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Complex, Intelligent, and Software Intensive Systems

Proceedings of the 13th International
Conference on Complex, Intelligent,
and Software Intensive Systems
(CISIS-2019)

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Editors

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 Springer

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Welcome Message of CISIS-2019

International Conference Organizers

Welcome to the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019), which will be held from July 3 to July 5, 2019, at University of Technology Sydney (UTS), Sydney, Australia in conjunction with the 13th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS-2019).

The aim of the conference is to deliver a platform of scientific interaction between the three interwoven challenging areas of research and development of future ICT-enabled applications: software intensive systems, complex systems, and intelligent Systems.

Software intensive systems are systems, which heavily interact with other systems, sensors, actuators, devices, other software systems, and users. More and more domains are involved with software intensive systems, e.g., automotive, telecommunication systems, embedded systems in general, industrial automation systems, and business applications. Moreover, the outcome of Web services delivers a new platform for enabling software intensive systems. The conference is thus focused on tools, practically relevant and theoretical foundations for engineering software intensive systems.

Complex systems research is focused on the overall understanding of systems rather than its components. Complex systems are very much characterized by the changing environments in which they act by their multiple internal and external interactions. They evolve and adapt through internal and external dynamic interactions.

The development of intelligent systems and agents which is each time more characterized by the use of ontologies and their logical foundations build a fruitful impulse for both software intensive systems and complex systems. Recent researches in the field of intelligent systems, robotics, neuroscience, artificial intelligence, and cognitive sciences are very important factor for the future development and innovation of software intensive and complex systems.

CISIS-2019 is aiming at delivering a forum for in-depth scientific discussions among the three communities. The papers included in the proceedings cover all aspects of theory, design, and application of complex systems, intelligent systems,

and software intensive systems. The conference received 166 papers and accepted 45 papers (about 27% acceptance rate), which were selected after a careful review process.

We are very proud and honored to have two distinguished keynote talks by Prof. Wanlei Zhou, University of Technology Sydney, Australia, and Dr. Nadeem Javaid, COMSATS University Islamabad, Pakistan, who will present their recent work and will give new insights and ideas to the conference participants.

The organization of an international conference requires the support and help of many people. A lot of people have helped and worked hard to produce a successful CISIS-2019 technical program and conference proceedings. First, we would like to thank all the authors for submitting their papers, the Program Committee Members, and the reviewers who carried out the most difficult work by carefully evaluating the submitted papers. We are grateful to Honorary Co-Chairs Prof. Makoto Takizawa, Hosei University, Japan, and Prof. Jie Lu, University of Technology Sydney, Australia, for their guidance and advice.

This year in conjunction with CISIS-2019 we have seven international workshops that complemented CISIS-2019 program with contributions for specific topics. We would like to thank the Workshops Co-Chairs and all Workshops Organizers for organizing these workshops.

Finally, we would like to thank Web Administrator Co-Chairs and Local Arrangement Co-Chairs for their excellent and timely work.

We hope you will enjoy the conference and have a great time in Sydney, Australia.

Leonard Barolli
Farookh Khadeer Hussain
CISIS-2019 General Co-Chairs

Omar Hussain
Hiroaki Nishino
Kin Fun Li
CISIS-2019 Program Committee Co-chairs

Welcome Message from CISIS-2019 Workshops Co-chairs

Welcome to the Workshops of the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019), which will be held from July 3 to July 5, 2019, at University of Technology Sydney, Sydney, Australia.

We are pleased that for this edition of CISIS International Conference we have seven international workshops. Some of these workshops are in 9th, 10th, 11th, 12th, and 13th editions. The objective was to complement as much as possible the main theme of CISIS-2019 with specific topics of different workshops in order to cover topics from the three challenging areas of ICT-enabled applications: software intensive systems, complex systems, and intelligent systems.

The list of workshops is as follows:

1. The 13th International Workshop on Engineering Complex Distributed Systems (ECDS-2019)
2. The 12th International Workshop on Intelligent Informatics and Natural Inspired Computing (IINIC-2019)
3. The 10th International Workshop on Frontiers in Complex, Intelligent and Software Intensive Systems (FCISIS-2019)
4. The 10th International Workshop on Virtual Environment and Network-Oriented Applications (VENOA-2019)
5. The 9th Semantic Web/Cloud Information and Services Discovery and Management (SWISM-2019)
6. The 6th International Workshop on Hybrid/Cloud Computing Infrastructure for E-Science Application (HCCIEA-2019)
7. The 1st International Workshop on Knowledge Creation and Innovation in Digital World (IKIDW-2019)

These workshops bring to the researchers conducting research in specific themes the opportunity to learn from this rich multidisciplinary experience. The Workshop Co-Chairs would like to thank CISIS-2019 International Conference Organizers for their help and support. We are grateful to the Workshops Organizers for their great

efforts and hard work in proposing the workshops, selecting the papers, the interesting programs, and the arrangements of the workshops during the conference days. We are grateful to Web Administrator Co-Chairs for their excellent work and support.

We hope you enjoy the workshops program and proceedings.

Mohammad Alshehri

Tomoya Enokido

Beniamino Di Martino

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Welcome Message from ECDS-2019 International Workshop Co-chairs

It is our great pleasure to welcome you to the 13th International Workshop on Engineering Complex Distributed Systems (ECDS-2019), which will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

In the past, this field included technology concerns related to middleware solutions, dealing with the heterogeneity of the miscellaneous hardware and software environments and computing infrastructure. These technologies have been used to address the integration of existing legacy applications and improve the interoperability between applications across enterprises. The advances in wireless communication and pervasive computing extend this traditional wired area of distributed systems and make the new advanced application possible. The complexity of today's applications requires additional approaches to be able to realize an enterprise application time- and cost-saving. This includes the ability to model business processes, business policies, and event-oriented aspects of large systems and express these models through design solutions to address the complexity of enterprise applications and ease software design efforts. In addition, the engineering of complex distributed systems also requires a good understanding of the problem areas of concern for information systems and business administration, such as process management, supply chain management, security issues, and electronic business. These topics need to be addressed in order to deal with the complexity of today's increasingly dynamic, mobile, cross-organizational, and cross-jurisdictional systems.

In this workshop, various aspects of the design and implementation of distributed systems will be discussed. The scope of the presented papers ranges from engineering approaches and techniques to applications.

This workshop would not have been possible without the help of many people. First of all, we would like to thank all the authors for submitting their papers to our workshop. We also like to thank the Program Committee Chair, Program

Committee Members, and additional reviewers, who carefully evaluated the submitted papers.

We hope that you find the ECDS-2019 program inspiring and that the workshop provides you with the opportunity to interact, share ideas with, and learn from other distributed systems researchers from around the world. We also encourage you to continue to participate in future ECDS workshops, to increase its visibility, and to interest others in contributing to this growing community.

Leonard Barolli
Makoto Takizawa
ECDS-2019 Workshop Co-chairs

ECDS-2019 Organizing Committee

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Message from IINIC-2019 International Workshop Organizers

Advanced information processing technologies have the potential to significantly accelerate research in different fields. In particular, techniques from artificial intelligence, machine learning, and data mining can assist researchers in the discovery of new knowledge for next-generation applications. This workshop aims to attract state-of-the-art solutions and novel attempts in this direction.

The 12th International Workshop on Intelligent Informatics and Natural Inspired Computing (IINIC-2019) will provide a platform for researchers to meet and exchange their thoughts. IINIC-2019 will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

Many people contributed to the success of IINIC-2019. We wish to thank the Program Committee Members for their great effort. We also would like to express our gratitude to the main organizers of CISIS-2019 for their excellent work in organizing the conference. Last but not least, we would like to thank and congratulate all the contributing authors for their support to the workshop.

Takahiro Uchiya
Leonard Barolli
IINIC-2019 Workshop Co-chairs

IINIC-2019 Organizing Committee

Workshop Co-chairs

Takahiro Uchiya
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Fukuoka Institute of Technology, Japan

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Santi Caballé	Open University of Catalonia, Spain
Farookh Hussain	University of Technology Sydney, Australia

Message from FCISIS-2019 International Workshop Organizers

It is our great pleasure to welcome you for the 10th International Workshop on Frontiers in Complex, Intelligent and Software Intensive Systems (FCISIS-2019). The workshop will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

The objective of FCISIS Workshop is to foster the discussion in a rich interdisciplinary context of the three challenging areas of ICT-enabled applications: software intensive systems, complex systems, and intelligent systems. FCISIS-2019 is conceived in terms of special papers, which were also carefully selected, from the organizers.

We would like to thank all participants of the workshop for submitting their research works and for their participation and look forward to meet you again in forthcoming editions of the workshop.

Leonard Barolli
FCISIS-2019 Workshop Chair

FCISIS-2019 Organizing Committee

Workshop Chair

Leonard Barolli Fukuoka Institute of Technology, Japan

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Evjola Spaho	Polytechnic University of Tirana, Albania
Noriki Uchida	Fukuoka Institute of Technology, Japan
Hiroshi Maeda	Fukuoka Institute of Technology, Japan

Message from VENOA-2019 International Workshop Organizers

Welcome to the 10th International Workshop on Virtual Environment and Network-Oriented Applications (VENOA-2019), which will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

The past eight workshops were very successful, and many high-quality papers were presented and published in these workshops. We are pleased to announce the continuation of this workshop for serving as a forum for the exchange of information and ideas in the field of 3D computer graphics, virtual reality (VR), augmented reality (AR), mobile communications, IoT, and Web and network applications. We again received many unique and high-quality paper submissions in this workshop. We strictly followed the CISIS review procedures and finally selected excellent papers for publication and presentation. The program shows a variety of research activities with high relevance to the scope of the workshop.

This workshop cannot be organized without hard and excellent work of CISIS-2019 conference organizers. We would like to express our sincere appreciation to VENOA-2019 Program Committee Members and reviewers for their cooperation in completing their efforts under a very tight schedule. We also give our special thanks to all authors for their valuable contributions. We hope that these papers will have significant impacts and stimulate future research activities.

Yong-Moo Kwon
Hiroaki Nishino
VENOA-2019 Workshop Co-chairs

VENOA-2019 Organizing Committee

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Kenzi Watanabe	Hiroshima University, Japan
Kazuyuki Yoshida	Oita University, Japan

Message from SWISM-2019 International Workshop Organizers

Welcome to the 9th International Workshop on Semantic Web/Cloud Information and Services Discovery and Management (SWISM-2019), which is held in conjunction with the 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Sydney, Australia.

SWISM-2019 will bring together scientists, engineers, computer users, and students to exchange and share their experiences, new ideas, and research results about all aspects (theory, applications, and tools) of intelligent and semantic methods applied to Web- and Cloud-based systems, and to discuss the practical challenges encountered and the solutions adopted.

The program of SWISM-2019 includes papers related to information retrieval, ontologies, intelligent agents, intelligent techniques for management and programming of Cloud services and business processes. The program for the conference is the result of the excellent work of reviewers and Program Committee Members. We hope you will find the final program enriching and stimulating.

We believe that all the papers and topics will provide novel ideas, new theoretical and experimental results, and will stimulate the future research activities in this area.

The papers collected in this international workshop were carefully reviewed by reviewers. According to the review results, the Program Committee Members selected high-quality papers to be presented in this workshop.

We would like to express our sincere appreciation to all Program Committee Members for their cooperation. We are thankful to Honorary Co-Chairs, General Co-Chairs, Program Committee Co-Chairs, and Workshops Co-Chairs of CISIS-2019 for excellent conference organization. It was a great pleasure in working with them.

Last but not least, we are grateful to all authors for their valuable contributions and attendees who contributed to the success of the program with their papers and speeches on their research results, and with their participation in the conference.

We hope you will enjoy the workshop and conference and have a great time in Sydney, Australia.

Beniamino Di Martino
 Salvatore Venticinque
 Antonio Esposito
 SWISM-2019 Workshop Co-chairs

SWISM-2019 Organizing Committee

Workshop Co-chairs

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Vincenzo Loia	University of Salerno, Italy

Welcome Message from HCCIEA-2019 International Workshop Chair

On behalf of the Organizing Committee, we would like to welcome you to the 6th International Workshop on Hybrid/Cloud Computing Infrastructure for E-Science Application (HCCIEA-2019) which will be held in conjunction with the 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2019) from July 3rd to July 5th, 2019, at University of Technology Sydney (UTS), Australia.

The workshop aims to promote research and development activities focused on E-science applications using distributed computing infrastructure, such as grid, Cloud computing, and hybrid system. With the rapid emergence of software systems and their applicability, the amount of data is growing exponentially. Existing computing infrastructure, software system designs, and use cases must take into account the enormity in volume of requests, size of data, and computing load. A complementary goal is to identify the open issues and the challenges to fix them, especially on security, flexibility, reliability, and privacy aspects.

Cloud computing has become a scalable services consumption and delivery platform in the field of services computing. Cloud is a platform or infrastructure that allows execution of code in a managed and elastic way. We want to put the emphasis of scientific and technologies progress on Cloud solutions and infrastructures, in particular concerning research activities on scalability and adaptability using effective scheduling for the virtualization.

All people involved in this workshop (authors and PC members) are researchers with high expertise, working on related research areas and projects. We are really grateful for their support, and we thank them for contributing their knowledge toward a successful event.

We would like to thank CISIS organizers for giving us the opportunity to organize HCCIEA Workshop series. We hope that the results of this event will advance the related research in multifold ways.

Olivier Terzo
HCCIEA-2019 chairs

HCCIEA-2019 Organizing Committee

Workshop Chair

Olivier Terzo LINKS Foundation, Italy

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Klodiana Goga	LINKS Foundation, Italy
Leonard Barolli	Fukuoka Institute of Technology, Japan
Vincenzo Romano	INGV, Italy

Welcome Message from IKIDW-2019 International Workshop Co-chairs

Welcome to the 1st International Workshop on Knowledge Creation and Innovation in Digital World (IKIDW-2019). The workshop will be held in conjunction with the 13th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2019) at University of Technology Sydney, Australia, from July 3rd to July 5th, 2019.

The value of most organizations today greatly exceeds their net tangible assets. The IKIDW-2019 workshop aims to address contemporary issues in managing knowledge, intellectual capital, and other intangible assets in the digital world with the help of IT application. The digital era contributes to the amount of knowledge available in various qualities. This is a challenge for business people in strategic decision making. IT application is expected to reduce knowledge ambiguity so that it will improve the quality of organizational decisions. Beginning with a view that knowledge becomes strategic assets, the workshop will discuss the fundamentals of managing knowledge and intellectual capital, understanding some of the measurement issues, processes, and cycles involved in their management and the specific issues in managing knowledge, especially with the availability of big data and with the help of IT application.

We would like to express our sincere gratitude to the members of the Program Committee for their efforts. We thank the 13th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2019) for co-hosting IKIDW-2019. Most importantly, we thank all the authors for their submission and contribution to the workshop.

We hope all of you will enjoy IKIDW-2019 and find this a productive opportunity to exchange ideas with many researchers.

Olivia Fachrunnisa
Ardian Adhiatma
IKIDW-2019 Workshop Co-chairs

IKIDW-2019 Organizing Committee

Workshop Co-chairs

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Farookh Hussain University of Technology Sydney (UTS), Australia
Omar Hussain University of New South Wales, Canberra, Australia

CISIS-2019 Keynote Talks

Trust, Security and Privacy in Low-Cost RFID Systems

Wanlei Zhou

University of Technology Sydney, Sydney, Australia

Abstract. Radio Frequency Identification (RFID) enables the automatic identification of objects using radio waves without the need for physical contact with the objects. RFID has been widely used in various fields such as logistics, manufacturing, pharmaceutical, supply chain management, healthcare, defense, aerospace and many other areas, apart from touching our everyday lives through RFID enabled car keys, ePassports, clothing, electronic items and others. However, the wide adoptions of RFID technologies also introduce serious security and privacy risks as the information stored in RFID tags can easily be retrieved by any malicious party with a compatible reader. In this talk, we will introduce some trust, security and privacy challenges in RFID technologies, and based on our research, we will outline a number of schemes for authentication, ownership transfer, secure search and grouping proof in Low-cost RFID systems.

Intelligent Context Awareness in Internet of Agricultural Things

Nadeem Javaid

COMSATS University Islamabad, Islamabad, Pakistan

Abstract. Variability in climate and recession in water reservoirs, diminishing the agrarian sector ecosystem production day by day. There is an imperative requirement to restore robustness and ensure high production rate with the use of smart communication infrastructure. Moreover, the farmers will be able to make resource efficient decisions with the availability of modern monitoring systems like Internet of agricultural things (IoAT). However, the data generated through IoAT devices is disparate which needs to be handled intelligently to bring artificial intelligence (AI), machine learning (ML) and data analytic (DA) techniques into play. In this talk, we will recommend the intensive use of coordination between AI, ML and DA at middleware to optimize the performance of IoAT system along with context awareness. Additionally, it will enable horizontal functionality for diverse services to mitigate the problem of inter-operability. An analysis is carried out using TOWS matrix to consider the effects of internal and external factors on the performance of automation techniques collaboration. This analysis points out various opportunities to innovate the livelihood of agrarian society around the globe.

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Financial Technology and E-Corporate Governance Model for Small Medium Enterprises

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Abstract. This paper is designed to develop an E-Corporate Governance model for Small and Medium Enterprises that uses Fintech financing. The agency problem in the relationship between Fintech Corporation and SMEs is between creditor and debtor. In digital era today, most SMEs have accessed financing through Fintech Corporation. SMEs are included into high risk borrowers group, so in order to reduce moral hazard as well as credit risk E-Corporate Governance is needed. E-Corporate Governance is a system, structure, regulation and mechanism to control and monitor SMEs' behavior digitally, so moral hazard and credit risk can be reduced and SMEs' performance can increase.

Keyword: E-Corporate Governance · Small Medium Enterprises · Fintech · Credit risk

1 Introduction

SMEs have strategic role in Indonesia economy, however the development of SMEs are still slow due to the limit of access to financing (Haider 2018; Yoshino and Taghizadeh-Hesary 2016). Government has regulated the banks to allocate credits for SMEs in 2018 by 20%, although there are still some SMEs that are unable to access capital from financial institutions. It is caused by the condition where SMEs do not have sufficient collateral, high interest from banks, complicated procedures and insufficient financial reports (Haider 2018).

Along with digital advance, SMEs are also utilizing the development of information technology and according to Central Bureau of Statistic in 2017, recorded that 3.79 million of SMEs have used digital technology. It shows that SMEs have potential to carry out financial innovations called Fintech. Fintech can provide financial solutions (Arner et al. 2015). It is also as an application of digital technology for financial intermediation problems (Aaron et al. 2017). According to Bank Indonesia, one of Fintech forms is Peer to Peer Lending which is a debt-based transaction between individuals, Fintech Corporation, and business such as SMEs. Fintech with such model is suitable for SMEs financing because it has several advantages, including: (a) Fintech can reach the society without location limits, (b) It is unnecessary to provide physical collateral to get loans, this collateral is an obstruction for SMEs to access capital from

non-digital financial institutions, (c) the procedures are simpler, faster and cheaper (Minerva 2016).

According to the Sharia Banking Outlook (“Karim Consulting Indonesia,” 2017) there has been a shift in assessing whether someone or an institution deserves or not for financing from a Fintech company. Assessment is based on intangible components such as: personality, intelligence and integrity, social media use, online shopping application use as well as mobile use. The assessment is actually only limited to the requirements to get credit. But it is unknown either the risk of these funds will be returned on time or not, it is also called as credit risk.

Moreover, SMEs are included in the high risk borrower group (Zairani and Zaimah 2013) and non performing financing for SMEs is higher than non-SMEs (Mutamimah and Hendar 2017). If the requirements for obtaining credit are intangible, it does not guarantee that loan funds will be well managed by SMEs which will certainly harm Fintech Corporation, investors and other stakeholders. Borrowed capital must be monitored properly using information technology; this is the necessity of E-Corporate Governance for SMEs. E-Corporate Governance for SMEs is a system, structure, regulation and mechanism to manage, monitor and control the behavior of managers based on information technology, so there will be no misbehaving in the management of SMEs. Through E-Corporate Governance, managers of SMEs can reduce credit risk as well as manage SMEs effectively and efficiently in order to increase the performance of SMEs.

The fundamental differences in this research with the previous ones are: *First*, in previous phenomenon, the feasibility assessment to obtain credit approval from Fintech was intangible including personality, intelligence and integrity, social media use and mobile use. These criteria do not guarantee that the borrowed fund can be managed properly by SMEs. In other words, according to these criteria, SMEs as debtor still have high credit risk; hence it will harm depositors, Fintech Corporation, investor and other stakeholders. This research as concept paper proposes SMEs to apply E-Corporate Governance to reduce the high credit risk. *Second*, corporate governance in Fintech was only applied on Fintech Corporation as creditor so far. This is reflected in OJK Regulation number 15/SEOJK.05/2016 concerning the Report on the Implementation of Good and Not Good Corporate Governance for SMEs as debtor. Even though there are 3 parties involved in Fintech, namely the society as depositors, Fintech company as intermediary institutions and SMEs as debtors. Although loans given to SMEs are one source of income for Fintech corporation, they still must be responsible toward the depositors and shareholders (Zairani and Zaimah 2013).

Fintech Corporation as intermediary institution have 2 kinds of agency conflicts: (a) between depositors or investors and Fintech Corporation as manager has been arranged on OJK Regulation number 15/SEOJK.05/2016 concerning the Report on the Implementation of Corporate Governance; (b) between Fintech Corporation as creditors and SMEs as debtors. However, SMEs as debtors trusted by Fintech Corporation as principal must be able to carefully manage the funds borrowed from the company and reduce the risk. Thus it is necessary to arrange E-Corporate Governance. This is the gap that *has not been found* until now (Fig. 1).

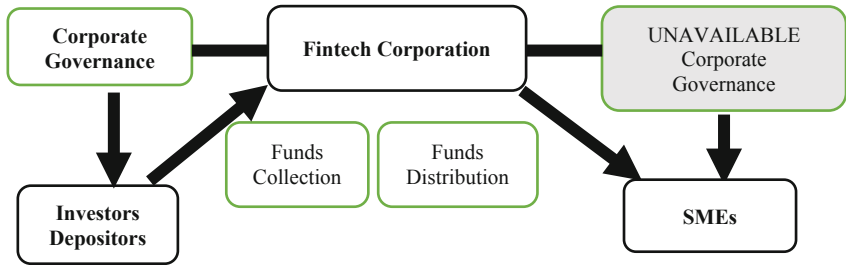


Fig. 1. Corporate Governance at Fintech Corporation

Henceforth Fintech Corporation must consider the quality of SMEs based on the implementation of E-Corporate Governance. This is supported by the result of research by Chevers and Chevers (2014) that to strengthen the implementation of corporate governance in SMEs, it must include information technology as an internal control. Hence, by the use of information technology, SMEs can run their business successfully.

Therefore, problem formulation in this research is: How is E-Corporate Governance model in SMEs that implement Financial Technology. The contribution of this article is to arrange a model of E-Corporate Governance for the development of SMEs in order to grow and survive in a long run through Fintech financing.

2 Literature Review

2.1 Fintech for Small Medium Enterprises

Fintech is a financial technology developed by information technology innovation which is able to provide financial solutions (Arner et al. 2015). One of Fintech model that is suitable to be applied to finance SMEs is Peer to Peer Lending (P2PL). This model is one of the forms of debt-based crowd-funding in the form of money lending practices where borrowers and investors are assembled through information technology. The P2P lending model is very attractive for SMEs to get financing because it does not need collateral, fast disbursement process, lower costs, competitive interest rates, paperless applications are easier and do not provide penalties for early repayment (Minerva 2016). Based on data from OJK, it shows that in 2018, the total number of Fintech operators that have been registered and obtained permission from OJK is 88 companies. Here are some examples of P2P lending in Indonesia: Modalku, Amartha, Crowdo, InvesTree, Mekar, and KoinWorks.

2.2 E-Corporate Governance for Small Medium Enterprises

There is no universal definition of corporate governance that can be applied to all situations, corporations or countries. Corporate governance appear as a solution from agency relationship if both parties to the relationship maximize the benefit, there is good reason to believe that the agent will not always act in the best interests of the principal (Jensen and Meckling 1967). This is strengthened by Panda and Leepsa (2017) with the

statement that the conflict of interest and agency cost arises due to the separation of ownership from control, different risk preferences, asymmetric information and moral hazards. International Financial Corporation defines corporate governance as “the structures and processes for the direction and control of companies”. Organization for Economic Cooperation and Development, “The internal means by which corporations are operated and controlled, which involve a set of relationships between a company’s management, its board, its shareholders and other stakeholders, including creditors,” (The Indonesian Corporate Governance Manual 2014). According to stakeholders theory, corporate governance model is a structure and process including the activities determined and operationalized in a company. Corporate governance in previous research is related to large companies and companies that go public where separation of ownership and control occurs within the company. Therefore the existence of corporate governance is intended to balance the importance and goals of owners and managers. However the corporate governance of SMEs in Indonesia has different characteristics from previous studies. First, there is no separation of ownership and control in SMEs, because mostly SMEs are family business where the owner, manager and employee are the same person (Anton, Muzakan, and Muhammad 2015). Second, agency conflict in SMEs is a conflict between creditors, Fintech Corporation and SMEs as debtors.

3 The Proposed Framework of E-Corporate Governance Model for SMEs

3.1 Mechanism of E-Corporate Governance Model for SMEs

There are two E-Corporate Governance mechanisms for SMEs, internal and external. The internal mechanism includes structures, systems and regulations that prevent moral hazard behavior digitally in SMEs. It includes SMEs’ business process, compliance and risk management which are supported by the implementation of E-Corporate Governance. E-Corporate Governance includes transparency, accountability, responsibility, independency, and fairness as instruments to measure the implementation of E-Corporate Governance. The external mechanism means that there are supervision and monitor by external parties digitally, in this case by Fintech as creditors. Both mechanisms are interrelated. If the internal E-Corporate Governance works well, then it will increase the quality of external E-Corporate Governance (Fig. 2).

3.2 Measurement of E-Corporate Governance Model for SMEs

The measurement of E-Corporate Governance for SMEs is shown in several components: transparency, accountability, responsibility, independence and fairness in order to reduce the risk of bad credit, to improve performance and sustainability of SMEs (Kurniawati et al. 2018). *Transparency* is openness in decision making and SMEs in disclosing truthful information and providing financial or non-financial reports digitally in a determined time both to Fintech Corporation and other stakeholders. *Accountability* is clarity of functions, authority and accountability of SMEs’ managers to Fintech Corporation and other stakeholders digitally, so the operations of SMEs can

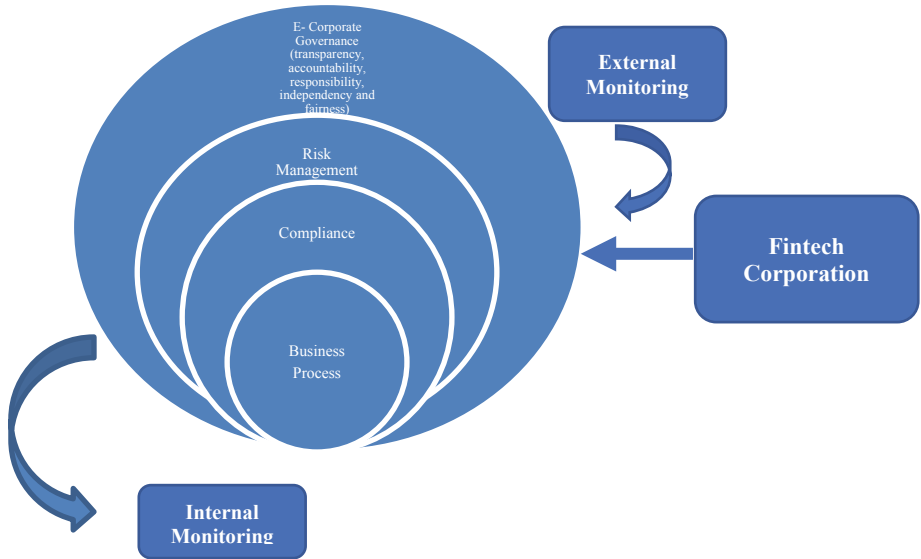


Fig. 2. Mechanism of E-Corporate Governance

run transparently, effectively and efficiently. *Responsibility* is compliance of SMEs’ management with the legislation in financing field and ethical values as well as standards, principles and practices of healthy financing. *Independency* means that SMEs must be managed independently, professionally and free from conflicts of interest and influence or pressure from any party; and *Fairness* refers to equality, balance and justice in fulfilling the rights of SMEs’ stakeholders which include: Fintech Corporation, managers and employees so that no party is harmed (Fig. 3).

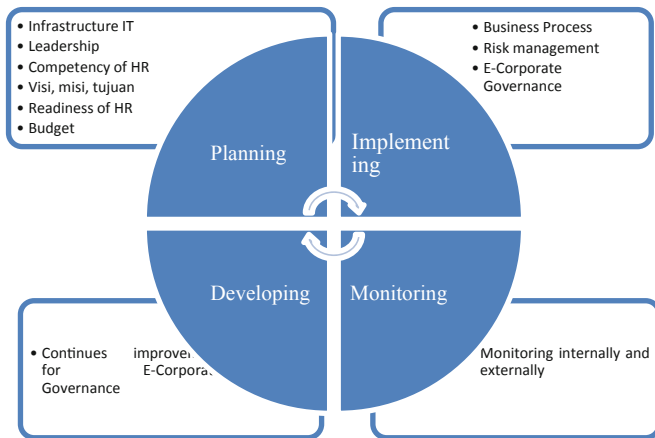


Fig. 3. Implementation of E-Corporate Governance

3.3 Implementation of E-Corporate Governance Model

For the implementation of E-Corporate Governance, it starts from planning, implementing, monitoring and developing. The Implementation has advantages which are faster, more efficient and cheaper. Planning requires adequate IT infrastructure, HR competencies, leadership commitment, HR readiness and budget. Implementing includes the implementation of business process and risk management. Monitoring is carried out both internally and externally. Developing includes continuous development to realize E-Corporate Governance goals which are to reduce moral hazard and credit risk as well as to improve and sustain SMEs' performance.

4 Conclusion and Future Research

In conclusion digital era is driving Fintech Corporation to grow rapidly. One of financing customers of Fintech Corporation is SME. The relationship between the two encourages the emergence of agency problem between creditors and debtors. SMEs are referred to as high risk borrowers, so to reduce the risk in today's digital era, it is necessary to apply E-Corporate Governance model.

For future research: (a) This article is still in the form of frame work on the Financial Technology and E-Corporate Governance Model for Small Medium Enterprises, so that in the future it is necessary to test the model by conducting empirical research related to the topic, (b) This article is a solution to agency problems between creditor and debtor, for future research the paper still needs to be developed in term of E-Corporate Governance Model as a solution for a broader agency conflict among other stakeholders, for example between employees, consumers, governments and communities.

References

- Aaron, M., Rivadeneyra, F., Sohal, S.: Fintech: is this time different? A framework for assessing risks and opportunities for central banks. Bank of Canada Staff Discussion Paper, vol. 10 (2017)
- Anton, S.A., Muzakan, I., Muhammad, W.F.: An assessment of SME competitiveness in Indonesia. *J. Competitiveness* 7(2), 60–74 (2015). <https://doi.org/10.7441/joc.2015.02.04>
- Arner, D.W., Barberis, J., Buckley, R.P.: The evolution of Fintech: a new post-crisis paradigm? *SSRN Electron. J.* 47(4), 1271–1319 (2015)
- Chevers, D.A., Chevers, J.E.: The impact of information technology material weakness on corporate governance changes in family-owned businesses. *Sir Arthur Lewis Inst. Soc. Econ. Stud.* 5(6), 87–96 (2014)
- Haider, H.: Constraints to business growth in low- and medium-income countries (2018)
- Jensen, M.C., Meckling, W.H.: Theory of the firm : managerial behavior, agency costs and ownership structure theory of the firm : managerial behavior, agency costs and ownership structure. *J. Financ. Econ.* 3(4), 305–360 (1976). <http://www.sfu.ca/~wainwrig/Econ400/jensen-meckling.pdf>
- Karim Consulting Indonesia.: November 2 (Outlook Perbankan Syariah 2018) (2017)

- Kurniawati, S.L., Sari, L.P., Kartika, T.P.D.: Development of good SME Governance in Indonesia: an empirical study of Surabaya. *Int. J. Econ. Manage.* **12**(April), 305–319 (2018)
- Minerva, R.: The potential of the Fintech industry to support the growth of SMEs in Indonesia 35142338-8 Raras Minerva Management Strategy and Industry Evolution, pp. 1–60 (2016)
- Mutamimah, S., Hendar, H.: Islamic Financial Inclusion: Supply Side Approach, pp. 1–9 (2017)
- Panda, B., Leepsa, N.M.: Agency theory : review of theory and evidence on problems and perspectives (2017). <https://doi.org/10.1177/0974686217701467>
- The Indonesia Corporate Governance Manual.: (First). International Finance Corporation (2014)
- Yoshino, N., Taghizadeh-Hesary, F.: Asian Development Bank Institute (564) (2016)
- Zairani, Z., Zaimah, Z.A.: Difficulties in securing funding from banks : success factors for small and medium enterprises (SMEs). *J. Adv. Manage. Sci.* **1**(4), 354–357. <https://doi.org/10.12720/joams.1.4.354-357>