

Lecture Notes on Data Engineering
and Communications Technologies 161



Leonard Barolli *Editor*

Advances in Internet, Data & Web Technologies

The 11th International Conference
on Emerging Internet, Data & Web
Technologies (EIDWT-2023)

 Springer

Lecture Notes on Data Engineering and Communications Technologies

161

Series Editor

Fatos Xhafa, *Technical University of Catalonia, Barcelona, Spain*

The aim of the book series is to present cutting edge engineering approaches to data technologies and communications. It will publish latest advances on the engineering task of building and deploying distributed, scalable and reliable data infrastructures and communication systems.

The series will have a prominent applied focus on data technologies and communications with aim to promote the bridging from fundamental research on data science and networking to data engineering and communications that lead to industry products, business knowledge and standardisation.

Indexed by SCOPUS, INSPEC, EI Compendex.

All books published in the series are submitted for consideration in Web of Science.

Leonard Barolli
Editor

Advances in Internet, Data & Web Technologies

The 11th International Conference on Emerging
Internet, Data & Web Technologies
(EIDWT-2023)

Editor

Leonard Barolli
Department of Information and Communication
Engineering
Fukuoka Institute of Technology
Fukuoka, Japan

ISSN 2367-4512

ISSN 2367-4520 (electronic)

Lecture Notes on Data Engineering and Communications Technologies

ISBN 978-3-031-26280-7

ISBN 978-3-031-26281-4 (eBook)

<https://doi.org/10.1007/978-3-031-26281-4>

© The Editor(s) (if applicable) and The Author(s), under exclusive license
to Springer Nature Switzerland AG 2023

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Welcome Message of EIDWT-2023 International Conference Organizers

Welcome to the 11th International Conference on Emerging Internet, Data and Web Technologies (EIDWT-2023), which will be held from February 23 to February 25, 2023.

The EIDWT is dedicated to the dissemination of original contributions that are related to the theories, practices and concepts of emerging Internet and data technologies yet most importantly of their applicability in business and academia toward a collective intelligence approach.

In EIDWT-2023, topics related to Information Networking, Data Centers, Data Grids, Clouds, Crowds, Mashups, Social Networks, Security Issues and other Web implementations toward a collaborative and collective intelligence approach leading to advancements of virtual organizations and their user communities will be discussed. This is because Web implementations will store and continuously produce a vast amount of data, which if combined and analyzed through a collective intelligence manner will make a difference in the organizational settings and their user communities. Thus, the scope of EIDWT-2023 includes methods and practices which bring various emerging Internet and data technologies together to capture, integrate, analyze, mine, annotate and visualize data in a meaningful and collaborative manner. Finally, EIDWT-2023 aims to provide a forum for original discussion and prompt future directions in the area.

An international conference requires the support and help of many people. A lot of people have helped and worked hard for a successful EIDWT-2023 technical program and conference proceedings. First, we would like to thank all authors for submitting their papers. We are indebted to Program Area Chairs, Program Committee Members and Reviewers who carried out the most difficult work of carefully evaluating the submitted papers. We would like to give our special thanks to Honorary Chair of EIDWT-2023 Prof. Makoto Takizawa, Hosei University, Japan, for his guidance and support. We would like to express our appreciation to our Keynote Speakers for accepting our invitation and delivering very interesting keynotes at the conference.

EIDWT-2023 Organizing Committee

Honorary Chair

Makoto Takizawa

Hosei University, Japan

General Co-chairs

Olivia Fachrunnisa

UNISSULA, Indonesia

Juggapong Natwichai

Chiang Mai University, Thailand

Tomoya Enokido

Rissho University, Japan

Program Co-chairs

Ardian Adhiatma

UNISSULA, Indonesia

Elis Kulla

Fukuoka Institute of Technology, Japan

Admir Barolli

Alexander Moisiu University, Albania

International Advisory Committee

Janusz Kacprzyk

Polish Academy of Sciences, Poland

Arjan Durresi

IUPUI, USA

Wenny Rahayu

La Trobe University, Australia

Fang-Yie Leu

Tunghai University, Taiwan

Yoshihiro Okada

Kyushu University, Japan

Publicity Co-chairs

Naila Najihah

UNISSULA, Indonesia

Farookh Hussain

University of Technology Sydney, Australia

Keita Matsuo

Fukuoka Institute of Technology, Japan

Pruet Boonma

Chiang Mai University, Thailand

Flora Amato

Naples University Federico II, Italy

International Liaison Co-chairs

Muthoharoh	UNISSULA, Indonesia
David Taniar	Monash University, Australia
Tetsuya Oda	Okayama University of Science, Japan
Omar Hussain	University of New South Wales, Australia
Nadeem Javaid	COMSATS University Islamabad, Pakistan

Local Organizing Committee Co-chairs

Agustina Fitrianingrum	UNISSULA, Indonesia
Andi Riansyah	UNISSULA, Indonesia

Web Administrators

Kevin Bylykbashi	Fukuoka Institute of Technology, Japan
Ermioni Qafzezi	Fukuoka Institute of Technology, Japan
Phudit Ampririt	Fukuoka Institute of Technology, Japan

Finance Chair

Makoto Ikeda	Fukuoka Institute of Technology, Japan
--------------	--

Steering Committee Chair

Leonard Barolli	Fukuoka Institute of Technology, Japan
-----------------	--

PC Members

Akimitsu Kanzaki	Shimane University, Japan
Akira Uejima	Okayama University of Science, Japan
Alba Amato	National Research Council (CNR) - Institute for High-Performance Computing and Networking (ICAR), Italy
Alberto Scionti	LINKS, Italy
Antonella Di Stefano	University of Catania, Italy
Arcangelo Castiglione	University of Salerno, Italy

Beniamino Di Martino	University of Campania “Luigi Vanvitelli”, Italy
Bhed Bista	Iwate Prefectural University, Japan
Carmen de Maio	University of Salerno, Italy
Chotipat Pornavalai	King Mongkut’s Institute of Technology Ladkrabang, Thailand
Dana Petcu	West University of Timisoara, Romania
Danda B. Rawat	Howard University, USA
Elis Kulla	Fukuoka Institute of Technology, Japan
Eric Pardede	La Trobe University, Australia
Fabrizio Marozzo	University of Calabria, Italy
Fabrizio Messina	University of Catania, Italy
Farookh Hussain	University of Technology Sydney, Australia
Francesco Orciuoli	University of Salerno, Italy
Francesco Palmieri	University of Salerno, Italy
Gen Kitagata	Tohoku University, Japan
Giovanni Masala	Plymouth University, UK
Giovanni Morana	C3DNA, USA
Giuseppe Caragnano	LINKS, Italy
Giuseppe Fenza	University of Salerno, Italy
Harold Castro	Universidad de Los Andes, Bogotá, Colombia
Hiroaki Yamamoto	Shinshu University, Japan
Hiroshi Shigeno	Keio University, Japan
Isaac Woungang	Toronto Metropolitan University, Canada
Jiahong Wang	Iwate Prefectural University, Japan
Jugappong Natwichai	Chiang Mai University, Thailand
Kazuyoshi Kojima	Saitama University, Japan
Kenzi Watanabe	Hiroshima University, Japan
Kiyoshi Ueda	Nihon University, Japan
Klodiana Goga	LINKS, Italy
Lidia Fotia	Università Mediterranea di Reggio Calabria (DIIES), Italy
Lucian Prodan	Polytechnic University Timisoara, Romania
Makoto Fujimura	Nagasaki University, Japan
Makoto Nakashima	Oita University, Japan
Marcello Trovati	Edge Hill University, UK
Mauro Marcelo Mattos	FURB Universidade Regional de Blumenau, Brazil
Minoru Uehara	Toyo University, Japan
Mirang Park	Kanagawa Institute of Technology, Japan
Naohiro Hayashibara	Kyoto Sangyo University, Japan
Naonobu Okazaki	University of Miyazaki, Japan
Nobukazu Iguchi	Kindai University, Japan

Nobuo Funabiki	Okayama University, Japan
Olivier Terzo	LINKS, Italy
Omar Hussain	UNSW Canberra, Australia
Pruet Boonma	Chiang Mai University, Thailand
Raffaele Pizzolante	University of Salerno, Italy
Sajal Mukhopadhyay	National Institute of Technology, Durgapur, India
Salvatore Ventiqincue	University of Campania Luigi Vanvitelli, Italy
Shigetomo Kimura	University of Tsukuba, Japan
Shinji Sugawara	Chiba Institute of Technology, Japan
Shinji Sakamoto	Kanazawa Institute of Technology, Japan
Sotirios Kontogiannis	University of Ioannina, Greece
Teodor Florin Fortis	West University of Timisoara, Romania
Tomoki Yoshihisa	Osaka University, Japan
Tomoya Enokido	Rissho University, Japan
Tomoya Kawakami	NAIST, Japan
Toshihiro Yamauchi	Okayama University, Japan
Toshiya Takami	Oita University, Japan
Xu An Wang	Engineering University of CAPF, China
Yoshihiro Okada	Kyushu University, Japan
Jindan Zhang	Xianyang Vocational Technical College, China
Luca Davoli	University of Parma, Italy
Ricardo Rodriguez Jorge	Jan Evangelista Purkyně University, Czech Republic
Yusuke Gotoh	Okayama University, Japan

EIDWT-2023 Reviewers

Adhiatma Ardian	Funabiki Nobuo
Amato Flora	Gotoh Yusuke
Amato Alba	Hussain Farookh
Barolli Admir	Hussain Omar
Barolli Leonard	Javaid Nadeem
Bista Bhed	Ifada Luluk
Chellappan Sriram	Iio Jun
Chen Hsing-Chung	Ikeda Makoto
Cui Baojiang	Ishida Tomoyuki
Di Martino Beniamino	Kamada Masaru
Enokido Tomoya	Kato Shigeru
Esposito Antonio	Kayem Anne
Faiz Iqbal Faiz Mohammad	Kikuchi Hiroaki
Fachrunnisa Olivia	Kohana Masaki
Fun Li Kin	Kulla Elis

Leu Fang-Yie
Leung Carson
Matsuo Keita
Ogiela Lidia
Ogiela Marek
Okada Yoshihiro
Pardede Eric
Paruchuri Vamsi Krishna
Rahayu Wenny
Spaho Evjola

Sugawara Shinji
Takizawa Makoto
Taniar David
Uehara Minoru
Yoshihisa Tomoki
Venticinque Salvatore
Wang Xu An
Woungang Isaac
Xhafa Fatos

EIDWT-2023 Keynote Talks

Fueling the Data Engine to Boost the Power of Analytics

Wenny Rahayu

La Trobe University, Melbourne, Australia

Abstract. Data analytics is often considered in isolation. The attractiveness of the problems that need to be solved, the sophistication of the solutions, and the usefulness of the results are certainly the significant strengths of work on data analytics. However, the input data is often too simplistic, or at least the assumption that the data is already readily prepared for data analytics often neglects the fact that preparing such an input data is in many cases, if not all, actually the major work in the data life cycle. The pipeline from the operational databases that keep the transactions and raw data to the input data for data analytics is very long; it often occupies as much as 80% (or sometimes even more) of the entire life cycle. Therefore, we need to put much effort to this preparation and transformation work in order to value the work and the results produced by data analytics algorithms. Having the correct input data for the data analytics algorithms, or in fact for any algorithms and processes, is critical, as the famous quote “garbage in garbage out” had said. Even when the original data is correct, but when it is presented inaccurately to a data analytics algorithm, it may consequently produce incorrect reasoning. This talk will present a systematic approach to build a data engine for effective analytics.

Impact of Uncertainty Analysis and Feature Selection on Data Science

Ricardo Rodriguez Jorge

Jan Evangelista Purkyně University, Ústí nad Labem, Czech Republic

Abstract. Data science applications usually need a previous preprocessing stage for feature extraction and data validation. The data needs to be preprocessed and analyzed to minimize the dataset while preserving variance and patterns in order to find the optimal feature vector configuration. The feature selection algorithm allows finding the feature vector configuration to ensure minimal uncertainty in mapping the corresponding outputs and feature vectors. In data science, feature vector designs can be performed by different techniques and the validation can be performed by uncertainty analysis. These considerations are timely because wearable devices are increasingly being used on a large scale in different scientific fields. This talk will contribute to recommendations for the use of signals and data as a means of informing the impact of different uncertainty analysis and feature selection methods for data science applications. Using this new knowledge together with machine learning, data science applications can be evaluated with more confidence.

Contents

Data Integration in Practice: Academic Finance Analytics Case Study	1
<i>Kittayaporn Chantaranimi, Juggapong Natwichai, Pawat Pajasaranuwat, Anawat Wisetborisut, and Surapong Phosu</i>	
Proposal of an Aquarium Design Support Virtual Reality System	12
<i>Fumitaka Matsubara and Tomoyuki Ishida</i>	
The Source Code Maintenance Time Classifications from Code Smell	22
<i>Patcharaprapa Khamkhiaw, Chartchai Doungsa-ard, and Passakorn Phannachitta</i>	
Evolution Analysis of R&D Jobs Based on Patents' Technology Efficacy Labeling	33
<i>Cui Ruiyi, Deng Na, and Zheng Cheng</i>	
The Models of Improving the Quality of Government Financial Reporting	44
<i>Edy Suprianto, Dedi Rusdi, and Ahmad Salim</i>	
Fuzzy Mean Clustering Analysis Based on Glutamic Acid Fermentation Failure	52
<i>Chunming Zhang</i>	
Mustahik Micro Business Incubation in Poverty Alleviation	64
<i>Zainal Alim Adiwijaya, Edy Suprianto, and Dedi Rusdi</i>	
$T - \psi$ Schemes for a Transient Eddy-Current Problem on an Unbounded Area	76
<i>Yiyue Sun</i>	
Zakat Management Model Based on ICT	85
<i>Bedjo Santoso, Provita Wijayanti, and Fenita Austriani</i>	
Teaching Method of Advanced Mathematics Combining PAD Classroom with ADDIE Model	98
<i>Yanyan Zhao, Qiong Li, Xuhui Fan, Lili Su, Jingtao Li, and Xiaokang Liu</i>	
A Kind of Online Game Addictive Treatment Model About Young Person	108
<i>Xiaokang Liu, Jingtao Li, Yanyan Zhao, Yiyue Sun, and Haibo Zhang</i>	

Research on E-commerce Customer Value Segmentation Model Based on Network Behavior 118
Jing Zhang and Juan Li

Blockchain Applications for Mobility-as-a-Service Ecosystem: A Survey 129
Elis Kulla, Leonard Barolli, Keita Matsuo, and Makoto Ikeda

Construction of a Fully Homomorphic Encryption Scheme with Shorter Ciphertext and Its Implementation on the CUDA Platform 141
Dong Chen, Tanping Zhou, Wenchao Liu, Zichen Zhou, Yujie Ding, and Xiaoyuan Yang

Traffic-Oriented Shellcode Detection Based on VSM 152
Pengju Liu, Baojiang Cui, and Can Cui

Supply Chain Finance Mediates the Effect of Trust and Commitment on Supply Chain Effectiveness 163
Lisa Kartikasari and Muhammad Ali Ridho

Blockchain Technology and Financing Risk in Profit Loss Sharing Financing of Indonesian Islamic Bank 171
Mutamimah Mutamimah and Indri Kartika

Privacy-Preserving Scheme for Nearest Life Services Search Based on Dummy Locations and Homomorphic Encryption Algorithm 180
TieSen Zhao and LiPing Shi

Terminology Extraction of New Energy Vehicle Patent Texts Based on BERT-BILSTM-CRF 190
Cheng Zheng, Na Deng, Ruiyi Cui, and Hanhui Lin

Conceptual Paper of Environmental Disclosure and Financial Performance: The Role of Environmental Performance 203
Luluk Muhiatul Ifada, Naila Najihah, Farikha Amilahaq, and Azizah Azmi Khatamy

Applying BERT on the Classification of Chinese Legal Documents 215
Qiong Zhang and Xu Chen

Technology and Efficacy Extraction of Mechanical Patents Based on BiLSTM-CRF 223
Ruiyi Cui, Na Deng, and Cheng Zheng

Talent Incubator System: A Conceptual Framework of Employee Recruitment Strategy in Digital Era 235
Olivia Fachrunnisa, Nurhidayati, and Ardian Adhiatma

Thai Word Disambiguation: An Experiment on Thai Language Dataset with Various Deep Learning Models 243
Nontakan Nuntachit, Karn Patanukhom, and Prompong Sugunnasil

Energy-Efficient Locking Protocol in Virtual Machine Environments 248
Tomoya Enokido, Dilawaer Duolikun, and Makoto Takizawa

A Flexible Fog Computing (FTBFC) Model to Reduce Energy Consumption of the IoT 256
Dilawaer Duolikun, Tomoya Enokido, and Makoto Takizawa

Research on Federated Learning for Tactical Edge Intelligence 268
Rongrong Zhang, Zhiqiang Gao, and Di Zhou

Load Balancing Algorithm for Information Flow Control in Fog Computing Model 275
Shigenari Nakamura, Tomoya Enokido, and Makoto Takizawa

Federated Reinforcement Learning Technology and Application in Edge Intelligence Scene 284
Xuanzhu Sheng, Zhiqiang Gao, Xiaolong Cui, and Chao Yu

Cryptanalysis of a Public Cloud Auditing Scheme 292
Xu An Wang, Mingyu Zhou, and Wenyong Yuan

A Fuzzy-Based Approach for Selection of Radio Access Technologies in 5G Wireless Networks 297
Phudit Ampririt, Makoto Ikeda, Keita Matsuo, and Leonard Barolli

A Comparison Study of FC-RDVM and LDVM Router Placement Methods for WMNs Considering Uniform Distribution of Mesh Clients and Different Instances 308
Shinji Sakamoto, Admir Barolli, Yi Liu, Elis Kulla, Leonard Barolli, and Makoto Takizawa

Performance Evaluation of FBRD Protocol Considering Transporter Autonomous Underwater Vehicles for Underwater Optical Wireless Communication in Delay Tolerant Networking 317
Keita Matsuo, Elis Kulla, and Leonard Barolli

A Road State Decision Method Based on Roughness by Crowd Sensing Technology	324
<i>Yoshitaka Shibata and Yasushi Bansho</i>	
Experimental Results of a Wireless Sensor Network Testbed for Monitoring a Water Reservoir Tank Considering Multi-flows	331
<i>Yuki Nagai, Aoto Hirata, Chihiro Yukawa, Kyohei Toyoshima, Tetsuya Oda, and Leonard Barolli</i>	
A Depth Camera Based Soldering Motion Analysis System for Attention Posture Detection Considering Body Orientation	341
<i>Kyohei Toyoshima, Chihiro Yukawa, Yuki Nagai, Nobuki Saito, Tetsuya Oda, and Leonard Barolli</i>	
Effect of Lighting of Metal Surface by Different Colors for an Intelligent Robotic Vision System	350
<i>Chihiro Yukawa, Nobuki Saito, Aoto Hirata, Kyohei Toyoshima, Yuki Nagai, Tetsuya Oda, and Leonard Barolli</i>	
A Design and Implementation of Dynamic Display Boards in a Virtual Pavilion Based on Unity3D	357
<i>Zimin Li and Feng Pan</i>	
A Comparative Study of Several Spatial Domain Image Denoising Algorithm	365
<i>Rui Deng, Yanli Fu, and Shuyao Li</i>	
A Pedestrian Avoidance System for Visual Impaired People Based on Object Tracking Algorithm	375
<i>Rui Shan, Wei Shi, Zhu Teng, and Yoshihiro Okada</i>	
Web-Based Collaborative VR System Supporting VR Goggles for Radiation Therapy Setup Training	386
<i>Yuta Miyahara, Kosuke Kaneko, Toshioh Fujibuchi, and Yoshihiro Okada</i>	
Development Framework Using 360VR Cameras and Lidar Scanners for Web-Based XR Educational Materials Supporting VR Goggles	401
<i>Yoshihiro Okada, Kosuke Kaneko, and Wei Shi</i>	
A Comparison Study of LDVM and RDVM Router Replacement Methods by WMN-PSODGA Hybrid Simulation System Considering Two Islands Distribution of Mesh Clients	413
<i>Admir Barolli, Kevin Bylykbashi, Leonard Barolli, Ermioni Qafzezi, Shinji Sakamoto, and Makoto Takizawa</i>	

FBCF: A Fuzzy-Based Brake-Assisting Control Function for Rail Vehicles Using Type-1 and Type-2 Fuzzy Inference Models 423
Mitsuki Tsuneyoshi, Makoto Ikeda, and Leonard Barolli

A Memetic Approach for Classic Minimum Dominating Set Problem 432
Peng Rui, Wu Xinyun, and Xiong Caiquan

Exploration of Neural Network Imputation Methods for Medical Datasets 441
Vivatchai Kaveeta, Prompong Sugunnasil, and Juggapong Natwichai

Applying BBLT Incorporating Specific Domain Topic Summary Generation Algorithm to the Classification of Chinese Legal Cases 451
Qiong Zhang and Xu Chen

Implementation of a Fuzzy-Based Testbed for Coordination and Management of Cloud-Fog-Edge Resources in SDN-VANETs 460
Ermioni Qafzezi, Kevin Bylykbashi, Elis Kulla, Makoto Ikeda, Keita Matsuo, and Leonard Barolli

A Consistency Maintenance Method Integrating OT and CRDT in Collaborative Graphic Editing 471
Chen Weijie, Xiong Caiquan, and Wu Xinyun

Data Pipeline of Efficient Stream Data Ingestion for Game Analytics 483
Noppon wongta and Juggapong Natwichai

IPT-CFI: Control Flow Integrity Vulnerability Detection Based on Intel Processor Trace 491
Zhuorao Yang, Baojiang Cui, and Can Cui

Business Intelligence: Alternative Decision-Making Solutions on SMEs in Indonesia 500
Agustina Fitrianingrum, Maya Indriastuti, Andi Riansyah, Abdul Basir, and Dedi Rusdi

Author Index 509



Blockchain Technology and Financing Risk in Profit Loss Sharing Financing of Indonesian Islamic Bank

Mutamimah Mutamimah¹ (✉) and Indri Kartika²

¹ Department of Management, Faculty of Economics, Universitas Islam Sultan Agung,
Semarang, Indonesia

mutamimah@unissula.ac.id

² Department of Accounting, Faculty of Economics, Universitas Islam Sultan Agung,
Semarang, Indonesia

indri@unissula.ac.id

Abstract. Profit loss-sharing contracts (*mudharabah* and *musyarakah*) have higher financing risk than debt financing contract (*murabahah*). The purpose of this study is to develop a blockchain technology model as a mechanism to reduce financing risk in profit loss-sharing contracts in Indonesian Islamic banks. This is a conceptual paper with an integrative literature review related to the financing feasibility evaluation mechanism, financing risks, smart contracts, and blockchain technology. The results show that blockchain technology can reduce asymmetric information and financing risk in Islamic bank profit loss-sharing contracts because, in blockchain technology, there are smart contracts that can omit asymmetric information, and all stakeholders involved in the blockchain can access and monitor data and none of them can change the data.

Keywords: Profit loss sharing contract · Financing risk · Smart contract · Blockchain technology

1 Introduction

Islamic banks in Indonesia are experiencing good development. This is shown by Islamic banking data in 2021 that the market share is 6.52%; asset value of 646.2 trillion; total financing 413.3 trillion and third party funds 503.8 trillion [1]. Islamic banks as intermediary institutions that carry out fundraising and financing, where in financing there are *murabahah* contracts, *mudharabah* contracts, and *musyarakah* contracts. Based on data from [2], it shows that the amount of *murabahah* financing is 46.22%, *musyarakah* is 45.69%, and *mudharabah* is 2.65%. This means that *murabahah* financing dominates both *musyarakah* financing and *mudharabah* financing. The reason is that *musyarakah* and *mudharabah* financing has a higher risk than *murabahah* financing [3, 4]. In fact, the two financing contracts are actually in accordance with the essential objectives of Islamic banks, namely empowering the real sector and improving the economic welfare of community. In addition, based on the results of research [5] found that there are 4

obstacles in the financing of Profit Loss Sharing, namely: risk, difficulty in choosing the right partner; requests come from customers with low creditworthiness; and lack of capital security. Thus, it is necessary to manage the risk of Islamic bank financing, especially for profit loss sharing contracts, namely: *musyarakah* and *mudharabah* so that risk can be reduced. The low risk indicates that Islamic bank managers are able to manage risk professionally so as to improve the reputation and sustainability of Islamic banking. Moreover, the sources of Islamic banking fund collection in Indonesia are dominated by Third Party Funds which must be managed professionally [1]. If Islamic bank managers are able to manage risk well, they will be able to improve financial performance [6].

Financing risk is the risk that occurs if the debtor does not return the loan according to the initial agreement [7, 8]. One of the causes of financing risk in Islamic banks is due to the asymmetric information between Islamic banks as principals and customers as agents. One of the mechanisms to reduce financing risk is the implementation of corporate governance. Corporate governance is a mechanism, system and structure to monitor and control the behavior of managers so that they carry out business activities in accordance with the objectives of stakeholders [9]. One form of corporate governance implementation is the application of an assessment and evaluation mechanism for prospective debtors by Islamic banks as a basis for determining the feasibility of obtaining financing, with the aim that risk can be reduced. However, the implementation of corporate governance is not effective in reducing financing risk in *musyarakah* financing [6].

Therefore, the existence of these problems encourages researchers to use blockchain technology in the profit loss sharing (*mudharabah* and *musyarakah*) financing mechanism, so that the financing risk can be reduced. The use of blockchain technology in Islamic banks in Indonesia is still very limited. In fact, in the current technological era, banks are already using digital in their transactions where based on data from the [1] shows the value of digital transactions at Islamic banks in Indonesia reaches Rp 39,841 trillion. Blockchain technology can reduce asymmetric information because blockchain technology is a form of ecosystem and smart contract that connects stakeholders through blocks [10, 11]. Blockchain can facilitate recording, financial reporting, and storage of business transactions by all stakeholders on a digital block network that encourages stakeholder behavior to always be honest, transparent, resilient and trusting between stakeholders, all stakeholders can monitor all business processes properly, thereby reducing credit risk [12]. Therefore, the purpose of this study is to develop a conceptual blockchain technology model to reduce the risk of profit loss sharing financing at Indonesia Islamic banks.

This paper is divided into five parts: (1) introduction, (2) literature review, (3) research methods, (4) finding and discussion, and (5) conclusion, limitations, and future research.

2 Literature Review

2.1 Financing Based Profit Loss Sharing in Islamic Bank

Islamic banking has 2 types of contracts, namely debt financing and Profit Loss Sharing (PLS) financing. Debt financing consist of *murabahah* financing which means a sales and purchase contract wherein the Islamic bank as seller buys goods and then sells to the

customer with payment is made based on agree two party, Islamic bank and customer [6]. Financing based on PLS is divided into 2, namely: *mudharabah* and *musyarakah* contracts [5]. *Mudharabah* financing means where the bank and the customer agree to work together on a business project and where the bank acts as a provider of capital and the customer provides the knowledge and skills to run the project [13]. *Mudharabah* financing has potential risks, because the profits obtained by the *mudharib* are uncertain, and if a loss occurs, the bank must be prepared to bear all the losses of the project. *Musyarakah* financing is profit-sharing financing, where Islamic banks and customers both collect funds and work together to fund projects, and the results are shared by both parties according to the agreement [13].

2.2 Risk Management in Islamic Banking

Potential risk always occurs in all Islamic bank activities. Islamic banks as intermediary institutions that collect funds and channel funds to customers and carry out social functions, must be able to manage risk professionally. Risk mitigation is a part of risk management [14]. The whole series of activities are integrated each other as an ecosystem that must be managed professionally. Islamic banks as intermediary institutions are required to implement risk management, because one indicator of the performance and reputation of Islamic banks is the ability of managers to manage risk. According to Bank Indonesia Regulation Number 13/23/PBI/2011, Islamic banking risk is divided into 10 risks, namely: Credit Risk, Market Risk, Liquidity Risk, Operational Risk, Legal Risk, Reputational Risk, Strategic Risk, Compliance Risk, Return Risk, and Investment Risk. Risks are interrelated each other. For example, if an Islamic bank is not able to manage financing risk, it will have an impact on liquidity risk and reputation risk. One of the reasons for the high risk of financing is the asymmetric information between Islamic banking as creditors and MSMEs as debtors, thus encouraging high deviations in the use of loan capital, which in turn MSMEs cannot repay loans on time, which is called bad credit. Various efforts have been made so that asymmetric information can be reduced, one of which is the implementation of corporate governance so that there are no irregularities in the use of loan capital, and the risk of financing decreases. However, the implementation of corporate governance is only effective on *Mudharabah* financing, but is not effective when applied to *Murabahah* and *Musyarakah* financing schemes [6].

2.3 Blockchain Technology and Islamic Banking Profit Loss Sharing Contract

Blockchain technology is a technological innovation that is currently developing. According to [15], blockchain is a new, decentralized technology with a ledger system, capable of storing information, and recording all transactions made by stakeholders without third parties. All information from stakeholders that is stored on a computer, can be monitored by all parties in real time and no one party can change the data so that the validity of the data is well maintained. Blockchain can facilitate the recording, financial reporting, and storage of business transactions by all stakeholders on the digital block network so that they are valid, transparent, and robust so that all stakeholders in this block can monitor all business processes properly, so as to reduce credit risk [12]. Blockchain technology can make it easier to connect between stakeholders with smart contracts,

so that all stakeholders involved in financing profit loss sharing can enter data, monitor and access digitally recorded data and those owned by other stakeholders in a fast and cost-efficient manner. This means that the existence of blockchain makes it easier to make profit loss sharing financing decisions so that financing risk can be reduced.

3 Research Method

This study aims to develop a blockchain technology model in reducing the risk of financing in profit loss sharing contracts for Islamic banks in Indonesia. These contracts consist of two parties (Islamic Bank and Debtor) in cooperation in capital and skill. Furthermore, the costs of searching, screening, and contracting will increase [22]. This model does not only apply in Indonesia but applies to all Islamic banks around the world, because all Islamic banks have profit loss sharing contracts (*mudharabah* and *musyarakah*).

This is a conceptual paper that uses an integrative literature review approach [16] through reviewing and critiquing previous literature related to Islamic bank financing risks, corporate governance, financing worthiness and profit loss sharing contracts and the adoption of blockchain technology as the basis for developing a conceptual model of blockchain technology in reducing financing risk in profit-loss sharing contracts for Indonesia Islamic bank. This blockchain technology model has a smart contract, all stakeholders involved in the block, namely Islamic banks, customers/investors, governments, and debtors can find out, analyze, and evaluate all data and documents of other stakeholders through the block network (see Fig. 2).

4 Finding and Discussion

Finding and discussion explain subchapters as follows: corporate governance, financing worthiness and Profit Loss Sharing (PLS) contract, smart contract and blockchain technology in decreasing financing risk at profit loss sharing in Islamic bank, and implementation of blockchain technology in financing Profit Loss Sharing (PLS).

4.1 Corporate Governance, Financing Worthiness and Profit Loss Sharing Contract

In carrying out the financing function, there are 2 contracts, namely: debt financing contract and Profit Loss Sharing (PLS) contract. To reduce the risk of financing, Islamic banking implements a mechanism to evaluate the feasibility of obtaining financing as a form of corporate governance. Based on the results of research by [17], it shows that the distribution of Islamic bank funds is predominantly to MSMEs with greater risk than non-MSME financing. The Islamic banking party evaluates the feasibility of customers to obtain financing using a 5C analysis consisting of: Character, Capacity, Capital, Collateral, and Condition [18]. In addition, Islamic banking also analyzes the clarity of the debtor's business that meets sharia principles and DIS (Debtor Information System). However, based on this mechanism, it turns out that there are still unresolved financing risks until today.

Figure 1 shows several weaknesses of the mechanism for analyzing the feasibility of financing as a form of corporate governance, including: a). In submitting financing requirements to Islamic banks, prospective debtors still use proof of identity that must be photocopied as well as administrative documents in the form of papers that are easy to forge and change the data, so that it has the potential for financing risks to arise. b). In this mechanism, there is still a third party; namely Islamic banking, where when the prospective debtor does not have financial data and does not have the necessary documents, the feasibility of getting financing is only based on the perception of the bank manager [19]. This is certainly a potential risk of financing. c). The process of assessing the feasibility of obtaining financing approval takes a very long time, with a gradual and inefficient process. d). The implementation of corporate governance is only between Islamic banking as principal and debtor as agent, without involving other stakeholders in monitoring business transactions and other activities carried out by debtors. With this mechanism, of course there is still risk of Islamic bank financing.

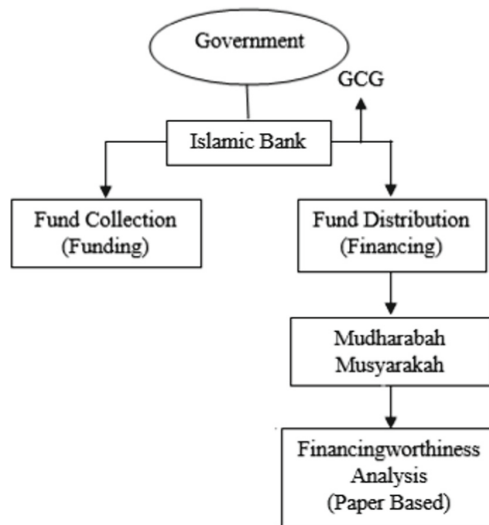


Fig. 1. Corporate governance, financing worthiness and profit loss sharing contract (existing model)

Figure 1 explains the function of an Islamic bank as an intermediary institution that collects funds from customers/investors, then these funds are channeled to debtors under *murabahah*, *mudharabah* and *musyarakah* contracts. The government acts as a regulator and monitors the operations of Islamic banks. In this Fig. 1, the stakeholders are not connected in blocks, so there is still asymmetric information between the Islamic bank and the debtor, where the information held by the debtor is more than the information held by the Islamic bank. This encourages the emergence of moral hazard and irregularities in the use of funds by debtors so that financing risk increases.

While Fig. 2 explains that all stakeholders, namely: Islamic banks, consumers/investors, government, debtors are connected in blocks. Through this block, all

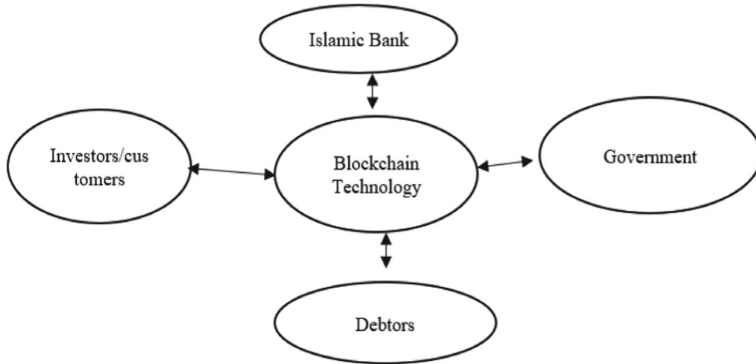


Fig. 2. Blockchain technology and profit loss sharing financing (new model)

stakeholder data and information can be accessed and monitored by all stakeholders and no third party, in fact, no party can change data or documents except with the approval of all parties in the block. Besides, Fig. 2 also explains that in the financing mechanism with profit-loss sharing contracts, namely *mudharabah* and *musyarakah* contracts, Islamic banks can use smart contracts so that Islamic banks can know, analyze, evaluate the feasibility of obtaining financing based on debtor data that is connected in the block. All business transactions, financial conditions and debtor prospects are known by all stakeholders involved in the block. Thus, there is no hidden debtor data or documents and no asymmetric information, so that financing risk can be reduced.

4.2 Smart Contract and Blockchain Technology in Decreasing Financing Risk Profit Loss Sharing in Islamic Bank

Islamic banks carry out the financing function with 2 contracts, namely: debt financing and Profit Loss Sharing (PLS). Figure 2 shows the existence of blockchain technology in profit loss sharing, where in blockchain technology there are 5 stakeholders involved, namely: investors/ customers, Islamic banks, government, Sharia Supervisory Board, and Debtors. All stakeholders involved in blockchain using smart contracts can monitor, and evaluate the data of other stakeholders, there is no third party and no party can change the data unless there is a mutual consensus. Asymmetric information can be eliminated, because all stakeholders involved in the block can provide information, monitor, track information quickly as a basis for decision making. The existence of blockchain technology will be able to avoid wrong perceptions in making creditworthiness decisions that are only based on perceptions, especially for MSMEs as debtors who do not have data and documents systematically. Thus, blockchain technology can increase transparency and transactions according to sharia, there is no asymmetric information, and the risk of financing can be reduced. This is reinforced by [20], that smart contracts in accordance with the Qur'an Surah al-Baqarah 282–283 emphasize the need to record agreements with full accuracy, fairness and accountability.

Blockchain technology can provide benefits through smart contracts which are part of the transactions that are used and executed on the blockchain system. Asymmetric

information as the cause of financing risk can be eliminated by the presence of smart contracts [11]. Thus, it is very appropriate if blockchain Technology is used to deal with asymmetric information problems, so that it can reduce financing risk. Smart contracts in Islamic banks are different from traditional contracts because they are in the form of actual code on a computer, while traditional contracts are in written form and in a language that is easily understood by the contracting party [20]. But in blockchain, computer code, counterparts can rely on consistent execution (automated trust) between the stakeholders involved. The code cannot be changed without the coordination of all parties involved. [21] states that *mudharabah* can be developed with smart contracts. If a smart contract is implemented, it will be efficient, secure, and transparent. [20] states that through blockchain technology, all information and transactions are recorded systematically through a cryptographic process in a public database that allows all stakeholders in this public network to participate and contribute in validating all information and no one party can change or even delete it. Data. Thus, the existence of data is very helpful for stakeholders in every decision making. Through this smart contract, it will be easier to track transactions quickly and validly. The absence of a third party will actually speed up the process of evaluating the feasibility of financing at Islamic banks and save the cost of applying for financing [20]. The existence of blockchain technology will be able to avoid wrong perceptions in making creditworthiness decisions that are only based on perceptions, especially for MSMEs as debtors who do not have data and documents systematically.

4.3 Implementation of Blockchain Technology in Financing Profit Loss Sharing

Implementation of blockchain technology in Islamic banking is not easy, and there are several challenges, including: a). The quality of human resources for all stakeholders must be improved, especially information technology. b). There must be adequate infrastructure to implement blockchain technology. c). In Islamic banking there are sharia principles that must be obeyed. Thus, a strategy is needed so that sharia principles can be encoded computationally. d). There are no regulations and policies for implementing blockchain technology in Islamic banking involving all stakeholders, and there is no fatwa from the MUI (Indonesian Ulema Council) related to blockchain technology [20].

5 Conclusion, Limitations, and Future Research

Islamic banks carry out the financing function with 2 contracts, namely: debt financing contracts and Profit Loss Sharing (PLS) contracts. However, the issue of financing risk has not been resolved until now. Profit Loss Sharing (PLS) financing is higher risk than debt financing. One of the efforts to reduce the risk of Profit Loss Sharing (PLS) financing is by implementing corporate governance. However, this mechanism is not effective in reducing the financing risk of Islamic bank. Therefore, blockchain technology is needed as a mechanism to reduce financing risk on profit loss sharing in Indonesian Islamic banks. With smart contracts on blockchain technology, asymmetric information can be eliminated, because all stakeholders are connected to blocks that can convey information, monitor and evaluate other stakeholder data as a basis for decision making. Even the

blockchain technology has a ledger record that contains all transactions that can be monitored by all parties according to the agreement in the smart contract, so that the risk of financing can be lowered. This article only analyzes risk financing on profit loss sharing financing at Islamic banks, which can still be developed for other contracts, for example in Islamic insurance, Islamic Micro Finance. In addition, this article is in the form of a conceptual model, so it still needs to be tested empirically in the future, especially for Islamic banks in evaluating and making decisions on the feasibility to get financing, so that financing risk can be reduced.

References

1. Financial Services Authority, "Islamic banking snapshot september (2021). www.ojk.go.id
2. Financial Services Authority, Islamic banking snapshot february 2022. (2022) www.ojk.go.id
3. Yaya, R., Saud, I.M., Hassan, M.K., Rashid, M.: Governance of profit and loss sharing financing in achieving socio-economic justice. *J. Islam. Account. Bus. Res.* **12**(6), 814–830 (2021). <https://doi.org/10.1108/JIABR-11-2017-0161>
4. Ishak, M.S.I., Rahman, M.H.: Equity-based Islamic crowdfunding in Malaysia: a potential application for mudharabah. *Qual. Res. Financ. Mark.* **13**(2), 183–198 (2021). <https://doi.org/10.1108/QRFM-03-2020-0024>
5. Abdul-rahman, A., Nor, S.M.: Challenges of profit-and-loss sharing financing in Malaysian islamic banking. *Geogr. Malays. J. Soc. Sp.* **12**(2), 39–46 (2017)
6. Mutamimah, M., Saputri, P.L.: Corporate governance and financing risk in Islamic banks in Indonesia. *J. Islam. Account. Bus. Res.* (2022). <https://doi.org/10.1108/JIABR-09-2021-0268>
7. Haryono, Y., Ariffin, N.M., Hamat, M.: Factors affecting credit risk in Indonesian islamic banks. *J. Islam. Financ.* **5**(1), 12–25 (2016). <https://doi.org/10.12816/0027649>
8. Mustafa, O.A.O.: Why do islamic banks concentrating finance in murabaha mode? performance and risk analysis (Sudan: 1997–2018). *Int. Bus. Res.* **13**(7), 208 (2020). <https://doi.org/10.5539/ibr.v13n7p208>
9. Mutamimah, M., Tholib, M., Robiyanto, R.: Corporate governance, credit risk, and financial literacy for small medium enterprise in Indonesia. *Bus. Theory Pract.* **22**(2), 406–413 (2021). <https://doi.org/10.3846/btp.2021.13063>
10. Schinckus, C.: The good, the bad and the ugly: an overview of the sustainability of blockchain technology. *Energy Res. Soc. Sci.* **69**, 101614 (2020). <https://doi.org/10.1016/j.erss.2020.101614>
11. Lacasse, R., Lambert, B., Khan, N.: Islamic banking - towards a blockchain monitoring process. In: Conference: 5th International Conference on Entrepreneurial Finabce, CIFEMA 2017, *Journal of Business and Economics*, vol. 6, pp. 33–46 (2017)
12. Osmani, M., El-Haddadeh, R., Hindi, N., Janssen, M., Weerakkody, V.: Blockchain for next generation services in banking and finance: cost, benefit, risk and opportunity analysis. *J. Enterp. Inf. Manag.* **34**(3), 884–899 (2021). <https://doi.org/10.1108/JEIM-02-2020-0044>
13. Warninda, T.D., Ekaputra, I.A., Rokhim, R.: Do mudarabah and musyarakah financing impact islamic bank credit risk differently?. *Res. Int. Bus. Financ.* **49**, 166–175 (2019). <https://doi.org/10.1016/j.ribaf.2019.03.002>
14. Mutamimah, M., Zaenudin, Z., Cokrohadisumarto, W.B.M.: Risk management practices of Islamic microfinance institutions to improve their financial performance and sustainability: a study on Baitut Tamwil Muhammadiyah, Indonesia. *Qual. Res. Financ. Mark.* (2022). <https://doi.org/10.1108/QRFM-06-2021-0099>

15. Singh, H., Jain, G., Munjal, A., Rakesh, S.: Blockchain technology in corporate governance: disrupting chain reaction or not? *Corp. Gov.* **20**(1), 67–86 (2020). <https://doi.org/10.1108/CG-07-2018-0261>
16. Snyder, H.: Literature review as a research methodology: an overview and guidelines. *J. Bus. Res.* **104**, 333–339 (2019). <https://doi.org/10.1016/j.jbusres.2019.07.039>
17. Mutamimah, H.: Islamic financial inclusion: supply side approach. In: 5th ASEAN International University Conference on Islamic Finance (5th AICIF), pp. 1–9 (2017)
18. Wasiuzzaman, S., Nurdin, N., Abdullah, A.H., Vinayan, G.: Creditworthiness and access to finance: a study of SMEs in the Malaysian manufacturing industry. *Manag. Res. Rev.* **43**(3), 293–310 (2020). <https://doi.org/10.1108/MRR-05-2019-0221>
19. Karlan, D., Bryan, G., Jakiela, P., Keniston, D.: Direct and indirect impacts of credit for SMEs, Res. Note, no. 670, (2015). http://pedl.cepr.org/sites/default/files/ResearchNote_670_KarlanBryanJakielaKeniston.pdf
20. Chong, F.H.L.: Enhancing trust through digital islamic finance and blockchain technology. *Qual. Res. Financ. Mark.* **13**(3), 328–341 (2021). <https://doi.org/10.1108/QRFM-05-2020-0076>
21. Rejeb, D.: Smart contract’s contributions to mudaraba. *Tazkia Islam. Financ. Bus. Rev.* **15**(1), 1–18 (2021). <https://doi.org/10.30993/tifbr.v15i1.236>
22. Badaj, F., Radi, B.: Empirical investigation of SMEs’ perceptions towards PLS financing in Morocco. *Int. J. Islamic Middle East. Financ. Manag.* (2017). <https://doi.org/10.1108/IMEFM-05-2017-0133>