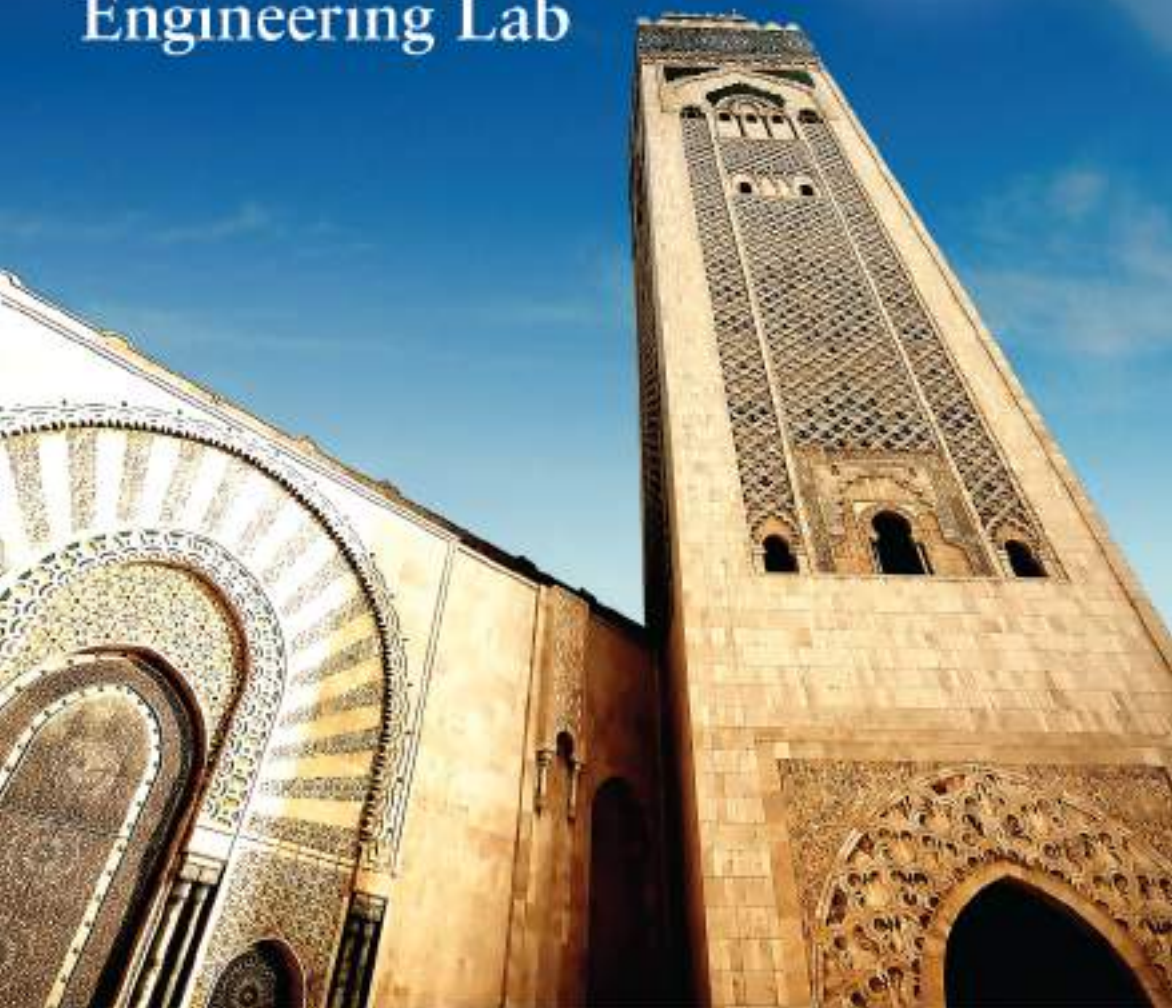


Islamic Financial Engineering Lab



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On behalf of the Center:

Housseem Eddine BEDOUI – Product Development Specialist, FPDC

Mohsin Sharif – Senior Technical Assistant, FPDC

FOREWORD

It gives us great pleasure to present this introductory booklet on the Islamic Financial Engineering (IFE) Lab, a one-of-its-kind in the Member Countries of the Islamic Development Bank (IsDB). The IFE Lab is a joint initiative of the Financial Product Development Center at IsDB, and the Mohammadia School of Engineering, at Mohammed V University, Rabat.

The IFE Lab engages in pioneering research in Islamic economics and finance using modern technology, which has hitherto remained untapped. The recently announced Award for Best Application of Agent-based Simulation in Islamic Finance extends the reach of the new techniques to students worldwide. This also serves the objective of the Islamic Development Bank to support Islamic finance on a global scale.

Applying modern technology to develop complex systems and generating models that can simulate products and markets based on principles of Islamic economics is a breakthrough approach embraced by the IFE Lab.

The novel efforts of all members and participants in the IFE Lab are highly commendable. We are looking forward to the exciting opportunities that the IFE Lab will present to the field of Islamic economics and finance and to the Islamic financial industry worldwide.

Dr. Ahmet Tiktik

Acting Vice President Finance,
Islamic Development Bank

**Professor Rajaâ Cherkaoui
El Moursli**

Vice President,
Mohammed V University



1. The IFE Lab

The Islamic Financial Engineering (IFE) Lab is a pioneering effort to bring together modern technology and the principles of Islamic economics and finance. It is a first-of-its-kind research laboratory, which applies novel techniques to achieve implementation of these principles. The Lab is, therefore of high value for supporting the objectives of the Islamic Development Bank (IsDB) in expanding and leading the Islamic financial industry worldwide. Furthermore, it aims to build a new generation of financial engineers in Islamic finance to lead the industry in the 21st century.

As a 3-year Ph.D. program at the Mohammadia School of Engineering, the Lab aims towards building a generation of pioneers in financial engineering who succeed in applying modern techniques to implement the objectives of the Islamic economics through ethical financial innovation. Candidates of the Lab build models and contribute publishable work that identifies certain challenges of Islamic financial industry and how they can be practically solved.

The Lab capitalizes on the long-standing expertise of the Research Laboratory for Applied Mathematics (LERMA) at the Mohammadia School of Engineering, and the leading role of the Islamic Development Bank in Islamic banking and finance, as represented by the recently established Financial Product Development Center at IDB.

1.1. Objectives

The Lab aims to achieve the following objectives:

- ❖ To develop, evaluate and test new Islamic financial instruments and systems;
- ❖ To find out how these models may be best implemented in real world scenarios;
- ❖ Assist the economic development of IsDB Member Countries (MCs) and the Islamic financial industry by:
 - developing Agent-Based Simulation (ABS) platforms and building reliable artificial markets and economies with many agent types, in order to conduct scenario simulations that approximate the reality.
 - building a new generation of Ph.D. candidates for the Islamic financial industry who will succeed in applying modern techniques to implement the objectives of Islamic economics by means of innovative financial instruments.
 - contributing publishable work that identifies challenges of the Islamic financial industry and how they can be practically solved.

1.2. Agent Based Simulation and Modeling

Agent-Based Model (ABM) is a class of computational models for simulating the actions and interactions of autonomous agents (both individual and collective entities such as organizations or groups) with a view to assessing their effects on the system as a whole. It combines elements of game theory, complex systems, computer science, and is applied to almost all fields of knowledge, natural and social.

Agent-based models are a kind of micro-scale models that simulate the simultaneous operations and interactions of multiple agents in an attempt to re-create and predict the appearance of complex phenomena. The process is one of emergence from the lower (micro) level of systems to a higher (macro) level. As such, a key notion is that simple behavioral rules generate complex behavior.

Most agent-based models are composed of:

- a. Numerous agents specified with various properties
- b. Simple rules for decision-making
- c. Learning rules or adaptive processes
- d. An interaction environment between the agents

Agent-based models are typically implemented as computer simulations, either as custom software, or via ABM toolkits, and this software can be then used to test how changes in individual behaviors will affect a system's emerging overall behavior. Agent-based modelling can be very helpful in understanding how complex phenomena might arise from simple interactions.

For more information on Agent-based simulation and modelling, the following link provides a wealth of resources particularly for starters:

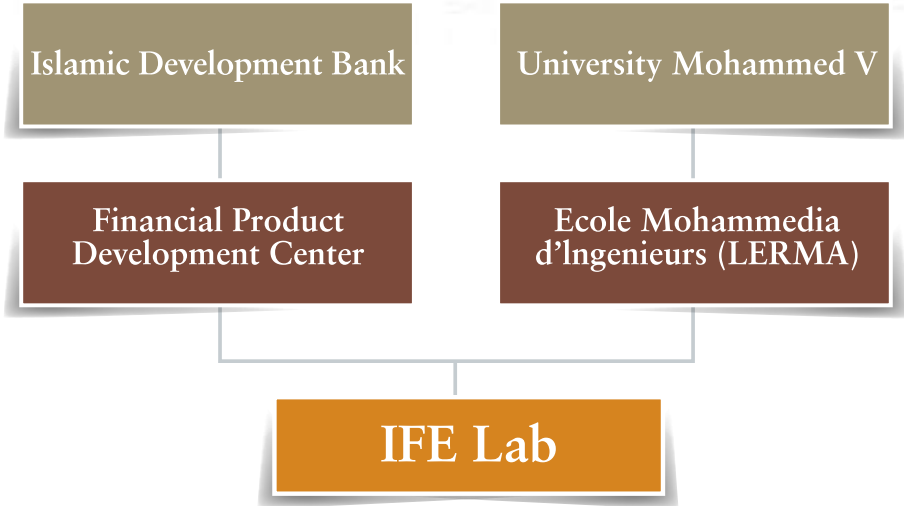
<http://www2.econ.iastate.edu/tesfatsi/ace.htm>

One of the most common software packages for Agent-based Simulation is NetLogo, which is easy to use and has plenty of applied models:

<https://ccl.northwestern.edu/netlogo>

2. Organization and Management of IFE Lab

The IFE Lab is hosted by the Laboratory of Study and Research in Applied Mathematics (LERMA) in the Mohammadia School of Engineering of Mohamed V University, Rabat, Morocco. It is managed by two teams: LERMA and the Financial Product Development Center of the Islamic Development Bank, Jeddah, Saudi Arabia.



2.1. Mohammed V University

Mohammed V University is the first university of Morocco after Al Karaouine in Fes. It is the first modern university of Morocco, founded in Rabat in 1957 and inaugurated two years later by the late King Mohammed V. It has the distinction of being the mother of Moroccan universities. Over the years, Mohammed V University established several branches in cities such as Casablanca, Fes, Kenitra, Tangiers, and Tetouan, which eventually became independent universities in 1975. A turning point in the history of Mohammed V University was 1993 when it was split into two independent universities, Mohammed V-Agdal University (UM5A) and Mohammed V-Souissi University (UM5S)

In 2015, Mohammed V University - Agdal and Mohammed V University - Souissi merged back into one University called **Mohammed V University**.



Mohammed V University is a public university that provides high quality education to over 20,000 students annually. Its alumni include leading government officials, ambassadors, academics, engineers, lawyers and executives.

To align itself with the European higher education system adopted during the Bologna Process, the University's administrative and teaching faculty worked together, from 2003 to 2012, to implement the three cycles of qualifications system otherwise known as the "LMD System" ("*License*", "*Master*" et "*Doctorat*"; Bachelor, Master and Doctorate). This reform was in line with the University's vision and values:

- ✓ Offering its students and partners a myriad of high quality study programs, many of which lead to employment upon graduation;
- ✓ Maintaining high standards of teaching and research on par with the best universities in the world;
- ✓ Helping students reach their full potential;
- ✓ Strengthening international exchanges by developing ties and partnerships with foreign institutions;
- ✓ Responding to the socio-economic needs of the government and the community





UM5A – Rabat offers a wide set of degrees both in the undergraduate and graduate levels. The university has the following schools:

- ✓ Mohammadia School of Engineering
- ✓ School of General Technology
- ✓ Teachers Training School
- ✓ Faculty of Letters and Human Sciences
- ✓ Faculty of Law, Economics and Social Sciences
- ✓ Faculty of Science
- ✓ Faculty of Medicine and Pharmacy of Rabat
- ✓ Faculty of Dentistry Rabat
- ✓ Faculty of Law, Economics and Social Sciences -Rabat-
- ✓ Faculty of Law, Economics and Social Sciences -Salé-
- ✓ National School of computer science and systems analysis
- ✓ Faculty of Educational Sciences
- ✓ Institute for the Study and Research for Arabization
- ✓ University Institute for Scientific Research
- ✓ Institute of African Studies
- ✓ Ecole Normale Supérieure of technical Education

2.2. Mohammadia School of Engineering- EMI

The Mohammadia School of Engineering (Arabic: المدرسة المحمدية للمهندسين; abbreviated EMI) is the oldest School of Engineering in Morocco. EMI was founded in 1959 by the late King Mohammed V as Morocco's first polytechnic. It is the largest institution of higher education in technology and one of the leading technical schools in Morocco.

In 1981, upon the order of the late King Hassan II, EMI became the first school combining academic and military education. Following the establishment of polytechnic schools in many European countries, schools in the early years of the 19th century were often based on the model of “*École Polytechnique*” of Paris in 1794.

After three years of studying, the students would be awarded with the ‘Grandes Ecoles d’ingénieurs’ degree, a *Bac+5* in the French education System, and the equivalent of a Master degree. The students would be awarded a rank of Reserve Officer too.



The school offers a variety of fields in engineering organized into eight departments:

- Department of Civil Engineering
- Department of Electrical Engineering
 - Electrical Energy Engineering
 - Networks & Telecommunications

- Department of Industrial Engineering
- Department of Computer Science
- Department of Mechanical Engineering
- Department of Mineral Engineering
- Department of Modelling and Scientific Computing
- Department of Chemical and Process Engineering.

EMI has 30 research structures including LERMA (Laboratoire d'Etudes et Recherche en Mathématiques Appliquées) Laboratory of study and research in applied mathematics

2.3. Laboratory of Study and Research in Applied Mathematics- LERMA

Ever since its creation, the main objective of the LERMA (Laboratory of Studies and Research in Applied Mathematics) has been to monitor the work of the EMI's (Mohammadia School of Engineering) Applied Mathematics team and to establish a link between this team and the several disciplines using the mathematical and computer science methods.

The scientific objective of the LERMA is the development of mathematical methodologies and tools, starting from modeling that allows placing the studied application in an adequate mathematical framework, through the development of algorithms and heuristics that might initiate efficient and effective scientific software, and finally leading to the numeric calculus and the simulation of the studied phenomena.

The aim is to achieve accessible findings that can be easily used by the industry. This requires a strong interaction between the members of the LERMA and the researchers in other disciplines on one hand, and the socio-professional environment on the other. The LERMA is equipped with various scientific competences, which promises to promote and accept multidisciplinary research.

2.3.1. Research themes

Since 2004, the research program of the LERMA is part of the common program of the networks in which the laboratory takes part. The main objective of the LERMA members is to develop adequate methods for the resolution of concrete problems. The developed research axes are essentially:

- Partial differential equations and applications
- Numerical methods and the optimization
- Risk analysis and modeling

- Operational research and logistics

The targeted application domains are:

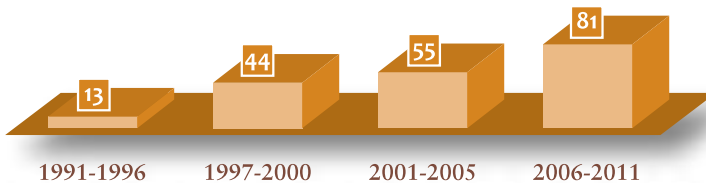
- Image and medical imaging processing
- Mathematical finance
- Finance and Economic modeling
- The flow in homogeneous and heterogeneous media
- Reliability and maintenance management
- Industrial and financial risks
- Markov decision Processes (MDP)

2.3.2. LERMA Team

The LERMA is a laboratory that consist of about fifty (50) researchers; twenty (20) of them are professors and the other thirty (30) are doctoral students. Some of these research professors are appointed at the EMI (Mohammadia School of Engineering) while others work in several other Moroccan institutions. About ten (10) of them are Assistant Professors preparing for their post-doctoral degree (in order to oversee research in the future).

Numerous national and international projects gather these researchers around specific themes.

LERMA PUBLICATIONS



LERMA team in numbers:

- 20 senior researchers, members and associate members
- 10 researchers preparing for “habilitation¹”
- More than 45 Ph.D. Students
- 3 habilitations
- 65 Ph.Ds so far

¹ Habilitation is the highest academic qualification a scholar can achieve by his or her own pursuit; it requires that the candidate write a professorial thesis.

2.3.3. LERMA projects and partnerships

LERMA members are members of numerous networks and international projects, including the LIRIMA, an international laboratory for IT and applied mathematics research, the LEM2I, the Euro-North-African laboratory for mathematics and its interactions, and the IFE Lab.

Researchers of LERMA are working on numerous national and international projects around specific themes, in modeling and simulation in several areas including finance and Islamic finance.

LERMA consists of three international laboratories:

- ❖ LIRIMA: an international Euro-African laboratory for IT and applied mathematics research, with INRIA – France. It was created in November 2009, with the head office based in the University Yaounde I, bringing together researchers from nine (9) countries of sub-Saharan Africa and the Maghreb with French researchers to work on common projects, modelled as INRIA (France) project teams.
- ❖ LEM2I: (*Laboratoire Euro-Maghrébin de Mathématiques et leurs Interactions*) An Euro-North-African laboratory for mathematics and its interactions at the National Center for Scientific Research (CNRS), France. It was created in September 2009. It involves more than 200 researchers in applied mathematics from France, Spain, Italy, Algeria, Morocco, and Tunisia. The aim of the LEM2I is to develop research programs and mathematical publications in collaboration between the partners.
 - It is funded by the CNRS and from each partner institution in France, Italy, Spain, Algeria, Morocco and Tunisia.
 - LEM2I organizes international conferences, thematic workshops, schools on high performance calculus and develops an exchange program between researchers.
 - LEM2I is involved in the creation of the Master Méditerranéen de Mathématiques (submitted to the Erasmus Mundus program of the EACEA agency of the European Commission). It is also involved in the creation of a high-level PhD training program in Mathematics for the whole Mediterranean area. (Theses with 2 advisors on both sides, south and north, of the Mediterranean area).
- ❖ IFE Lab: Islamic Financial Engineering Lab, with IsDB.

LERMA members are also part of several bilateral and international projects:

- Euro-Mediterranean projects (3 + 3): Scientific Computing and Multidisciplinary Optimization “SCOMU” 2009-2013, this project brings together researchers from (France, Italy, Morocco and Tunisia).
- Inverse problems in hydrogeology “Hydromed” 2009 - 2013 and “Hydrinv” 2013 - 2015. This project brings together researchers from Spain, France, Algeria, Morocco and Tunisia.
- Team Inverse Problems in cardiac electrophysiology: « EPICARD » is an associate team of the Carmen project at INRIA, regrouping researchers from INRIA, LAMSIN – ENIT, LERMA – EMI, Mohammed V University and from Université Technologique de Compiègne.
- The overarching goal of these laboratories and projects is to develop new mathematical approaches and models for solving different considered problems.

2.4. Islamic Development Bank (IsDB)

The Islamic Development Bank (IsDB) (Arabic: البنك الإسلامي للتنمية) is a multilateral development financing institution located in Jeddah, Saudi Arabia. It was founded in 1973 by the Finance Ministers at the first Organization of the Islamic Conference (now called the Organization of Islamic Cooperation) with the support of the late King Faisal of Saudi Arabia, and began operating on 20 October 1975. The purpose of the Bank is to foster the economic development and social progress of member countries and Muslim communities individually as well as jointly in accordance with the principles of Shari’ah i.e., Islamic Law.



The functions of the Bank are to participate in equity capital and grant loans for productive projects and enterprises besides providing financial assistance to its Member Countries in other forms for economic and social development. The Bank also establishes and operates special funds for specific purposes including a fund for assistance to Muslim communities in non-member countries, in addition to setting up trust funds. The Bank is authorized to accept deposits and to mobilize financial resources through Shari’ah-compatible modes. It is also charged with the responsibility of assisting in the promotion of foreign trade especially in capital goods, amongst Member Countries; providing

technical assistance to member countries; and extending training facilities for personnel engaged in development activities in Muslim countries to conform to the Shari'ah.

2.4.1. IsDB Vision

“To be the leader in fostering socio-economic development in member countries and Muslim communities in non-member countries in conformity with Sharia. “

2.4.2. IsDB Mission

“The IsDB Group is committed to alleviating poverty; promoting human development; science and technology; Islamic economics; banking and finance; and enhancing cooperation amongst member countries, in collaboration with our development partners.”

2.5. The Financial Product Development Center (FPDC)

The Financial Product Development Center was established in Muharram 1432H (December 2010). Its main purpose is to enhance the leadership of the Islamic Development Bank Group (IDBG) in the development and promotion of innovative Islamic financial products within the framework of the Maqasid al-Shari'ah, while securing and further strengthening the financial soundness and relevance of the IsDB Group.



The Center is the focal point for the development of new and innovative financial instruments in the IsDB Group, and for this purpose, it also collaborates with various institutions in the Islamic financial industry.

The Center has three major strategic objectives:

- a. Developing Business Process for new product development
- b. Building capacity of product developers
- c. Designing new financial products

These three objectives are summarized by the “3Ps” that the Center works along; Process, People, and Products.

2.5.1. Process

Formulating the Business Process (BP) of developing new products is vital to determine the requisite steps for product development. The BP will be used as a framework for all other activities for product development.

The Center has already completed the general Business Process Matrix for IsDB Group, and is working to develop the detailed processes of each step in the BP. The Center is also moving ahead to implement the processes. The steps for this include:

- a. Identifying product gaps with respect to the needs of investors and customers, both on the assets side and liabilities side.
- b. Developing tools and techniques for generating and evaluating new product ideas.
- c. Producing Manuals of Islamic Financial Products

2.5.2. People

For the process to be effective there has to be a good number of product developers who are equipped with the skills and knowledge needed for product development. This objective is achieved mainly through:

- a. Capacity building and training programs.
- b. Establishing networks with experts in the IsDB Group and in the industry, to:
 - i. Identify gaps within each department or entity.
 - ii. Stimulate new idea generation.
 - iii. Share information on existing products.
 - iv. Coordinate product development process.
 - v. Organize periodic seminars and conferences by inviting experts and scholars to enrich and enhance developing new products.

2.5.3. Products

With an effective process and the right people, the stage is set for designing new products to fill the gaps between customers' and investors' needs on one hand, and the existing products on the other. Accordingly, the Center carries out the following activities:

- a. Carry out periodic surveys of existing Islamic and conventional products.
- b. Respond to the needs of the IsDB Group entities for new products.
- c. Work closely with the Advisory Panel and the Working Group for idea generation and evaluation.

- d. Collaborate with the concerned departments and entities for due approval and implementation.
- e. Arrange pilot experiments for testing new products

2.6. Establishment of IFE Lab

Following preliminary meetings between the Center and LERMA during the summer of 2013, the IsDB and Mohammed V University signed an agreement to establish the Islamic Financial Engineering (IFE) Lab in November 2013. The Lab officially started operating by the beginning of the year 2014.





3. IFE Lab activities

Since its inception, the Lab has been actively working to achieve its objectives. The tables below summarize the main activities up to date (June 2015).

3.1. Courses

Academic Year 2013/14			
#	Date	Course Title	Instructor
1	24 - 26 February 2014	NetLogo Programming and Applications in Finance	Professor Murat Yildizoglu, University of Bordeaux
2	20 - 22 March 2014	Fundamentals of Islamic Finance	Dr. Ridha Saadallah, President of the Tunisian Association of Islamic finance
3	26 - 30 May 2014	Game Theory (Part I)	Professor Mohamed Tkiouat, EMI
4	4 - 5 June 2014	Game Theory (Part II)	Dr. Salman Ali Sayed, IRTI
Academic Year 2014/15			
5	15 to 18 October 2014	Real Estate Finance	Dr. Yildiray Yildirim, Syracuse University
6	23 November 2014	Multi-agent systems	Prof. Abderrafiaa Koukam, University of Technology of Belfort-Montbéliard
7	26 - 28 February 2015	Economics of Sharing Contracts	Dr. Mahmoud Sami Nabi, Head, Economics Department at Tunisia Polytechnic School
8	31 March and 1 April 2015	Financial transactions jurisprudence	Dr. Mohammed Karrat
Academic Year 2015/16			
#	Date	Course Title	Instructor
9	1-3 June 2015	Hedging in Islamic Finance	Dr. Sami Al-Suwailem, IsDB
10	18-19 September 2015	Introduction to MATLAB	Pr. Rajae Aboulaich, LERMA & Pr. El Mahdi El Garmah. Moroccan Royal Air School
11	5-7 October 2015	Introduction to Sukuk	Dr. Ridhaa Saadallah, President of the Tunisian Association of Islamic finance
12	20-22 November 2015	Real Estate and Corporate Finance	Dr. Yildiray Yildirim, Chair, William Newman Department of Real Estate, Baruch College, CUNY, USA

3.2. Seminars

Academic Year 2013/14			
#	Date	Seminar Title	Presenter
1	10 October 2013	Agent-Based Simulation in Islamic Finance	Dr. Sami Al Suwailem, IsDB
2	2 December 2013	Introduction to Multi-Agent Simulation	Pr. Karim Bouzoubaa, EMI
3	13 & 24 December 2013	Introduction to Netlogo	Mohamed Amine Souissi & Wail Aaminou, PhD Students at IFE Lab
4	6 January 2014	Complexity and endogenous instability	Dr. Sami Al Suwailem, IsDB
5	16 January 2014	Financial transactions jurisprudence	Dr. Mohammed Karrat
6	28 January 2014	Modeling a Logistic platform using Netlogo	Mr. Samir Tetouani
7	4 February 2014	Macroeconomic computable general equilibrium models	Ms. Salima Mansouri, Ph.D. student at IFE Lab
8	18 February 2014	Strategic behavior and economics of climate change: A Differential Game Theory Approach	Pr. Hassan Bencheekroun, McGill University
9	12 May 2014	Conference: Challenges and operational problems for the establishment of Islamic banks in the Moroccan context	Dr. Ali Alami Idrissi, Optima Finance Consulting
10	13 May 2014	Conference: Functioning of the Moroccan stock market	Dr. Mohamed Amrani, CEO, BMCI Asset Management
11	7 June 2014	Time Series Modeling	Pr. Youssef Benghabrit, ENSAM Mèknes
12	21 June 2014	Genetic Algorithms	Pr. Hanaa Hachimi, ENSA Kenitra

Academic Year 2014/15			
#	Date	Seminar Title	Presenter
1	24 November 2014	Modeling and multi-agent simulation in economics and finance	Dr. Sami Al Suwailem, IsDB
2	12 March 2015	Islamic financial investment techniques	Mr. Mohammed Wail Aaminou, Ph.D. Student at IFE Lab
3	19 March 2015	Corporate Valuation	Mrs. Ilham Boularhmane, Ph.D. Student at IFE Lab
4	26 March 2015	Islamic Financing Techniques	Mrs. Khadija El Hachami, Ph.D. Student at IFE-Lab
5	1 April 2015	Applications of Maqasid Shari'ah in Economics	Mr. Houssem Eddine Bedoui
6	14 April 2015	Islamic Economics and Microfinance	Mr. Nawfal Naciri, Ph.D. Student at IFE Lab
7	23 April 2015	Islamic Portfolio Management	Mrs. Fatima Zohra Elihssini, Ph.D. Student at IFE Lab
8	14 May 2015	Conference: Economic Empowerment	Mr. Anas Hasnaoui, Director, IBF Group Consulting

3.3. Publications

The IFE Lab students have published papers and communiques (brief reports) about their research in various outlets. These include:

Communications

W. Aaminou and R. Aboulaich: **Modeling consumer behavior, case of Islamic finance**, Published at the 10th edition of Numerical Analysis and Optimization conference (Essaouira, Morocco) October 2013.

W. Aaminou and R. Aboulaich: **Consumer behavior in Islamic Finance: Literature review**, Published at the 1st edition International Symposium on Islamic Finance: Applications, Challenges and Prospects (Agadir, Morocco) October 2013.

M. A. Souissi and M. Tkiouat: **State of the art on Sukuk, The Numerical Analysis and Optimization Days** The 10th edition of Numerical Analysis and Optimization conference Essaouira-Morocco (Oct. 2013).

I. Boularhmane and R. Aboulaich: **Valuing Investments through Principles of Islamic Finance: a Modeling Solution**, 10th edition of Numerical Analysis and Optimization conference Essaouira-Morocco (Oct. 2013).

I. Boularhmane and R. Aboulaich: **Valuation model of socially responsible companies from an Islamic point of view**, 6th Islamic Banking Accounting and Finance Conference, Nilai-Malaysia (Sept. 2014).

A. Dchieche and R. Aboulaich: « **Islamic Contingent Premium Options** ». Le premier congrès international en finance éthique et islamique sous le thème: Finances alternatives et crise: finance éthique, responsable, participative, islamique. 2014, October, 30-31 Cadi Ayyad University, Marrakech, Morocco.

M. A. Souissi and M. Tkiouat: **Introduction of Sukuk in Morocco, Challenges and Risks**, Le premier congrès international en finance éthique et islamique, 2014, October, 30-31 Cadi Ayyad University, Marrakech, Morocco..

F. Z. Elihssini and M. Tkiouat: **Vers un MASI et un MADEX islamiques sur la bourse de Casablanca**, Le premier congrès international en finance éthique et islamique, 2014, October, 30-31 Cadi Ayyad University, Marrakech, Morocco.

N. Naciri and M. Tkiouat: **Complex systems Overview**, Second World Conference on Complex Systems, Agadir- Morocco (Oct. 2014).

N. Yachou and R. Aboulaich: **Mortgage loan in Islamic and conventional finance**, Conference on “Islamic Economy from crises to solidarity institutions”, Beni Mellal, Morocco, 11-12 May 2015

N. Yachou and R. Aboulaich: **Principle of Sharing Of Profits and Losses within Islamic institutions, “Musharaka Contract”**, 3rd International Congress of Islamic Finance, Islamic Banks and Companies Financing: Practices and Theoretical Challenges “ Marrakech, Morocco, 25-26 May 2015.

W. Aaminou, R. Aboulaich, Fadwa Chaker and Abdellah El Manouar: **CSR Dynamics under Peer Pressure and Green Confusion: a Multi-Agent Simulation Approach**. 10th International conference on intelligent systems: Theories and applications (SITA), Oct 2015.

K. El Hachami and M. Tkiouat: **The Agent-Based Modeling of the Macroeconomic Behavior of Sharia-Compliant Companies**; International Congress on Islamic Economics and Finance; Sakarya-Turkey. 2015, October.

Amina Dchieche and Rajae Aboulaich: « **Pricing of Waad Bil mourabaha** » au Premier Colloque International en Finance sous le thème, Finance Islamique modèle alternatif de développement de la finance mondiale. 2015, December 10-11, Université Ibn Tofail, ENCG Kénitra.

K. Dahani et R. Aboulaich: **Modélisation macroéconomique dans le cadre de l'économie islamique: I-DSGE**, Première édition du colloque international

en finance, 2015, December 10-11, 2015, December 10-11, Université Ibn Tofail, ENCG Kénitra.

Amina Dchieche and Rajae Aboulaich: «**Pricing of profit and loss sharing contract new approach to model Salam**» Accepted in 18th International Conference on Information and Financial Engineering, 2016, April 25-26 World Academy of Science Engineering and Technology in Paris.

Published papers

Siham Omrana and Rajae Aboulaich: “**Bai Al Arboun**” **A Shariah Compliant Alternative to Conventional Call Options**. International Research Journal of Finance and Economics. ISSN 1450-2887. Issue 115 October, 2013

Nawfal Naciri and Mohamed Tkiouat: **Understanding Complexity in Economic Systems with Agent Based Modeling**, International Journal of Latest Research in Science and Technology, Volume 4, Issue 3: Page No.28-31, May-June 2015.

Naciri Nawfal and Tkiouat Mohamed: “**Complex systems: state of the art**” International Journal of Advances in Management and Economics (IJAME), 2015.

Naciri Nawfal and Tkiouat Mohamed: **Multi Agent Systems: theory and applications; survey**. International Journal of Intelligent Systems Technologies and Applications. Inderscience Publishers Ltd.

Naciri Nawfal and Tkiouat Mohamed: **Agent-Based Platforms: Review and Comparison**. International Journal of Applied Engineering Research (IJAER). Volume 10, Number 14 (2015) pp 34224-34229.

Rajae Aboulaich and Amina Dchieche: **Pricing of Waad Bil Mourabaha**”, Asian journal of applied sciences, Vol 3, No 3 (2015), June 2015

Siham Omrana, Rajae Aboulaich, Ali Alami Idrissi: **Modelling “Bai Al Arboun” Using Binomial Model**, International Journal of Business, 20(3), Fall 2015.

Adil El Fakir and Mohamed Tkiouat: **An Incentive Mechanism Game Theory Approach to Musharakah Contracts**, Asian journal of applied sciences, Vol 3, No 4 (2015)

Adil El Fakir and Mohamed Tkiouat: « **New Projects Sharing Ratios under Musharakah Financing: A Repeated Game Theoretical Approach Using an Output versus a Proposed Effort Based Contract** », American Journal of Applied Sciences, 12 (9): 654.662, 2015.

Rajae Aboulaich and Amina Dchieche: “**Participating Contingent Premium Option**”, Review of Pacific Basin Financial Markets and Policies, accepted

on October 2015.

Amina Dchieche and Rajae Aboulaich, “**New approach to model Salam Contract for profit and loss sharing**”, International Journal of Applied Engineering Research, accepted on November 2015.

Submitted Papers

W. Aaminou and R. Aboulaich: “**Simulating consumers’ behavior in new dual banking markets**”. Review of Pacific Basin Financial Markets and Policies, submitted in February 2015.

R. Aboulaich, S. Badraoui, K. Bensaid, A. Mouad El Haloui: **Impact of qualitative characteristics on market equilibrium; Simulation with agent-based modeling**, Review of Quantitative Finance and Accounting, submitted in June 2015.

I. Boularhmane, R. Aboulaich: **Valuation of Quarterly Stock Prices: Applying Ethical Principles to Discounted Cash Flow Method**, Research in Finance, submitted in Research In Finance, submitted in June 2015.

3.4. Internships

As part of the IFE Lab program, students undertake brief internships at Islamic financial institutions to enhance their research. This includes:

- a. Wail Aaminou, Mohamed Amine Souissi – Islamic Development Bank, April-May 2014
- b. Siham Omrana, Wail Aaminou - Malaysia, June 2014
- c. Ilham Boulrahmane – Malaysia and Bahrain, September - October 2014
- d. Nawfal Naciri, Khalid Bensaid, Ahmed Mouad Elhaloui – Islamic Development Bank, December 2014 – January 2015

4. IFE Lab Team

4.1. IFE Lab Advisory Committee

The Advisory Committee oversees the plans and objectives of the Lab. It is composed of the following scholars.

From LERMA:

- ❖ Dr. Rajae Aboulaich
- ❖ Dr. M. Tkiouat

From IsDB:

- ❖ Dr. Ridha Saadallah
- ❖ Dr. Salman Syed Ali
- ❖ Dr. Sami Al-Suwailem

4.1.1. Dr. Rajae Aboulaich

Dr. Rajae Aboulaich is a professor at EMI (Mohammadia School of Engineering) Her research is focused on “Partial Differential Equations: Analysis, Resolution and Applications, Optimization.” The application of her research is Fluid mechanics, Image processing, Biomathematics, Finance, etc.



- ❖ Ph.D. in Mathematics and Numerical Analysis, University of Laval, Canada
- ❖ Master & Ph.D. in Analysis and Probability, Muhammad V University, Rabat
- ❖ Associate Director, LIRIMA – 2009 – present
- ❖ Head of LERMA, 1991 – present

4.1.2. Dr. Mohamed Tkiouat

Dr Mohamed Tkiouat is a professor at EMI (Mohammadia School of Engineering)



- ❖ Ph.D. in Mathematical Sciences in the field of Markov decision processes and applications at the Université libre de Bruxelles. Mention: Summa cum Laude, 1991
- ❖ Ph.D. in Mathematics, Faculty of Sciences Rabat. Mention: Laude, 1984

4.1.3. Dr. Sami Ibrahim Al-Suwailem

Dr. Al-Suwailem is currently Head of Financial Product Development Centre at the Islamic Development Bank. He was previously Deputy Director of Islamic Research and Training Institute at the IDB Group. Before joining IRTI in 2004, Dr. Al-Suwailem managed the Research and Development Center of the Shari'ah Group at Al-Rajhi Bank, Riyadh, Saudi Arabia. He worked at Institute of Islamic and Arabic Sciences in America, Virginia, Southern Illinois University, Carbondale, Illinois, USA, and King Saud University, Riyadh.



He authored many books and published several papers on Islamic economics and finance. Dr. Al-Suwailem held membership in several professional committees, including the Technical Committee of the Islamic Financial Services Board; Economic Committee of Awqaf at the Ministry of Islamic Affairs in Riyadh; Academic Committee in Islamic Fiqh Academy of Muslim World League; Executive Committee of the Islamic International Foundation for Economics and Finance; Liquidity Risk Management Working Group for IFSB; and Task Force for Islamic Finance and Global Financial Stability.

He obtained his M.A from Southern Illinois University in 1990, and his Ph.D. from Washington University, St. Louis, Missouri, in 1995.

4.1.4. Dr. Ridha Saadallah

A member of IRTI Board of Trustees.

- ❖ Doctorat d'Etat in Economics - Tunis University, 1980

With Distinction and Highly Commended
(*Mention Très honorable avec les félicitations du jury*)

- ❖ Diplôme de Statisticien Economiste (Postgraduate degree in Statistics and Economics)

National School of Statistics and Economic Administration (French *Grande Ecole*). Paris, 1973

- ❖ D.E.S in Econometrics (Master Degree)

University of Paris I, 1972

- ❖ B.A. in Economics (Licence es Sciences Economiques) - Distinction

Tunis University, 1970



4.1.5. Dr. Salman Syed Ali

Dr Salman Syed Ali is a senior economist at IRTI (Islamic Research and Training Institute), IsDB Group.



- ❖ Ph.D.in Economics, University of Pennsylvania, U.S.A., 1995
- ❖ B.Sc. (Hons.) & M.Sc. in Economics, International Islamic University, Islamabad, Pakistan
- ❖ Editor of Journal: Islamic Economics Studies
- ❖ Served as Director of Research and Training, International Institute of Islamic Economics (IIIE), Pakistan.

4.2. Executive Committee of IFE Lab

The Executive Committee is responsible for implementation of the IFE Lab's plans and programs and oversees its daily activities. It is composed of:

- e. Prof. Rajae Aboulaich, Director of IFE Lab. and LERMA, EMI, Mohammed V University
- f. Prof. Mr. Tkiouat, LERMA. Member of the IFE Lab. and LERMA, EMI, Mohammed V University

4.3. IFE Lab IsDB Coordinator

From IsDB, Br. Housseem Bedoui is the focal point for coordinating the activities of the IFE Lab with IsDB.

Br. Housseem is a financial engineer and Product Development Specialist in Islamic Development Bank. He is a Ph.D. student at the ENS (Ecole Normale Supérieure, France). He develops scientific work on Islamic Finance. Before joining IsDB, he had a career as a consultant in management advisory and ethical/sustainable finance. He has worked with different think tanks to develop Islamic Finance in France. As a part of FPDC, he is contributing to innovative products, and creating processes to develop new financial products. He manages the IFE lab as part of his target to work on People as a main component of financial innovation and product development.



4.4. IFE Lab Professors

The Lab collaborates with a large network of highly qualified and internationally recognized professors in various fields related to its area.

4.4.1. EMI Professors

a. Dr. Mohammed Ryad

Dr Mohammed Ryad is an Economist at the EMI (Mohammadia School of Engineering). He holds a Ph.D. in Economics (Option: economic strategies and economy companies) from the Faculty of Social Sciences, Law and Economics, Rabat. His area is on economics (macro and microeconomics).



b. Dr. Rachid Ellaia

Dr Rachid Ellaia is a professor at the EMI in Applied Mathematics. He has published papers in the field of optimization, probability transformation etc.



4.4.2. External professors

a. Dr. Murat Yildizoglu

- ❖ Professor of Economics, Bordeaux University
- ❖ Member of GREThA (UMR 5113)
- ❖ Associate member of BETA (UMR 7522 du CNRS), Université Louis Pasteur de Strasbourg.

Previous Positions:

2008-2011: Professor, Aix Marseille University, GREQAM (UMR CNRS 6579)

2000-2008: Professor, Bordeaux University, GREThA (UMR CNRS 5113)

1992-2000: Assistant professor, Strasbourg University, BETA (UMR CNRS 7522)

1989-1992: IEP Strasbourg, Ph.D. student and teaching assistant (ALER)

Research interests: Industry Dynamics, Economics of Innovation, Economic



Growth, Learning, Industrial Organization, Computational economics, Agent Based Models, Evolutionary modelling.

Technical competencies: Microeconomic modelling, Game theory, Computational economics, Agent based evolutionary modelling, Genetic Algorithms, Classifier systems, Artificial neural networks, Basic econometric modelling.

b. Dr. Yildiray Yildirim

- ❖ William Newman Real Estate Chair, Professor
- ❖ Chair, William Newman Department of Real Estate
- ❖ Director, Steven L. Newman Real Estate Institute
- ❖ Ph.D., Cornell University



His main research interests are in real estate, in particular securitization and commercial leasing, credit risk, fixed income securities, inflation modeling, and structured finance. He was a visiting scholar at Princeton University, Office of Comptroller of the Currency, and Borsa Istanbul. He has provided consultancy at the U.S. Department of Housing regarding issues concerning multi-family mortgage default and foreclosure, and most recently received a grant from JP Morgan Chase on commercial mortgage origination and tenant risk. He developed the undergraduate real estate program at Syracuse University in 2009. He has taught finance and real estate courses, including real estate finance and investment, real estate capital markets, case studies in real estate investment, fixed income securities, and corporate finance. He graduated from Yildiz Technical University with a B.Sc. in Computer Science and Engineering. He received both his M.A. in Economics and Ph.D. in Statistics at Cornell University.

c. Dr. Abderrafia Koukam

Pr. Dr. Abderrafia Koukam is a Professor at the “Université de Technologie de Belfort-Montbéliard” (UTBM). He obtained his doctorate at the “Université de Nancy 1” and his Research Direction Habilitation at the “Université de Bourgogne”. He was Director of the “Laboratoire Systèmes et Transports”, Vice President of the Scientific Council of UTBM, Director of Computer Science Department and the founder



of the team Multi-agent Systems and Optimization. His research focuses on multi-agent systems: modeling, simulation, verification. He assumed the coordination of two European projects (TRASCOM 2002-2004, SURE

2003-2005), several national projects (CRISTAL, ANR SafePlatoon,...), and contracts with industry in the areas of transportation planning, mobile networks, traffic flow simulation in industrial sites, and intelligent vehicle.

Research activities:

The Multi-agent Group is involved in the following research activities:

- Agent-based Simulation
- Agent Software Engineering
- Agent Architecture
- Platooning
- Cooperative Design Process and Knowledge Management
- Optimization

d. Dr. Cars Hommes

- ❖ Professor of Economic Dynamics, University of Amsterdam
- ❖ Director Center for Nonlinear Dynamics in Economics and Finance (CeNDEF)
- ❖ Institute New Economic Thinking, member of task force for systemic risk and Agent-based Modeling, led by Nobel laureate Joseph Stiglitz
- ❖ Visiting Professor, Department of Economics, University Wisconsin, USA
- ❖ Ph.D. in Mathematical Economics, University of Groningen (1991)



Dr. Cars Hommes is one of the pioneers in complexity economics. His work develops an alternative complexity paradigm based on agent-based behavioral complexity models.

The Center for Nonlinear Dynamics in Economics and Finance (CeNDEF), which he founded in 1998, is a multi-disciplinary research center in complexity economics. CeNDEF has not only developed an alternative theory of complex economic systems, but has also tested this alternative paradigm successfully in laboratory experiments with human subjects and estimated complexity models using financial and macroeconomic datasets.

Dr. Cars has published more than 100 articles in leading international journals and book chapters and has authored and edited four books.

e. Dr. Francisco Doria

Francisco Antonio Doria was born in Rio (Brazil) in 1945. Received a B.Sc. in chemical engineering from the Federal University at Rio in 1968 and a Ph.D. in mathematical physics in 1977 (Brazilian Center for Research in Physics) under the guidance of Leopoldo Nachbin. Published around 80 papers on theoretical physics, foundations of physics and of the mathematical sciences. Proved that chaos theory, if axiomatized, is undecidable and Gödel incomplete, and (with N. C. A. da Costa and M. Tsuji) proved that Nash games are similarly undecidable and incomplete.



f. Dr. Isabelle Salle

Isabelle L. Salle obtained her Ph.D. from the University of Bordeaux (France) in 2012 on “Learning, heterogeneity and monetary policy: an application to inflation targeting regimes”. She then worked as a Junior Economist at the research department of the International Labor Office, a UN agency based in Geneva, and joined the University of Amsterdam in September 2013 as a post-doc researcher to work on several European projects. Her research interests include (macro) economics, with an emphasis on behavioral and experimental approaches, and agent-based modelling.



g. Dr. Mahmoud Sami Nabi

Dr. Mahmoud Sami NABI is an Associate Professor of Economics and Head of the Economics Department at Tunisia Polytechnic School (TPS).

He occupied the position of Senior Research Economist at the Research Division of IRTI (Institute of the Islamic Development Bank) from 2011 to 2013 and served as Vice-Director of the Sousse Business School from 2008 to 2011.



Dr. Nabi holds an Engineering Diploma from TPS, and a Ph.D. in Economics from University of Paris I- Pantheon Sorbonne. Thesis title: “*Economic Development, Banking Intermediation and Crises: Theoretical Essays*”. Mention: Highest distinction.

h. Dr. Mahmoud Bekri

Dr. Mahmoud Bekri received his doctorate degree in Quantitative Finance and Economics from Karlsruhe Institute of Technology (KIT) in Germany at 2014. He also received his diploma in Physics from the same university in 2011. Dr. Bekri collaborates to develop scientific work on Islamic Finance. He is also an instructor and a supervisor of different theses on the same topic. In addition, he provides consulting services to develop Islamic Finance business activities for international banks and asset management companies and delivers courses on advanced financial engineering.



i. Dr. Mohammed Karrat

Dr. Mohammed Karrat studied Shari'ah from Al-Azhar University in Egypt. Dr. Karrat holds a Ph.D. from the Faculty of Sharia (Fes) at Al Quarawyyine and is currently a Professor of Islamic Jurisprudence and its foundations at the same university as well as a Partner at Al Maali Islamic Finance Consulting.



Before joining Al Maali, Dr. Mohamed held several senior academic and research positions in Islamic jurisprudence in Awqaf (endowments) Ministry of the UAE before joining the Fatwa Committee in Abu Dhabi where he was in charge of Islamic financial and commercial transactions. Dr. Mohammed was also involved in the preparation of the UAE legal framework for Waqf, Waqf product structuring for the Waqf ministry, Sukuk research for the National Sukuks Company in UAE. Dr. Mohammed Karrat is certified as an Arbitrator for Islamic Finance from the International Islamic Centre for Reconciliation and Arbitration (IICRA). He is also a trainer of "Certified Islamic Banker" which is a certificate programme of CIBAFI. Dr. Karrat also serves on the Shari'ah Board member of a number of investment funds.

j. Dr. Ali Alami Idrissi

Dr. Ali Alami Idrissi is a director and co-founder of Optima Finance. Till 2005, He was the Chief Risk Officer of Caisse de Depot et de Gestion (CDG), Rabat, in charge of the evaluation and monitoring of risks (activities of the Trading Room, Operational Risk and ALM)



❖ Ph.D. in Econometrics of Finance from the

University Paris IX-Dauphine, Paris, France, 1999

- ❖ Masters in Markets and Financial Intermediaries, University Toulouse I, France, 1993
- ❖ Masters in Econometrics and Mathematical Economics, University Toulouse I, France, 1992

k. Dr. Mohamed Amrani

Dr. Mohamed Amrani is the CEO of a BNP Paribas Investment Partner, BMCI Asset Management (Banque Marocaine du Commerce et de l'Industrie) since 2008. He is member of the Board of Casablanca Stock Exchange. He is a Ph.D. holder in Applied Mathematics from University of Lorraine (France).



l. Dr. Sami Assoulaimani

Dr Sami Assoulaimani is a co-founder of Finéopolis. Before founding Finéopolis Consulting, Sami launched and led the African office of a specialized international consulting firm and participated in the development of its international strategy. He has consulted for various national and international projects for Islamic financial product development missions, Shariah governance, structured financing and design of development strategies. He is a Ph.D. holder in Game Theory (multi-agent decision) from the University of Brest.



4.5. IFE Lab Students



1. *Aaminou Wail*

- Thesis aims at modeling the consumer behavior and its impacts on banks when the consumer is faced by Islamic and conventional banking choices.

2. *Bensaid Khalid*

- Takaful: The Islamic way of insurance: Investors' behavior: Simulation, study and analysis

3. *Boularhmane Ilham*
 - Asset pricing model of Stocks applying Islamic Values
4. *Dahani Khawla*
 - Building an agent-based model of Islamic monetary macroeconomics
5. *Dchieche Amina*
 - Islamic Derivatives and hedging contracts
6. *El Hachami Khadija*
 - The effect of the introduction of Islamic financial products in the overall balance of the Moroccan economy using the Calculable General Equilibrium Models.
7. *El Haloui Ahmed Mouad*
 - Private Equity in Islamic Finance environment: Allocation models of Private Equity funds and Investors' behavior
8. *Fatima Zobra EL IHSSINI*
 - Due to the absence of any Islamic Index on the Casablanca stock market, she decided to work on this market to construct an Islamic MASI and MADEX.
9. *Fquihi Kaoutar*
 - Modeling financial stability in the context of a dual banking system: the case of a new introduction of Islamic banking.
10. *Naciri Nawfal*
 - Islamic microfinance and ABS
11. *Omrana Siham*
 - Modeling “Bai Al Arboun“ as a Shariah Compliant Alternative to Call Option
12. *Souissi Mohamed Amine*
 - Quantitative study of sukuk market in Morocco
13. *Yachou Najlae*
 - Substitute the mortgage by the Musharakah contract

5. Admission to IFE Lab

For admission to the IFE Lab, candidates have to fulfill the requirements of both the Moroccan Centre for Doctoral Studies (CEDOC) as well as the IFE Lab.

1. Requirements of CEDOC

CEDOC manages doctoral training and postgraduates in Morocco.

Access to Ph.D. is open to holders of Master degrees, specialists or Master graduates of Engineers (Bac + 5). The duration of the preparation of Ph.D. is three years. An additional year may be granted, as required by the Director of the school. An additional second year may be granted as an exception.

2. Requirements of IFE Lab

- Letters of recommendation from professors of candidates;
- Good level in English;
- Age at time of registration should not exceed thirty (30);
- Signed Letter of Commitment from the candidate committing to attend all classes, seminars and internships arranged by the IFE Lab.

Obtaining a Ph.D. is conditional upon:

- Validating all trainings programmed by CEDOC and IFE LAB;
- Publication of the results of the scientific work of the Ph.D. student as Lead Author in indexed journals (SCOPUS or more);
- Participation in conferences;
- Public defense of the research work in front of a jury of experts in the field.

3. Conditions to defend the thesis:

To defend his/her thesis, a student should have two requirements:

- two papers indexed in SCOPUS
- an ABS model for the simulation of a problem in Islamic finance or Islamic economics.

6. Award for Best Application of ABS in Islamic Finance

In 2014, the Advisory Committee of the IFE Lab decided to launch a competition to award the Best Application of ABS in Islamic Finance to reach out to graduate students worldwide who are eager to learn new techniques and use these techniques to contribute to the advancement of Islamic economics and finance. The award encourages students to learn and apply these new tools in this field. Such efforts would greatly expand the scope of research in this area, and, more importantly, encourage a more systematic approach to Islamic financial engineering and product innovation.

The Award prizes are supported by the SABIC Chair of Islamic Financial Markets Studies from the Imam Muhammad bin Saud University, Riyadh.

Timeline

Deadline for Submission of Paper and Codes	-	20 th October 2015
Announcement of Winners	-	January 2016
Award Ceremony	-	18 th February 2016

Prizes

1) Cash Prize

1 st Place	-	USD 8,000/-
2 nd Place	-	USD 6,000/-
3 rd Place	-	USD 4,000/-

2) Commemorative Medal

3) Certificate of Honor

For more details, www.facebook.com/absinif



7. In the media



Sunday, 01 February 2015 - Jeddah, KSA - The Islamic Development Bank (IDB), SABIC Chair of Islamic Financial Markets Studies, and Islamic Financial Engineering Lab at Mohamed V University, Morocco, have joined hands to present the first Award for Best Application of Agent-based Simulation (ABS) in Islamic Finance.

The Award is aimed at inspiring student researchers across the world to use and apply Agent-based Simulation (ABS) to various aspects of Islamic economics and finance. ABS is a valuable tool for studying complex phenomena and developing practical solutions. Platforms such as ABS can prove to be effective in understanding multi-agent behavior in complex systems. Over the past 25 years, ABS has been increasingly applied in a variety of fields of knowledge such as science, finance among others.

The Award offers three prizes to the best three winners: first place: \$8,000; second place: \$6,000; third place: \$4,000. Deadline for submission is 30 September 2015.

The Award is in line with the mandate of IDB of promoting Islamic finance by developing innovative Islamic financial products and instruments that support economic growth and development of Member Countries and Islamic financial institutions.

[Click here for a detailed Brochure of the Award.](#)



Sectors | Thu Feb 19, 2015 7:57am GMT

Researchers take scientific approach to Islamic finance

BY BERNARDO VIZZANO



Feb 19 Researchers are seeking to apply the principles of game theory to Islamic finance, one of several efforts to shed new light on economic behaviour in an industry driven by religious principles.

Traditionally, research into Islamic finance has focused on what is religiously permissible - whether activities and instruments follow sharia law, such as bans on interest payments and pure monetary speculation.

But as the industry grows, attention is shifting to include practical matters such as how investors and fund-raising institutions make decisions, and how to design economically viable new products.

The shift comes as Islamic banks try to expand beyond a relatively small client base that focuses on sharia compliance, to a much larger one whose financial decisions are based on a wide range of factors such as pricing and service quality.

A competition launched this month by the Islamic Development Bank (IDB), in partnership with universities in Morocco and Saudi Arabia, invites entrants worldwide to submit computer models of some aspect of Islamic economics or finance. Cash prizes are offered for the best three submissions.

Models are to employ agent-based simulation (ABS), which uses individual rules for the behaviour of each participant and shows how their interaction can have results that no participant intended.

Sami Al Suwailem, head of the financial product development centre at the Jeddah-based IDB, said he hoped the models would reveal how various agents in Islamic finance - such as customers, banks and regulators - responded to each other.

“There is a disconnect now between theory and practice in Islamic finance. Not surprisingly, there is little innovation in the industry,” he said. “ABS is one way, among many, to help bridge this gap and to spur innovation.”

PRODUCT DESIGN

Conventional finance has used mathematical models and massive computing

power for decades. Islamic finance now seems to be reaching a size and complexity that make it worth doing the same; the industry's global assets are estimated to exceed \$2 trillion and are growing faster than conventional finance.

In 2013, the IDB set up an Islamic financial engineering laboratory at Morocco's Mohamed V University, which launched the ABS research competition with Saudi Arabia's Imam Mohammed Bin Saud Islamic University.

ABS could help estimate the impact of introducing new Islamic financial products to the market, said Mohammad Al Suhaibani, professor of economics at the Saudi university.

"The research in this topic is very important to improve our understanding of Muslim economic behavior. We are confident that this award will open a new chapter in Islamic finance and economics research."

Many new research efforts are backed by partnerships between financial institutions - either multilateral institutions such as the IDB, or commercial banks - and universities.

In November, Malaysia's CIMB Islamic Bank and the International Centre for Education in Islamic Finance (INCEIF) in Kuala Lumpur set up a research centre that focuses on product development.

Islamic financial research is evolving from a focus on theoretical concepts in the 1980s and the regulatory environment in the 1990s to operational issues such as product design and cross-border deals, INCEIF said in a statement to Reuters.

"There is a real need to bridge the gap between academic knowledge and industry experience," it said, adding that this was becoming possible because more historical data had been made available in recent years, allowing more empirical studies to be conducted.

Meanwhile, the World Bank and the Bahrain-based Al Baraka Banking Group have tied up to develop a series of research projects studying the legal and regulatory environment needed for equity-based Islamic finance contracts.

The first initiative will study the risk-management challenges facing Islamic banks, with a focus on profit-sharing contracts known as musharaka and mudaraba, which are widely known conceptually but little used in practice. Preliminary findings of that project are expected to be available in the first quarter of this year.

(Editing by Andrew Torchia)

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