consistency and large spatial coverage, satellite data have the potential to give estimates of the climate in places far away from a ground station, or to fill gaps in ground station data to make them more usable. Understanding the potential of satellite data and its usability by comparison with ground measurements opens the use of satellite data to a wide range of applications, from agriculture and health to renewable energy.

Development of public procurement analyses in R-Instat and delivery of workshops

October 2018 – present

Funded by: University of Sussex

The R-Instat software developed and supported by IDEMS has a special menu for the analysis of public procurement data to make it easy for users to better understand corruption risks in the public procurement process. This was first developed through a project led by mathematicians at the University of Oxford, partnering with IDEMS staff and social scientists (including at University of Sussex). As a result of the success of the project, the Conflict and Social Development Issues Department of DFID, UK, are funding continuation of this work led by the University of Sussex in collaboration with IDEMS.

In this project, IDEMS, with support from the African Maths Initiative (AMI), are enhancing the facilities of the procurement menu in R-Instat to support further analysis of procurement data. We are also including open procurement data sets, collected by the University of Sussex from a variety of countries, into R-Instat's dataset library to allow access to everyone. During this year, further developments have been made to R-Instat's procurement menu which now has an extended set of visualisations, in particular to highlight the most extreme

aspects of the data, which is usually most relevant to corruption risks. R-Instat is being used in an international Master's programme in public procurement management in Italy to give students hands-on experience of working with procurement data. Following the successful workshop at Makerere University, Uganda, last year, at least one more workshop is being planned for 2020.

The use of large scale public procurement datasets to analyse corruption risks is a new innovation which could ultimately lead to improvements in the use of public money if the data can be made available, with high enough quality, and, crucially, if people have the skills to extract important information from the data. We are excited about the potential impact on development this could have, as well as the added benefit of motivating mathematical science students through workshops which show them how they could contribute to tackling current challenges facing their countries.

Understanding statistics teaching in higher education in Africa

April 2018 – June 2019

Funded by: Education Sub-Saharan Africa and IDEMS community work

Education Sub Saharan Africa (ESSA) is a UK charity whose aim is to improve educational outcomes in sub-Saharan Africa, from school level to universities. IDEMS's extensive knowledge and experience of higher education in Africa led to a project supported by ESSA to understand the teaching of statistics in higher education institutions across Africa.

Last year, IDEMS conducted a mixture of general and in-depth studies in Kenya, Niger, Rwanda, Botswana, and Ghana to understand the depth and complexity of the issues around statistics education, as well as representing the rich diversity across countries. This year that work concluded with the release of one-page fact sheets on each country and in-depth reports on Kenya, Rwanda, and Ghana, surveying all universities offering degrees in statistics in each country.

This project was important in illustrating some of the diversity which exists across the continent and we hope the fact sheets and reports will support international organisations in providing more targeted, tailored support in countries based on their needs. This also applies to IDEMS itself, and we hope this work will be used to inform our community work related to strengthening statistics in African higher education.

Exploring the PICSA approach with financial institutions in Kenya

September 2018 – March 2019

Funded by: University of Reading

Participatory Integrated Climate Services for Agriculture (PICSA) is a highly successful participatory extension approach, developed by researchers at the University of Reading. It has proven to be an effective method of supporting farmer innovation and has been adopted in over 20 countries around the world. PICSA makes use of historical climate data, forecasts, and farmers' knowledge of what works in their own context, with participatory planning methods to help farmers make informed decisions about their agricultural practices. The climatic data component of PICSA relies on the ability of the local partners, often the national meteorological services, to

analyse historical daily climatic data to provide the local climate information for their country. IDEMS has provided support for local partners to work with climate data in a number of PICSA implementations, including in Lesotho, Mozambique, and Ghana.

The International Fund for Agricultural Development (IFAD) funded the University of Reading for a project to investigate the potential of using the PICSA approach with financial service providers (FSP). Following a scoping study last year, IDEMS supported the delivery of a workshop in February 2019 to investigate how climate risk could be better modelled for FSP and how their activities and interests could align with the PICSA approach. This included presenting work carried out by IDEMS to investigate the potential of crop simulation models to provide information about crop planting risks which could be used as a basis for improved crop insurance products for farmers.

We believe in the PICSA approach and the way it uses climate data to help people make more informed decisions, in some cases changing opinions and mind sets, and ultimately empowering farmers to tackle problems that are within their control. This pilot project has shown that there is potential for broadening PICSA by engaging with FSP as another way of supporting farmers to manage their risks. We hope this leads to future projects that continue engaging with FSP.

Supporting PICSA in Mozambique

August 2019

Funded by: University of Reading

The Participatory Integrated Climate Services for Agriculture (PICSA) project is a highly successful participatory extension approach, developed by researchers at the University of Reading. PICSA makes use of historical climate data, forecasts, and farmers' knowledge of what works in their own context, with participatory planning methods to help farmers make informed decisions about their agricultural practices. IDEMS supports PICSA, particularly on the climatic data component, by working with local partners, often the national meteorological services, to analyse historical daily climatic data to provide the local climate information.

In August 2019, IDEMS supported the PICSA team's effort in implementing PICSA in Mozambique. One-week workshops were held in two districts in Mozambique where PICSA was to be implemented. The workshops were "training of trainers" where participants (district extension staff, provincial government representatives and local partnering institution) were trained on all aspects of the PICSA approach so that they could lead sessions on PICSA with their networks of farmers. IDEMS led many of the general PICSA sessions as well as sessions exploring the historical climatic data with the National Meteorological Institute of Mozambique. Participants learnt how graphs of historical climatic data are presented to farmers in a way that enables them to understand and calculate their own climate related risks for their crops.

These workshops prepare participants to implement the PICSA approach with their network of farmers, providing them with information to make informed decisions about their practices and livelihoods. We are proud to support this approach which has a direct impact on farmers and their families in Mozambique, and we look forward to continuing our partnership with the PICSA team in the expansion and implementation of PICSA in the future.

Supporting PICSA in Ghana

March 2019

Funded by: University of Reading

PICSA activities have been taking place in Ghana since 2015 when 160 communities in 10 districts in northern Ghana were reached through the PICSA approach, and others since then through various linked projects up to 2018.

In 2019, the PICSA team with IDEMS conducted a series of meetings with previous and potential collaborators with the aim of assessing how to restart PICSA in Ghana. Meetings were held with stakeholders including the Ghana Meteorological Agency, the University of Ghana, Ghana Space Science and Technology Institute, the Agricultural Extension Services, World Vision, United Nations Development Programme, and International Fund for Agriculture Development. The meetings were successful in both strengthening the relationships with existing partners and developing relationships with potential new partners where there were opportunities to showcase the success of the PICSA approach in Ghana and elsewhere.

The formal evaluation of PICSA activities in 2015 showed that almost all farmers reached through the PICSA approach made changes to their practices because of it. There is enthusiasm from both government and non-governmental organisations to continue PICSA activities in Ghana and we are excited to be part of this effort to revive PICSA in Ghana.

Open source products

Development of R-Instat

January 2018 – present

Funded by: IDEMS community work

IDEMS is committed to supporting the open source development of R-Instat, a front end to the popular statistics language R, conceived for and developed primarily in Africa. It was instigated by the African Maths Initiative (AMI) as part of their collaborative African Data Initiative (ADI) project to support data having a transformative role in African development and education.

IDEMS continues to support the development of R-Instat, through contributions to the source code, often linked to other projects which use custom functionalities in R-Instat, and providing support and mentorship for the developers within AMI. We actively look for contracts which can raise funds to support the development team in AMI, and IDEMS has taken on a responsibility to source this continued funding stream.

Over the last year, R-Instat has become recognised, particularly through workshops, by many different audiences, including with national meteorological services in analysing historical climatic data. This has led to recognition of R-Instat by the World Meteorological Organisation (WMO) and EUMETSAT. We hope to build on this support in 2020 by ensuring that R-Instat can be recognised internationally for a wide variety of user groups. IDEMS can support this by continuing to improve the functionality of R-Instat for climatic and general users and by ensuring that R-Instat continues to be developed to professional standards.

In the long term, we are committed to supporting the ADI project in its aims to transform statistics education across Africa to be more relevant and data focused, and more broadly to see data being used to support better decision making for development in Africa and elsewhere.

Development of Climsoft

January 2018 – present

Funded by: UK Met Office and IDEMS investment

IDEMS is supporting the development of Climsoft, an open source Climate Data Management System (CDMS). Like R-Instat, Climsoft was developed primarily in Africa, for an African audience, and was developed for the African National Meteorological Services.

The UK Met Office has been a long-term supporter of the Climsoft project, and they fund IDEMS contributions to the development of Climsoft. With the support of the UK Met Office, we mentor developers at the African Maths Initiative (AMI), and we used part of our funding for Climsoft to fund staff time at AMI so that they could contribute to the development of Climsoft. This is driven by our belief in developing talent in Africa and our commitment to ensuring that Climsoft remains primarily an African product.

The work on Climsoft this year has included enhancing functionality of the existing Climsoft version 4 and conceptualising a new database model for the upcoming version 5 of Climsoft. The new database being

developed will enable a range of new functionality in Climsoft, including better management and use of metadata, multiple data entry and a full audit trail of changes to the data. We are also involved in discussions and planning for OpenCDMS, a WMO led project that aims to bring together different aspects of climate data management for national meteorological services across the world using different CDMSs. Climsoft, a free and open source CDMS used by several countries in African and around the world, has an important role to play in the OpenCDMS project and we are looking forward to the OpenCDMS project progressing in 2020.

We are excited by the Climsoft work because we know how important it is for African meteorological services Met services to have access to products that match their data management needs. We believe that Climsoft is positioned to provide a sustainable long-term solution that will enable African meteorological services to make better use of their historical data.

Support for CAST (computer assisted statistics textbooks)

July 2019 – present

Funded by: IDEMS community work and Stats4SD

CAST (computer assisted statistics textbooks) is a collection of free electronic textbooks. CAST is highly interactive, with dynamic graphics, animations and randomised exercises that give automated feedback. CAST's approach is highly data focused with many example datasets used to demonstrate concepts in a practical way.

The IDEMS and Stats4SD team have been involved in the use and development of CAST for 10 years. Using CAST for teaching statistics in Kenya has shown evidence of improved student performance and motivation for statistics.¹ In the past, we have contributed to the development of CAST textbooks with African examples and climatic statistics textbooks.

CAST was originally developed at Massey University, New Zealand, and has continued to be maintained by a single developer. Although we believe CAST is a valuable resource for students and universities, particularly in Africa, it has not had the widespread adoption we think it deserves. Therefore, this year, IDEMS and Stats4SD jointly funded continued development of CAST. This included adding new exercises that link to statistical software, moving the source code to GitHub to make it officially open source to ensure its sustainability and developing a new textbook specifically adapted for a descriptive statistics course to be taught at Maseno University, Kenya.

We are eager to continue to support the maintenance and development of CAST and to see it reach the potential we believe it has. Huge effort has been put into developing the content, animations, interactive graphics, randomised exercises, and feedback over more than 10 years. To ensure this resource is used to improve the teaching and learning of statistics, the software needs to be maintained and updated. A major barrier to its adoption in African universities is that CAST can only run on computers. Over the next year or two, we want to support the development of a mobile friendly version of CAST, enabling access to many more students, making it easier to include in the teaching of statistics.

¹ http://icots.info/9/proceedings/pdfs/ICOTS9_8J2_ZACHARIAH.pdf

Parenting for Lifelong Health Digital

September 2019 – present

Funded by: University of Oxford

Parenting for Lifelong Health (PLH) is a suite of open access, non-commercial parenting workshop programmes, developed by the University of Oxford and other collaborators, including WHO, CWBSA, UNICEF and the University of Cape Town, South Africa. Workshops for parents and their children using the PLH resources have been run by various non-governmental organisations around the world to support families in their communities. Studies have shown that the workshops have many positive effects on the families that attend them, improving mental health and wellbeing and reducing violence in the home. Programmes are now being scaled in several countries but the demand for these programmes far outweighs the capacity to reach everyone through face to face workshops.

PLH Digital will extend the reach and impact of these efforts by creating a free mobile PLH app, based on existing PLH resources, with the potential to reach millions of families. IDEMS is leading the development of the app in this long-term project, spanning four years, and including multiple co-development and testing cycles across countries with a formal randomised controlled trial to support rigorous evidence and research outputs. The app will be a low-data offline-first application that will work on the most basic smartphones to ensure it can reach as many families as possible and those most in need. We are also including a significant amount of capacity building within the project to enable our partners in Kenya to contribute to the software development of the app and take a key role in the project. After an initial meeting with the University of Oxford team in September, the first co-development workshop took place in South Africa at the end of January 2020. IDEMS, Oxford and Kenyan team members along with Clowns Without Borders, an organisation that has been running PLH workshops in South Africa and training PLH trainers all over the world, met to discuss how the PLH Digital app should work, drawing on and complementing the success of the workshop programmes but being realistic about what can be achieved through a digital interface.

The extensive work will be done in 2020 when initial versions of the app will be developed for testing by select user groups. With the international partners already involved, we are extremely excited about the potential to scale out and support families all over the world. This project also enables IDEMS to grow its technical team, in the UK and through partners in Kenya, which will support the development of this project and allow IDEMS to take on new app and software development projects in the future.

IDEMS community work

Support for African Maths Initiative (AMI)

January 2018 – present

IDEMS has a strong connection with African Maths Initiative (AMI), a Kenyan NGO formed by mathematicians and mathematics educators working to create a stronger mathematical community and culture of mathematics across Africa at all academic levels. IDEMS collaborates with AMI on many of its consultancy contracts and open source software development projects. IDEMS also plays a role in mentoring junior staff in AMI. These activities are important aspects of our commitment to build capacity in Africa.

Towards the end of the year, IDEMS supported some of the staff from AMI in setting up a new organisation, INNODEMS, to complement the activities of AMI and to provide sustainable employment opportunities for those involved with AMI. Some of those involved in AMI will become employees of INNODEMS, others will stay more closely aligned with AMI, but both organisations will work together closely, and IDEMS will continue to provide support to both organisations.

Support for Supporting African Maths Initiatives (SAMI)

January 2018 – present

Supporting African Maths Initiatives (SAMI) is a UK charity established by mathematics educators in the UK to support initiatives in mathematics education across Africa, initially supporting the work of AMI. SAMI coordinates the international volunteer programme that supports maths camps run across Africa. SAMI also fundraises to support AMI in offering internships in Kenya.

IDEMS has a legal relationship with SAMI. SAMI is mentioned in IDEMS Articles of Association as a specified organisation. IDEMS can transfer assets (including money) within its requirements as a community interest company to SAMI. IDEMS made donations to SAMI this year totally £9,000.

IDEMS has attended and supported several SAMI events this year, offering advice and support where useful.

- IDEMS supported the Cross Pollination in Mathematics Education Workshop in Ghana in May (described below).
- We continue to be involved in the planning of maths camps that SAMI supports in several African countries. The maths camps are important events to bring together people who are passionate about mathematics education, in each host country and internationally, to provide an inspiring, enjoyable mathematics experience to high school students. We have seen how a maths camp can be a life changing experience for the students that attend, inspire students in mathematics and encourage teachers to embrace the fun and relevance of mathematics. This year Danny Parsons led the international volunteer team at the Bahir Dar Maths Camp, Ethiopia.
- IDEMS also attended SAMI's Annual General Meeting in September 2019.

An agroecology hub in Kenya to bridge science, practice, and movement

December 2018 – present

Funded by: McKnight Foundation's Collaborative Crop Research Program

The McKnight Foundation's Collaborative Crop Research Program (CCRP) funds collaborative research projects that aim to explore solutions for sustainable local food systems. IDEMS's staff have been involved in providing research methods support for CCRP's East and West African projects for several years. In December 2018, IDEMS received a separate planning grant to establish an agroecology hub (AE Hub) based in western Kenya.

Agroecology is an ecological approach to agriculture which centres on food production that makes the best use of nature's goods and services without damaging these resources. Across the world, scientists, researchers, NGOs, CBOs, activists, farmers, consumers, universities, and others are working in the agroecology space. However, there is often a disconnect between what is happening in the *science* and research into agroecology, the *movement* of those promoting agroecology and the *practice* of what agroecological practices farmers are actually using. Therefore, the AE Hub, formed with partners such as Manor House Agricultural Centre (MHAC), AMI and Participatory Ecological Land Use Management (PELUM) Association, Kenya, has an overarching aim of bridging the gap between science, practice and movement in agroecology.

After the successful inception meeting in January 2019, the AE Hub partners launched a number of activities and research. The activities balance the need for formal research in agroecology, leading to new insights, and practical activities that directly support farmers. Activities carried out in this initial phase included: (i) a scoping study to understand the major challenges faced by smallholder farmers in five counties in Kenya; (ii) *Tephrosia vogelii* research involving analysing samples from western and central Kenya to check for the effective chemotypes and interviewing farmers about their knowledge and use of *Tephrosia vogelii*, leading to new understanding of the effectiveness and use of *Tephrosia vogelii*; (iii) capacity strengthening workshops for hub members on agroecology related areas and research methods; (iv) involving students from the USA, Kenya and Uganda in research activities; and (v) supporting Manor House as the anchor of the AE Hub by developing an agroecology focused infrastructure plan and improving their demonstration farms.

Following this successful planning stage to establish the AE Hub and its partners, we were delighted to receive a 2-year extension grant by the McKnight Foundation to build on this work and grow the AE Hub. The AE Hub aims to facilitate a community of practice (CoP) to use farmer research network approaches to determine which agroecological practices are genuinely effective and acceptable for farmers in their context. The activities started this year that work towards this will continue and expand into next year.

We are committed to this project and to supporting local partners to develop the necessary structures that can enable them to support the wider farming community across East Africa with effective agroecological approaches. We hope that over this new phase we can support the local partners to take more of a lead role, with IDEMS continuing to be a supporting and enabling partner. We also believe in the importance of bridging the gap between science, practice, and movement, and feel this aligns with IDEMS's desire to work within and across broad areas. We believe in the importance of research for impact development and want to support research for development in this area.

Support for Maseno University, Kenya

August 2018 – present

IDEMS team members have had a close relationship with the School of Mathematics, Statistics and Actuarial Sciences at Maseno University, Kenya, for more than 10 years. Discussions are ongoing to formalise this collaboration, in particular on the ongoing support for integrating electronic assessment and support for postgraduate students through supervision, and potentially a new doctoral programme.

IDEMS also supported the workshop “Improving 1st year Mathematics and Statistics university courses using digital technologies” in August (described below).

Development of electronic assessment tools for university mathematics courses in Africa

November 2018 – present

Initiated by Michael Obiero, lecturer at Maseno University, Kenya, IDEMS supported the development of automated electronic assessment to provide high quality feedback to students through weekly online quizzes. The quizzes help students assess and build their understanding of the content. This was initially for two first year courses at Maseno University, with 700 and 500 students each. Quizzes were created using the open source STACK system, developed by Chris Sangwin at the University of Edinburgh, and integrated into Moodle, a course management system. The power of STACK is that it is specially designed for mathematics and allows complex input and checking of mathematical expressions, which is more useful than multiple choice questions alone.

With support from IDEMS, a set of weekly quizzes were developed for each course and used by the students, for their own formative assessment and as continuous assessment tests. A survey of the students showed that the approach was greatly appreciated, with many students taking the quizzes throughout the semester to improve their understanding and revise for their final written examination. Although some students struggled with access to devices and the internet, the ability to carry out the assessments on a mobile phone meant most were able to do the quizzes with their own or a friend’s device. The success of these first courses at Maseno led to other lecturers at Maseno adopting electronic assessment for their own courses. Also, after the workshop (mentioned below), lecturers from other universities in Kenya and East Africa showed an interest in adopting the ideas themselves. IDEMS has now supported courses in linear algebra, calculus I, basic mathematics, vector analysis and descriptive statistics. At Maseno, the STACK system is now integrated into the university’s online course management system and is thus available for any lecturer in the university to use.

The challenge in adopting this approach is the time and effort it takes to develop good quality questions with thoughtful feedback to support student learning. This is impractical for many lecturers in universities across Africa who are already struggling with high work loads of teaching multiple courses, with over 1000 students in some cases, and no other support. IDEMS offers free support to lecturers by developing electronic assessment for their courses. IDEMS has helped lecturers to turn paper-based assessments into electronic questions, training the lecturers along the way so that they can author more of their own content. Our only requirement is that the courses that are developed jointly with us are openly available on the IDEMS eCampus site. This enables others to adopt and adapt courses that have been developed in other universities, reducing the workload needed to adopt the ideas. This has already started to happen. Lecturers in Ethiopia, Tanzania, Uganda, and other universities in Kenya have taken some of the resources originally developed for Maseno and adapted them for their own courses. While adopting new approaches in a university takes time, needing the support from senior

management and an IT infrastructure, some universities were able to make use of the resources this year, largely because of the need for universities to provide more online content.

For next year, we hope to support our existing partners in adopting these resources for their own teaching and we will continue to build our bank of openly available questions and courses to support others. We also plan to investigate how these systems could be used to support mathematics education at the high school level, with possible integration of STACK into electronic textbooks, linking with our work on the CAST electronic textbooks.

Teaching statistical problem solving on AIMS Cameroon's Master's Programme

November 2019

Also funded by: Royal Statistical Society

In November, IDEMS and Stats4SD co-taught a statistical problem solving course for the second consecutive year to 45 MSc mathematical science students at the African Institute for Mathematical Sciences (AIMS) Cameroon. The course, taught over a three week period with five two-hour lectures per week, exposed students to problems in statistics, ranging from design, collection, manipulation and organisation of data, to analysis and reporting through games and simulated data and real data. Students also worked in groups to explore and report on a specific problem, including climate for agriculture, procurement for corruption, a poverty survey, and other topics. The course was the first of a series of statistics courses that year as part of an initiative by the Royal Statistical Society to strengthen the statistical component of AIMS training.

The course was challenging and rewarding to teach, with a diverse set of students from 12 African countries, some with a full statistics degree and others with no previous experience in statistics. We made some changes to the course this year, based on last year's experience, which seemed to improve the course and experience for the students. The main change was using Moodle to host materials and for discussion forums, and using the STACK system to develop interactive quizzes for students. We were pleasantly surprised by the positive responses to the interactive content, given the high amount of facilitation available on the course. This shows the value of electronic assessment, even when other resources are available. The availability of course materials on the Moodle site also seemed to help students who might have struggled in the previous year. Having access to notes and slides during and after the classes supported those students where learning in English was new to them. The notes and additional materials also helped those students who previously had a theoretical background in mathematics and statistics cope with the practical approach we took on the course.

The course continued to be an "eye opener" for many students and totally different from their past statistics courses. Those students who had some background in statistics were provided with practical contexts for many of the concepts they knew only as mathematical formulations. For many it seemed they gained an appreciation of what statistics is and how it applies to real world problems. They also gained interest in studying statistics further.

This year we were pleased to include in the team Francis Torgbor from Ghana, who supported the teaching as he approaches the end of his PhD in climate statistics, and Patrick Munyoki, an R-Instat developer from the AMI team in Kenya who got to see first hand how the software he has developed is used. We feel it is important to

involve our African partners in our teaching at AIMS so that they can teach such courses at AIMS and elsewhere in the future.

IDEMS maintains strong links with AIMS and is proud to support AIMS in delivering high quality mathematical science training in Africa. We are particularly keen in continuing to support the AIMS Cameroon centre through a strong statistics stream of courses supported by the Royal Statistical Society.

Conferences and workshops

Cross-pollination in mathematics education workshop, Ghana

May 2019

Funded by: International Mathematics Union – Commission for Developing Countries, SAMI and IDEMS community work

IDEMS supported the “Cross-pollination in mathematics education” workshop in Ghana in May. The aim of the workshop was to provide a platform for educators from across the African continent to discuss implementation, sustainability, scalability, impact, good practices, and challenges for a range of maths education initiatives. A total of 42 participants from 11 countries attended, some with support from IDEMS. IDEMS also attended and facilitated many of the workshop sessions.

The participants included the organisers of previous maths camps. This was the first meeting to bring together the organisers of the maths camps across Africa. This was a valuable experience and opportunity to learn about the successes and challenges in different places. Potential new maths camp organisers from Uganda, Rwanda and Togo were also present. The meeting was also an opportunity for participants to share initiatives from across the continent, aside from maths camps. The event led to several plans for new collaborations, including new maths camps, integration of electronic assessment in university teaching and further events to bring the new community together. We look forward to seeing these collaborations develop in 2020.

Improving 1st year mathematics and statistics university courses using digital technologies, Kenya

August 2019

Funded by: International Mathematical Union (IMU) – Commission for Developing Countries (CDC), Maseno University and IDEMS community work

IDEMS supported this workshop, held at Maseno University, Kenya, in August. The aim of the workshop was to bring together university lecturers to share and explore how digital technologies can be used to tackle the problem of high quality university education under challenging conditions, such as large class sizes and heavy lecturer workloads, with a particular focus on first year courses. Maseno University was an ideal host for the event, having pioneered the use of many digital technologies over the past 10 years, including the use of CAST, electronic assessment in mathematics and statistical software in teaching.

The original funding from the IMU was for a smaller workshop for Kenyan universities, however, there was also demand from other East African countries through our work with universities on the ESSA project (to understand statistics teaching) and from the cross-pollination in mathematics education workshop. So IDEMS provided additional support to allow international participants to attend, resulting in participants from universities in Ethiopia, Tanzania, Rwanda, and Uganda. Participants included both “decision makers”, such as heads of departments and schools, and “implementers”, such as lecturers who might implement new ideas in their teaching. This mix was chosen to best support participants to implement ideas after the workshop.

The workshop showcased a variety of digital technologies that have been used to support teaching of mathematics and statistics at the university level. Electronic assessment using STACK was a common interest among the participants. By the end of the workshop, many people had begun to design courses, quizzes, and questions to use in their teaching in the following semester.

IDEMS has committed to supporting the participants after the workshop to help them implement these ideas in their own universities; some were able to do this in the following semester. The enthusiasm for these ideas in the workshop reinforced our commitment to investing in this important initiative.

International Association for Statistical Education (IASE) Satellite Conference and International Statistical Institute (ISI) World Statistics Congress, Malaysia

August 2019

Funded by: IDEMS community work

David Stern and Danny Parsons attended the World Statistics Congress in Malaysia in August, and Danny also attended the satellite conference of the International Association for Statistical Education (IASE) in the week before the main event. The theme of the IASE satellite conference was “Decision making based on data”. Danny presented a paper entitled “A problem solving course in statistics for mathematical science students”. The paper presented the statistical problem solving course taught at AIMS Cameroon, discussing insights on how to engage and inspire students with data. The presentation generated a lot of interest in the ideas from the course as well as in AIMS itself.

At the World Statistics Congress, David presented “Reinventing a design game to teach real world data skills through simulated data” in the “Building future generations of statisticians through outreach” session. David’s presentation sparked interest from participants from several countries. He discussed the use of games in teaching data skills and presented a statistical design game for generating simulated data that has been used by students and researchers. David also chaired two sessions on statistics education and statistical literacy. David is a member of the ISI Task Force on Statistical Capacity Building, and a number of meetings were held to push this initiative forward during the event.

These events provide opportunities to interact with the international statistics and statistics education communities, sharing our ideas and current work, as well as learning about new innovations. We believe it is important for IDEMS to interact with these groups, and these conferences also provide an opportunity to build new collaborations and initiate new projects.

Innovation for development conferences, Niger

July 2019

Funded by: IDEMS community work

David Stern attended the “Innovation for development conferences” as side events to the African Union Summit in Niamey, Niger in July. David was a panellist for the discussion on “Open data, goals and sustainable development”, led by the AIMS Next Einstein Form (NEF) representative in Niger.

David spoke about some of the work happening in Niger which demonstrated how innovation can emerge from local projects and needs. The whole event related to a genuine effort of exploring how digital initiatives could potentially transform Nigerien society and pave the way for Niger to leapfrog into the digital economy. The vision is ambitious but the main message from David's contribution is that it is possible if the initiatives support local innovation while building from cutting edge global knowledge.

Islamic countries conference on statistical sciences and workshops, Pakistan

December 2019

Funded by: IDEMS community work

Following interactions at the ISI World Statistics Congress, David Stern was invited as a keynote speaker to the 15th Islamic Countries Conference on statistical sciences (ICCS-15) at the Lahore Institute of Science and Technology, Pakistan. The theme was "Statistics for social justice with healthy living". David delivered a talk on "Rethinking statistics and data science undergraduate curriculum".

David also gave a half day workshop at three institutions in Lahore on "Technology in university education" for university and college lecturers. The workshops discussed the opportunities and challenges of implementing technology higher education teaching as well as showing practical examples of the use of free electronic tools and resources for participants to consider in their own contexts.

The conference and workshops were excellent opportunities to interact with statistics educators in a new region for IDEMS. The workshops gave participants insights into innovations in technology for statistics education and we hope that some of these exchanges will lead to continued interactions and collaborations in the region in future.

IDEMS investment

Establishing INNODEMS, Kenya

November 2018 – present

Last year, with our colleagues in Kenya, we began investigating the idea of establishing IDEMS Kenya, as a route to creating sustainable opportunities for our partners in Kenya with a similar business model to IDEMS International.

During this year, we started the process of registering the organisation, and in October, INNODEMS was established as a company in Kenya. INNODEMS has a similar legal structure to IDEMS, a company limited by guarantee. The next steps are to transition some members of the AMI team to becoming the first employees of INNODEMS. INNODEMS will be able to begin operations and establish itself in Kenya. IDEMS will provide initial support to allow INNODEMS to operate but there are already opportunities in place, through IDEMS, for INNODEMS to begin contributing to projects.

We are excited about this first important step, and we look forward to working with and supporting the INNODEMS team. We believe that this model can provide sustainable opportunities for talented people in Kenya who can contribute to both international projects and support development initiatives in Kenya.

Francis Torgbor in Ghana

December 2018 – present

Francis continues to be a part of the IDEMS team based in Ghana since he first joined us at the end of 2018. IDEMS is supporting Francis while he completes his PhD. He expects to finish it by the end of 2020.

This year Francis has been involved in a number of IDEMS projects, including our support for PICSA in Mozambique and Ghana, our work with ESSA understanding statistics education in Ghana, the maths camp in Ghana and the cross-pollination in mathematics education workshop.

Francis has continued to investigate establishing IDEMS Ghana as a subsidiary of IDEMS International in preparation for him completing his PhD and joining IDEMS full time. When this happens, we look forward to building up activities in Ghana.

We are excited to have Francis on board because of his exceptional talent and commitment to development in Ghana, and we have confidence in him developing a successful local team for IDEMS Ghana. IDEMS has a vision to impact African development by making skills that are in demand available locally. Establishing IDEMS Ghana is part of that vision, with a long-term plan of IDEMS International supporting its African subsidiaries to grow and thrive locally.

Santiago Borio in Argentina

December 2018 – present

After joining as a freelance consultant at the end of 2018, Santiago has continued to be an important part of the IDEMS team, particularly for our education projects.

This year, Santiago focused on developing electronic assessment in STACK and supporting lecturers to integrate this into their teaching. He also worked with the team in Kenya in developing similar resources for schools and supporting IDEMS applications for grant funding in these areas.

We are delighted that Santiago has joined our team full time based in the UK. As well as continuing to build our education projects, Santiago will play a key role in managing aspects of the PLH Digital project, among others.

Cameline Nafula in Kenya

March 2019 – May 2019

Cameline joined the IDEMS team for a 3-month internship in Kenya shortly after returning to Kenya after finishing her PhD in disease modelling at the Department of Mathematics, University of Glasgow. As a graduate of Maseno University, Kenya, Cameline was already well known to some of the IDEMS team and we were delighted to be able to involve her in some of our projects while she considered her postdoctoral opportunities.

Cameline supported the Agroecology Hub project and was involved in the scoping study, where her previous experience in local government was highly valuable. She also supported the development of electronic assessment resources in STACK and worked closely with Santiago and the team in Kenya.

Cameline then took a lecturer position at Maseno University, Kenya, in the School of Mathematics, Statistics and Actuarial Sciences. We were pleased to be able to continue to work with Cameline as she successfully integrated electronic assessment into her first teaching courses at Maseno for first year students.

Cameline also provided mentorship to our Kenyan team and is an excellent role model for young Kenyans, particularly girls, interested in mathematics and science. We look forward to continuing to work with her in various ways in the future.

Maxwell Fundi support during MSc

September 2019 – present

Maxwell has been part of the AMI team in Kenya since 2014 when he first volunteered for the Maseno maths camp. He is the only member of the R-Instat development team in Kenya who was there from the beginning of the project in 2015, and he is involved in a variety of AMI projects because of his passion for both software development and education.

In September 2019, Maxwell began a part time Masters in Computing at Maseno University, Kenya. IDEMS supported Maxwell by paying his tuition fees and providing a stipend. This allowed him to continue his important work on AMI and IDEMS projects part time alongside his MSc studies.

Maxwell has been an important part of IDEMS and AMI projects in Kenya, and we are pleased that this support enables him to continue this work.

Danny Parsons support during PhD

November 2019 – present

In January 2020, Danny began his PhD in climate change sciences at the University of Rwanda and the African Institute for Mathematical Sciences (AIMS), Rwanda, as part of a cohort of PhD students based at AIMS centres across Africa.

Danny will continue to be involved with IDEMS during this time, and his PhD work overlaps with many IDEMS climate related projects. As well as giving Danny the flexibility to pursue his PhD studies, IDEMS will also provide small amounts of support when appropriate. For example, IDEMS partially funded Danny and David to travel to Rwanda in November 2019 for an initial meeting at AIMS and the University of Rwanda.

At IDEMS we believe strongly in education, and we are supportive of members of our team that choose to further their education. We hope that Danny and Maxwell's cases provide a template for how others in IDEMS could pursue educational opportunities.
