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Challenges in designing an inclusive Peer-to-peer (P2P) lending system

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ABSTRACT

Literature suggests advantages of Peer-to-peer (P2P) lending systems over conventional banking credit, such as better credit scoring, and direct interaction of lenders-borrowers. Fintech P2P lending companies can process scattered individual information using advanced statistical methods and serve unreached market segments improving inclusiveness in society. Establishing inclusive P2P lending systems remains challenging, however, there is no systematic overview of such design challenges. Failure in designing an inclusive system creates a system that remains exclusive for some parts of society which hinders them from increasing economic transactions or even continuing business as usual due to limited funds. This research aims to identify the challenges in designing P2P lending systems that block inclusiveness in society. We conducted a systematic literature review followed by semi-structured interviews with financial inclusions and P2P lending systems experts. Our review found a variety of challenges in designing inclusive P2P lending systems. We classify the challenges into six categories. The main challenges are related to trust in the systems, literacy, and data issues.

CCS CONCEPTS

• **Social and professional topics** → Professional topics; Computing and business; Socio-technical systems.

KEYWORDS

Inclusiveness, Financial inclusions, P2P lending systems, Design challenges

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1 INTRODUCTION

People at the bottom of the pyramid (BoP) of the economy are often failed in getting banking credit due to unconvincing financial profiles [34, 56]. As a solution, they sometimes apply for credit from illegal and informal lending providers which eventually creates

social issues [56]. The advancement of financial technology offers a variety of alternative lending as the complement or substitution of banking credit, such as the P2P lending systems [32]. In a banking institution, the funding is collected and distributed by banks as the financial intermediaries; whereas, in a P2P lending system, there is no formal financial intermediary to approve the loan [9]. In contrast with the banking system that does not maintain any relationship between borrowers and depositors, in the P2P lending system there exists a many-to-many relationship between investors-borrowers [36]. Moreover, direct interaction between investors and borrowers is possible [36, 56]. The P2P lending system introduces reintermediation, in which the system recommends prospective loans to the lenders based on borrowers' credit risk [6]. Furthermore, with the ability to utilize advanced statistical techniques, such as machine learning and deep learning, and utilize scattered information in social media, social networks, and utility providers, P2P lending companies offer the capability to improve individual credit scoring. Scoring calculations and default predictions computed by fintech companies are considered better than traditional systems due to the advancement of technology-driven innovation [6].

From the government and society's perspective, one of the main drivers for P2P lending is to address inclusion. The term inclusion is discussed in a wide variety of disciplines. This study adopts the definition of financial inclusion defined by [30], *'the process of ensuring access to financial services and timely and adequate credit where needed by a vulnerable group such as weaker sections and low-income groups at an affordable cost'* [30] p. 554. A system could have robust technical performance and have the ability to provide maximum profitability, yet be inaccessible to several market segments. This means the system is not inclusive to a particular group of society. By adopting the goal of financial inclusiveness defined by [23], the inclusiveness in this paper aims to *'drawing the unbanked population into the formal financial system so that they have the opportunity to access financial services ranging from savings, payments, and transfers to credit and insurance'* [23, p. 1]. Unbanked people refer to individuals without any type of account ownership, either formal accounts regulated by financial institutions or mobile-based accounts not regulated by any financial institutions [18]. An exclusive system fails to contribute to financial inclusion in society. This paper is limited to financial credit provided by the P2P lending systems, therefore, it does not cover other scopes of financial inclusion such as savings, payment, and insurance.

P2P lending systems have the potential to promote *financial inclusion* by reaching the market that has not been served by traditional banking sectors [32], providing lower interest rates [8] and extending the coverage of credit circulations and improve the strength of economic resilience [44]. [35] identifies six factors that have the potential to leverage the role of P2P lending in financial



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inclusions, e.g., technology, regulations, innovation, transparency, performance indicators, and vision. Technology enables the parties who have excess funds to meet those who lack funds with lower operating costs; regulations set up the standard and rules to maintain the industry's stability; innovation provides flexibility and room for adjustments; transparency improves trust; performance indicators assist various parties in assessing the progress and opportunities; visions provide a clear path for future development. Apart from these six factors, two dimensions provide further opportunities for P2P lending in supporting financial inclusion, which are geographical aspects – the participation of local and global businesses in reaching the remote market, and business objectives – the wide continuum of business types involved in financial inclusion, such as commercial and social.

Despite the opportunities offered by the P2P lending system, there are challenges tied to the nature of the P2P lending business model, such as information asymmetry and stakeholders' complexity. P2P lending is a growing industry with various risks and uncertainties [57]. Information asymmetry is considered a source of uncertainties in P2P lending that might lead to moral hazards [48]. Each participant is unaware of others' preferences and motivations [45], and lenders can not verify the validity of the information provided by borrowers [9]. Furthermore, the unavailability of financial intermediaries creates more uncertainties. In contrast with traditional banking, where credit risk is on the side of banks, credit risk owners in P2P lending are the lenders [11]. In P2P lending, inexperienced investors make decisions by utilizing online information provided by the system and using their intuition and judgment to select portfolios [54]. The decision could be biased and subject to the risk appetite of the investors [33]. Information asymmetry creates challenges as well as opportunities for P2P lending companies to design robust scoring systems and lending algorithms by utilizing scattered individual data from a variety of sources, such as social media, social networks, and utility providers.

The main research question is *what are the challenges in designing P2P lending systems blocking inclusiveness?* Failure in designing an inclusive system creates a system that remains exclusive for some parts of society which hinders them from increasing economic transactions or even continuing business of usual due to limited funds. There does not exist a comprehensive overview of the challenges of designing an inclusive system. The discussion about the challenges of the P2P lending system is mostly general and does not specifically address the inclusiveness issue. An understanding of the challenges is crucial in designing a proper system and assisting the policymaker in formulating an efficient regulatory regime. On the one hand, a P2P lending system could have high profits yet remains exclusive. On the other hand, a system that supports inclusiveness might not be attractive to P2P lending companies and lenders due to the high-risk profiles of the intended market segment. Questions about the challenges of inclusiveness in P2P lending systems are onerous in nature. First, research about the challenges of the P2P lending system is mostly in general and not specific to inclusiveness issues. Second, P2P lending is a growing industry that continuously seeks innovations and improvement. There might be challenges that have not been captured by the literature and can only be revealed through interviews or case studies. Therefore, as part of the research methodology, we conduct semi-structured interviews with

policymakers, practitioners, and academics who have a certain level of knowledge and expertise in financial inclusion and P2P lending systems.

2 LITERATURE BACKGROUND

The P2P lending system provides several competitive advantages compared to the banks' lending system. Using alternative sources of information in calculating the scoring enabled the customers to get better credit ratings [27]. The faster process of credit approval compared to traditional banking credit has also contributed to customer preferences for P2P lending credit [27]. Another value-added offered is the variation of the lending schemes and the omission of physical barriers [44]. P2P lending systems offer more access to credit for micro and small enterprises (MSEs) by promising easier processes, minimal physical document requirements, and non-mandatory collateral [50]. Moreover, the cooperation of P2P lending and the banking system provides more opportunities for the improvement of micro-loan disbursement [37].

The mushrooming growth of the P2P lending industry in the last two decades presents various challenges that are not only related to technical aspects but also social aspects which might impact economic stability. In general, works of literature discuss the challenges from the dimension of social, technical, and end-users. Research on *the social dimension* addresses the challenges related to the financial industry and operational context. However, the challenges are mostly tied to the specific characteristics of the P2P lending system and do not directly address inclusiveness. For example, general challenges in the P2P lending system from technical and non-technical aspects [51], business competition between P2P lending companies [29], challenges to maintaining company reputation [38], and challenges of moral hazard caused by the irresponsible companies. In terms of the financial industry, works of literature show that the collapse of dozens of P2P lending companies in China in 2017 was caused by moral hazard and the inexistence of regulatory regimes [1, 3, 57]. [26] elaborates on the opportunities and challenges of the regulatory regime in China to respond to the challenges in industrial stability. Moreover, there is also a massive amount of research on information asymmetry, a challenge in the P2P lending system triggered by the anonymity of participants [9] and the unavailability of financial intermediaries to conduct a risk assessment [5].

The second dimension of research in P2P lending systems is *technical challenges*, which mostly focus on the design of scoring models to improve performance and profitability by utilizing big data and artificial intelligence [2, 5]. As part of the investigation of the domain problem, we analyze 271 papers from the year 2012 to April 2022. Among these papers, we found at least 84 studies discuss the algorithm to optimize system performance and profitability, for example, network-based scoring algorithm [20], cost-sensitive algorithm [46, 53, 55], the neural network in default probability [31], and utilizing data from social media and social network for the scoring algorithm [21, 58]

The third dimension is *the challenges perceived by end users*, i.e., lenders and borrowers. For example, research in designing tools for portfolio optimization, such as [58] and [52], tools for lenders' decision-making, such as [4, 15], and [22]; and tools to

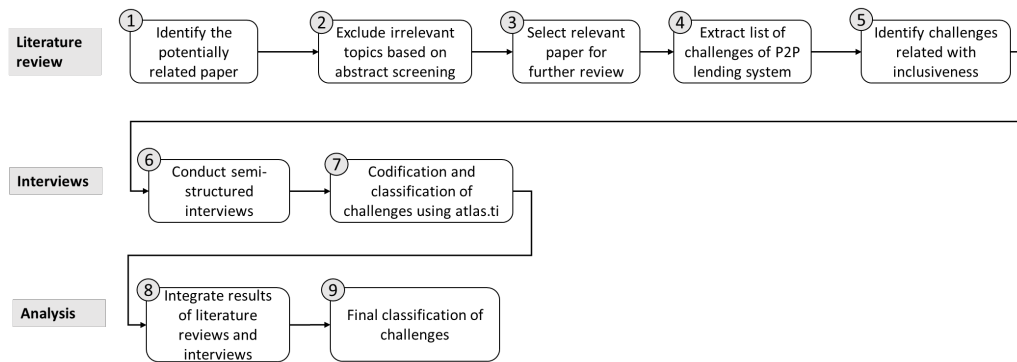


Figure 1: Research steps

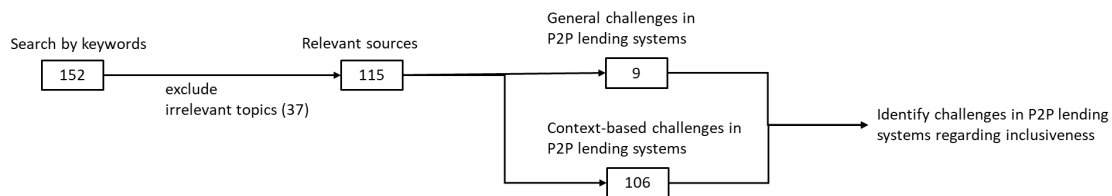


Figure 2: Searching stages in Systematic Literature Review

improve borrowers’ decision making, such as [28] and [41]. In addition, there is research that implemented game theory to explain the equilibrium of the P2P lending business by considering the company, investors, and government perspectives [10].

To conclude, there is a lack of literature addressing the challenges of designing an inclusive P2P lending system. The current literature mostly discusses *the general challenges* of P2P lending from the user dimension, technical dimension, and social dimension. In the subsequent part of this paper, we explain the methodology to identify and classify the challenges of an inclusive P2P lending system.

3 RESEARCH METHOD

The purpose of this study is to identify challenges in designing an inclusive P2P lending system. The following figure shows the steps conducted in this research, which consists of three main parts: literature review, interviews, and analysis.

We conducted a systematic literature review (SLR) to identify the general challenges of the P2P lending systems from the dimensions of technical, social, and users. We provide two sets of keywords in the searching process to ensure the query retrieves not only the general challenges in designing P2P lending systems but also address inclusiveness issues, such as inclusion, unbanked, prosocial lending, and micro-lending. We added the terms ‘fairness’ and ‘trustworthiness’ because these two terms are often discussed in financial inclusion challenges.

Following the search protocol, we identified 152 sources from the literature as of July 2022, as in Figure 2. We removed 37 irrelevant papers, such as the topics about Fintech in general, credit financing in general, e-commerce, and user profiling. It leaves us with 115 papers that address the challenges in the design and operational

aspects. Some challenges are general in nature (n=9), whereas other challenges are related to particular contexts (n=106), such as technology, business, organizational, and social aspects. However, not all of the challenges are related to inclusiveness. The next stage is to identify which challenges are strongly related to inclusiveness or financial inclusion.

Due to the difficulties in identifying literature that specifically addresses inclusion issues, the SLR is followed by semi-structured interviews to identify inclusion-related challenges that are not widely discussed in the literature. Based on [25], the constituent community of the research comprises the organizations and the people involved in milestones of information systems, such as planning, managing, designing, implementing, operating, and evaluating. We interviewed experts from Indonesia, one of the countries that experienced a significant interest in the P2P lending industry. This is confirmed by the number of research papers in this field by Indonesian authors in Scopus and Google Scholar. We identified seven different types of stakeholders involved in the P2P lending system in Indonesia, consisting of three types of policymakers, Fintech companies, banking institutions, MSMEs, and investors. The selection of the respondents is based on their portfolio and years of experience in their respective fields. We count the years of experience which only related to financial inclusions, SMEs, or P2P lending industries, despite the experience of the respondents in the financial system in general. We interview the respondents from Fintech P2P lending companies which represent the managerial level (including the owner) and the technical level. We included interviewees from academia to incorporate the perspective of the academic world. The following table shows the list of respondents in the Indonesia case study.

Table 1: Respondents of the interviews

Stakeholders type	Institution	Number of respondents	Years of experience
Policymaker	Financial service authority	3	4-6
Policymaker	Central bank	3	4-6
Policymaker	Ministry of Cooperative and SMEs	1	3
Industry	Fintech P2P lending company	3	4-6
Industry	Small-medium enterprises	1	4
Industry	Investor	1	4
Industry	Banking institution	1	5
Academics	Academics	1	4

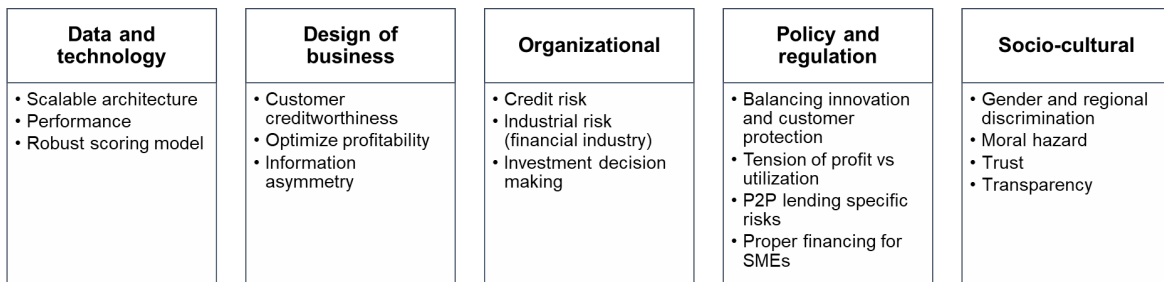


Figure 3: Classification of challenges based on literature

In the first round of data analysis, we apply open coding to identify patterns or themes, categorize the findings, and examine the salient features. The second round of coding analysis is conducted using Atlas. TI, a qualitative data analysis software that assists researchers in discovering actionable insights. We used the socio-technical elements of the P2P lending system, as proposed by [49] as the baselines in the classification of the challenges. There are five socio-technical elements in P2P lending systems, namely Data and Processing, Business, Organizational, Policy and Governance, and Culture. Moreover, we take the lenses of coordination theory and principal-agent theory to discuss the challenges from social aspects. The P2P lending systems are aimed at coordinating borrowers and lenders. However, the coordination mechanism addresses not only the coordination inside the system but also the involvement of human beings in operational settings and regulation aspects. Moreover, the complexities of interests of the P2P lending systems can be analyzed from the Principle-Agent theory. The principal-agent theory addresses the conflict of goals between the agents, those who perform works, and the principal who delegates works [17]. The agents receive incentives for conducting works commissioned by the principal [19]. The principal-agent theory assumes that the agent might conduct behavior that is not aligned with what is expected by the principal. For example, AI does not perform tasks as desired by the designer [43]. A principal-agent dilemma occurs when any party deliberately provides inaccurate information for personal benefit [16]. In the context of the P2P lending system, borrowers have more information than lenders, therefore, information asymmetry takes place [13]. Moreover, the different goals

of stakeholders in P2P lending could lead to arbitrariness to some extent [16].

4 FINDINGS AND DISCUSSION

The main question of this paper is “What are the challenges in designing P2P lending systems that block inclusiveness in society?”. Based on the literature, we identify the classifications of challenges in inclusive P2P lending systems, as shown in Figure 3. The classification of challenges is based on [49].

We use the result from the literature as one of the baselines in conducting open-ended interviews with 14 different experts from eight different types of stakeholders. The interviews were conducted from July to September 2022. The combination of results from the SLR and interviews provides us with ninety-eight of the challenges in providing P2P lending systems that promote inclusiveness in society. We provide a simplified version of the networks of challenges in Figure 4. Each block of challenge reveals the frequency of a particular challenge addressed in the interview sessions (G) and the interconnection of a particular challenge with its other challenges (D-1). We classify the challenges into six categories, i.e., technology and data, business, organization, regulation, social, and literacy. We extend the classification of challenges provided by [49], by adding literacy and education aspects; and combining cultural and other social challenges into one category of social aspects.

The networks of challenges depict two important insights, i.e., 1) the classification of ninety-eight challenges into six categories and 2) the interconnection among challenges. We analyzed 98 of the

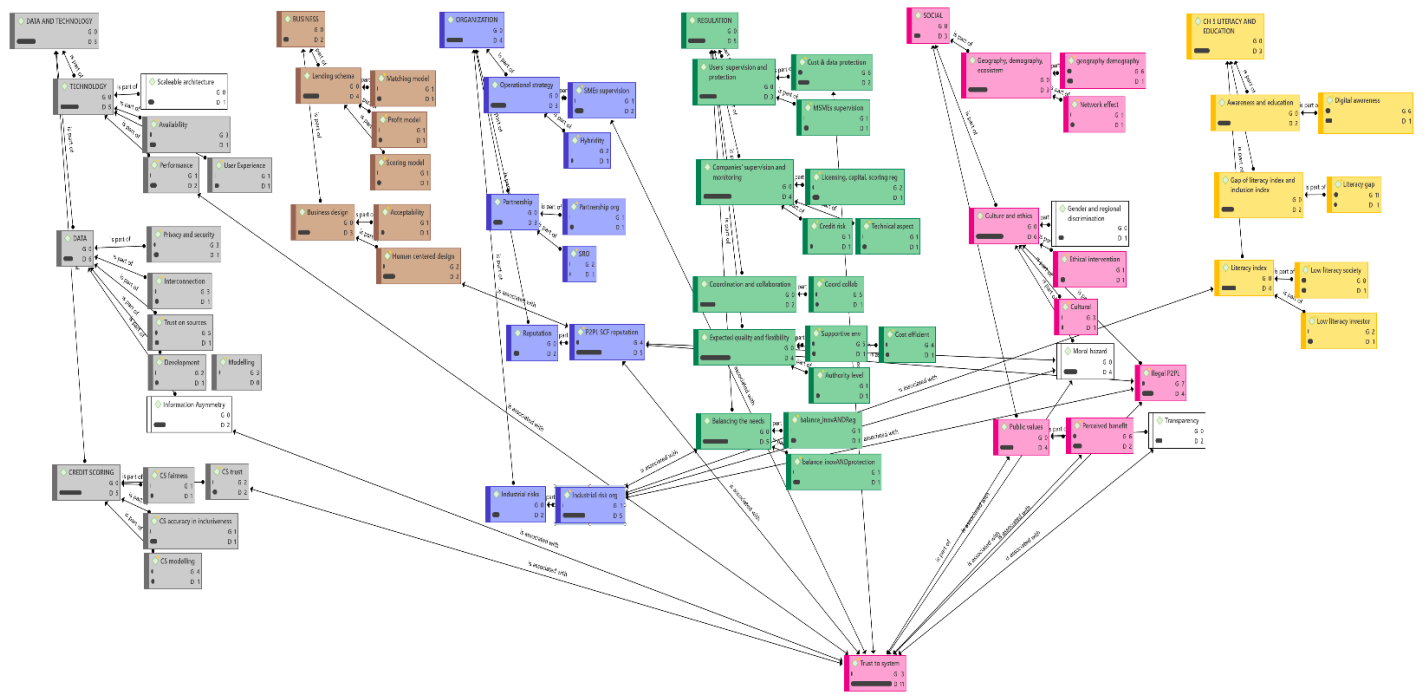


Figure 4: Networks of challenges in designing P2P lending systems



Figure 5: Final classifications of challenges in designing P2P lending system

challenges by re-examining and combining similar topics. We arrived at thirty-eight distinct challenges which are classified into six different categories, as depicted in Table 2 to Table 7. Furthermore, challenges were found to be interrelated. For example, the trust in the system is interconnected with ten other challenges, namely the system’s performance, credit scoring trust, information asymmetry, company’s reputation, regulation on data protection, regulation on customer protection, illegal P2P lending company, perceived benefit, transparency, and moral hazard.

Having analyzed the networks of challenges, we created the final list of challenges of inclusive P2P lending systems as in Figure 5. The list of challenges is classified into six different categories: 1)

technology, data, and modeling; 2) business aspects; 3) organizational aspects; 4) regulations; 5) social aspects; and 6) literacy and awareness. We will elaborate more explanation of the challenges in each type of classification in the next section.

Table 2 to Table 7 respectively show the final list of challenges as the result of the SLR and interviews.

4.1 Technology, data, and modeling challenges

Technology

- Lack of access to the system

The inability to access any formal financial institution is also called financial exclusion. P2P lending systems promote financial

Table 2: Technology, data, and modeling challenges

Classification	Challenges
Technology	<ol style="list-style-type: none"> 1. Difficulties in accessing the system due to a lack of infrastructure 2. Challenges to the accuracy of default prediction 3. Complicated system (UX) for unbanked and remote market segments 4. No available standard for scale-able architecture
Data	<ol style="list-style-type: none"> 5. Challenges of data privacy and data security during scoring development 6. No available data interconnection to enhance data validation 7. Trust issue on data sources 8. Information asymmetry among participants
Modeling	<ol style="list-style-type: none"> 9. Complexity in modeling the scoring, rating, and probability of default 10. Multi-perception of fairness in scoring and rating algorithm 11. Trust issue on scoring and rating algorithm

inclusion through the direct interaction of investors and borrowers using an online system. P2P online lending is highly dependent on the availability and the quality of infrastructure, however, the effort to ensure equal access to everybody remains a challenge due to geographical constraints and uneven infrastructure development.

- Unavailable standard for scale-able infrastructure

The inclusive P2P lending system means that the system can be accessed by all levels of society, i.e., equal opportunity of access. It can be achieved by developing new systems or enhancing existing systems by improving system outreach, serving various levels of income, and mitigating regional discrimination or gender discrimination. Improvement of existing systems needs to be supported by a scalable architecture, i.e., an architecture that can handle growths of workloads in terms of features, number of users, or extension of geographical outreach.

- The accuracy of default prediction

Model accuracy is one of the most popular research topics in P2P lending systems, that is to be able to predict the default probability. Remote market segments tend to have low scores which imply high credit risk and high default probability. High-risk customers tend not to be chosen by investors, therefore it is a challenge to design a system that can keep investors interested in investing in them.

- Complicated UX for unbanked and remote market

Interviews with P2P lending developers and borrowers concluded that end-users, especially the market segment at the bottom of the pyramid of the economy (BoP), favor simple and ergonomic application systems. A complex application system tends to have a low level of acceptance and is easily ignored. Moreover, designing an ergonomic user experience (UX) requires not only programming skills but also knowledge of human behavior and visual communication.

Data

Data is one of the most crucial resources in the design and development of P2P lending systems. Poor data will result in unreliable models. The vital role of data in P2P lending systems is reflected in the massive development of data science related topics in P2P lending research. We identify four main challenges related to data. First, data privacy and data security. Modeling of scoring, rating,

interest rate, and default prediction in P2P lending requires enormous amounts of data, which can be obtained from third-party providers or by developing a data collection algorithm. It remains a challenge to guarantee data privacy and data security during the modeling process. Ensuring the validity of access to the modeling output creates another challenge in data privacy and data security.

The Second challenge is data interconnection, that is how to provide the mechanism of data interconnection among P2P lending companies to support data validation and mitigate moral hazard. Data interconnect could prevent the debtors from applying for concurrent loans from multiple P2P lending applications. The third challenge is the trust issue of data sources due to a variety of sources of data that cannot always be verified. The next challenge is information asymmetry, which differentiates the P2P lending system and other financing facilities. One party could have more information than others, which might imply adverse selection and moral hazard [14].

Modeling

With the ability to implement advanced statistical methods and utilize various data sources, P2P lending systems could improve credit scoring and increases the opportunities for unbanked people to access funding [27]. A well-designed credit scoring system is essential to optimize profit and mitigate poor debt [7]. However, the complexity of modeling the scoring, the rating (interest rates), and default probability is remain a big challenge. The design of a scoring and rating model is closely related to companies' risk appetite. Different companies could deploy different models depending on the company's vision and risk tolerance. Therefore, designing a proper scoring and rating model could be more complicated if we put inclusiveness in addition to profitability as the design's goals. Moreover, public values inherent to P2P lending systems could have multi perceptions, such as fairness and trustworthiness. The definition of fairness to one party could be different from others. Another challenge is the trust issue in the scoring and rating algorithm. People are struggling to define how to trust a model and an algorithm of individual ratings. No standard or guideline can be used as a reference to assess the trustworthiness of a model, therefore, P2P lending companies tend to develop internal algorithms that are aligned with the company's vision and risk appetite.

Table 3: Business aspects challenges

Classification	Challenges
Lending schema	1. Challenges of profitability in high-risk customer lending 2. Complex matching model of investors and high-risk customer segments
Business design	3. Human-centered design (alignment of business vision and societal needs) 4. No silver bullet in designing an inclusive system (contextual challenges)

Table 4: Organizational challenges

Classification	Challenges
Reputation	1. The impact of non-performing loan (NPL) on company reputation
Operational strategy	2. Challenges in operational hybridity to improve data validity
Partnership	3. Challenges of Self-Regulated Organization (SRO) in providing standard and monitoring procedures
Industrial risks	4. The risk of financial stability

4.2 Business aspects challenges

The design of a lending schema is highly dependent on the target market of the company. For example, the lending schema for women entrepreneurs could be different with agriculture or manufacturing market segments. The term inclusiveness which is usually attached to micro and small enterprises (MSEs) creates a dilemma for P2P lending companies. How to ensure that the credit disbursed to micro-entrepreneurs continues to generate profit [42], and how to carry out an efficient assessment of MSEs to produce a reliable risk profile, are among the main concerns. Moreover, providing a proper matching mechanism [45] and convincing prospective investors to fund SMEs creates another challenge. Furthermore, P2P lending companies are under the supervision of the government which requires a low non-performing loan (NPL) as one of the indicators to assess the performance of Fintech companies. This requirement creates a dilemma for a company. On the one hand, they are encouraged to support government programs by providing credit to high-risk markets, which have the potential to have high NPLs; On the other hand, Fintech companies must also keep NPL as low as possible.

In terms of business design, experts suggest the alignment of Fintech companies' vision with societal needs by promoting human-centered design (HCD). HCD focuses on human perspectives, human needs, and human emotions in designing and delivering an IT product. Furthermore, stakeholders realize that there is no silver bullet in designing an inclusive system. The system is expected to be contextual depending on a particular challenge to be addressed. In the case of inclusiveness, the main focus is equal distribution of access to intended market segments.

4.3 Organizational challenges

The organizational aspect is regarding human intervention in operational activity. We classify the challenges into four areas.

Reputation

P2P lending systems have various business models, for example, cash loans, supply-chain funding, and debt loans. The variety of business models provides more opportunities for SMEs in increasing their production capabilities. However, the rise of illegal P2P lending

has made society start antipathy and hesitate to use P2P lending as a source of funding. Media reports about illegal P2P lending are mostly about inhumane debt collection practices or companies running out of customer money. Communities are exposed to more negative information rather than the benefits they can gain through productive debts.

Operational strategy

The interviews with young entrepreneurs in the Fintech field revealed that one of the determining factors for community involvement in using P2P lending applications is not the sophistication of features, but the ease of use. For the market segments that are still not too tech-savvy, the existence of hybrid operations significantly increases engagement [40]. For example, by conducting mass activities to validate SMEs' business operations while introducing P2P lending features and opportunities for improving their business. Offline activities not only increase engagement with the system but also assist SMEs to build networks, which in turn contribute to social inclusiveness.

Partnership

Fintech P2P lending could be perceived as a complementary of the banking industry in the disbursement of small loans [37]. A partnership between banks and Fintech companies apart from exchanging information is also to help potential SMEs get channels for a higher amount of credit. P2P lending companies could recommend SMEs that are eligible for a higher amount of financing due to good repayment behavior and promising business prospects. However, building a partnership between Fintech and banks face several obstacles. A paradigm of the shadow banking business model of Fintech has been perceived as a threat to the existence of the banking business. Fintech associations and banking associations play a major role in supporting the creation of an efficient collaboration between Fintech and banking institutions.

Industrial risks

The collapse of dozens of P2P lending companies in China in 2015 triggered a shock to the P2P lending industry in China [24]. The causes include mismanagement, the inexistence of a regulatory framework, and moral hazard.

Table 5: Regulatory challenges

Classification	Challenges
Users’ supervision and protection Balancing Innovation and Regulation	1. Regulation on data protection and consumer protection 2. Mitigating the impact of repayment failure 3. Balancing innovation and customer protection 4. Balancing innovation and profitability
Expected quality and flexibility	5. Challenges in providing cost-efficient regulation 6. Impact of debt restructuring on P2P lending companies’ sustainability and Profitability
Coordination and collaboration	7. The difficulties in orchestrating regulations produced by different institutions

Table 6: Social challenges

Classification	Challenges
Public values	1. Low perceived benefit by the end-users 2. Low trust in the system 3. Potential disruption to business as usual
Culture and ethics	4. Gender and regional discrimination 5. Ethical issues in the system’s intervention 6. Intentional and unintentional moral hazard 7. Illegal P2P lending system
Geography, demography, ecosystem	8. Geographical and demographical challenges due to archipelagic country 9. Challenges in the enforcement of network effect

4.4 Regulatory challenges

In the case of Indonesia, the government does not regulate detailed aspects of technology and analytics in the P2P lending business model. The emphasis on regulations is on *customer protection*, i.e., Fintech company must be aware of customer rights in their lending schema and operational activity. The second challenge related to user protection is *personal data protection*. Not all countries have laws on personal data protection, though personal data is prone to misuse for the interests of certain groups. The personal data protection law in Indonesia is in the drafting process and is expected to be ratified shortly.

The next challenge is supervision and monitoring. Micro entrepreneurs need supervision from the government in at least two aspects: 1) increasing capabilities, and 2) expanding opportunities to be recommended to potential investors. The government encourages innovations that provide more access to credit, however, innovation advancement is often accompanied by the challenges of consumer protection [26]. Ensuring that the business schemes not only increase inclusion and profitability but also maintain consumer protection, is remain a challenge. For example, how to design a regulation that mitigates the impact of repayment failure, how to protect end-users from the potential misuse of personal data, and how to design a regulation that balances the need for inclusiveness and companies’ profitability. Moreover, interview results revealed that regulations issued by different institutions sometimes are contra-productive to P2P lending companies and increase operational costs.

4.5 Social challenges

Public values

Robust technology alone cannot improve inclusiveness without the availability of ecosystems that could perceive the benefit of the P2P lending system. For example, a closed society that used to get credit from family or relatives could not easily understand how P2P lending creates value added to their life. This situation could be complicated by voluntary barriers, such as culture, religion, and trust issues with the financial system. Technology does not have to change the culture or the existing value, yet technology and innovation can be adopted while maintaining local wisdom.

Culture and ethics

Bias in investment decisions could also be caused by regional discrimination [47] and gender discrimination [12]. Discrimination does not always occur on purpose; it could be due to bias in data sources which results in the algorithm that tends to provide recommendations for borrowers in certain areas and exclude others. Another social challenge is *ethical issues*. The model can be intervened to exclude people with a certain ethnicity, race, region, and income level. Moreover, moral hazard is not always intentional but could occur due to ignorance. For example, repayment failures might occur because borrowers failed to understand credit risk, interest rates, and the obligation for repayment. Furthermore, a salient challenge in the P2P lending business is *illegal P2P lending*. Monitoring and imposing sanctions on illegal P2P lending systems are laborious. Illegal companies can quickly change their name and then carry out lending activities. The rise of illegal P2P lending not

Table 7: Challenges in Literacy and Awareness

Classification	Challenges
Literacy index	1. Low index of financial literacy and digital literacy
Gaps of Literacy and Inclusiveness	2. High gaps in inclusiveness and literacy
Awareness and education	3. Lack of awareness of risk, digital security, and data privacy

only threatens the stability of the financial industry but also creates a negative reputation for the P2P lending business in general, causing people’s reluctance to use the system.

Geography, demography, and ecosystem

Each country has its own contextual challenges which might not be comparable with others. For example, Indonesia is an archipelagic country with a challenge to connect thousands of islands for equal access to finance. Furthermore, ecosystem exploration requires adequate cooperation between the government and Fintech. For example, the collaboration of government and Fintech in designing an environment that encourages the creation of a network effect between MSEs. Moreover, collaboration and cooperation of SMEs are expected to improve their business capabilities which leads to better individual scorings.

4.6 Challenges in Literacy and Awareness

Statistically, the financial inclusion index in Indonesia has been increasing from year to year, meaning that there has been an increase in public exposure to financial products and services, including credit. The challenge is the gaps in inclusion and literacy. It means, there is a lack of understanding of the financial products that the people have access to. For example, do not fully understand about interest rate and how it impact payment obligations, and unaware of personal data privacy and digital security.

An adequate level of literacy is required to strengthen the capabilities of borrowers, especially micro-small enterprises. For example, how to prepare financial reports that reflect repayment capability; how to choose a lending schema that aligns with their business goal; and how to differentiate cash loans, debt financing, and supply chain financing. The government plays a vital role in designing and distributing educational materials related to financial literacy, digital literacy, and digital financial literacy. A gap between inclusion and literacy is inevitable; the policy goal is to minimize the gap so that society able to utilize financial products efficiently and minimize moral hazard.

5 CONCLUSIONS

Our analyses revealed three important findings. *First, challenges are not always discussed in scientific journals.* We retrieved more information about challenges to designing inclusive P2P lending systems from interviews (thirty-eight distinct challenges) than from the literature (seventeen distinct challenges). Most of the challenges found in the literature were explained in more detail in the interview sessions, therefore, we need to classify them into several new sub-challenges. Furthermore, several sub-challenges are new and rarely discussed in the literature about the P2P lending system. For example, *from the technological aspects*, we recognize: 1) the importance of designing a simple user interface, which is preferable

for unbanked and remote market segments, and 2) the importance of historical data interconnection in mitigating moral hazard. *From the business aspect*, the interview results revealed that a need-based lending schema is more essential to society rather than robust and advanced application features. *In terms of data privacy*, the literature mostly focuses on the technical aspects of analyzing scattered and hidden information instead of how to properly regulate a potential violation of data privacy. Furthermore, *the supervision of the P2P lending industry* is suggested to not only focus on Fintech companies but also the supervision of SMEs to improve their capabilities, such as in creating financial reports. A failure to obtain credit sometimes occurs due to the inability of SMEs to present a proper financial report. *From the social aspect*, there is a lack of literature that emphasizes how perceived benefits could improve engagement in the system. Moreover, a low index of literacy and education is also rarely discussed in the literature. Low literacy is one of the involuntary factors that block inclusiveness. An accessible system might not be utilized if society is unaware of its value added.

The second finding is the interconnectedness among the challenges. Trust in the system, for example, is connected with the system’s performance, information asymmetry, reputation, regulation, perceived benefit, transparency, and moral hazard. *Trust in the system* is the most discussed challenge in the interview sessions (D=11). *The system*, in this case, is not merely about technology and applications, yet about P2P lending systems in general including aspects of regulation, data protection, and consumer protection. Low trust creates a reluctance to get involved in the P2P lending system. In contrast, high trust gets people voluntarily participate in the system and increases the network effect. Another example of interconnectedness is the stability of the P2P lending industry (D=4) which is connected to the literacy index, industrial standards, moral hazard, and illegal lending companies. Furthermore, the list of challenges shows the crucial need for collaboration and coordination among stakeholders to provide a conducive environment to balance innovation and customer protection. For example, the improvement of literacy, awareness, and education is a shared responsibility between the government and the P2P lending industry. The goals of the improvement of education and literacy are not only to mitigate credit risk and maximize financial benefits but also to improve the capacity of the BoP market and micro-enterprises in enhancing knowledge and skills.

The third finding is about the need for a guideline in designing inclusive P2P lending systems. The majority of respondents are aware that challenges in improving inclusiveness are not merely technological aspects. Technology has become available, yet society is still reluctant to use the system due to a lack of a good design, no sense of urgency, and an inability to perceive the potential benefits. It is

important to construct a paradigm that the available technology has significant value added and provides more opportunities to improve the quality of life. However, we cannot ignore challenges related to technology. The network of challenges indicates that there are at least eleven distinct challenges related to technology, data, and analytics. In terms of numbers, the challenges in technology are the most compared to the other five areas (business, organization, regulation, social, and literacy). This means equal attention is needed for both technological and non-technological aspects.

The result of this study can be used as one of the baselines for policymakers and technology architects in designing inclusive P2P lending systems. For further research, we recommend conducting the case study in other developing countries to gain more insights into similar domains. In addition to inclusiveness, other public values such as fairness and transparency could be taken into attention in further research about the P2P lending system.

REFERENCES

- [1] Adriana, D. (2018). Regulating P2P lending in Indonesia: Lesson learned from the case of China and India. *Journal of Internet Banking and Commerce*, April 2018, vol. 23, no 1.
- [2] Ariza-Garzon, M.-J., Camacho-Milano, M.-D.-M., María-Jesús Segovia-Vargas, & Arroyo, J. (2021). Risk-return modelling in the p2p lending market: Trends, gaps, recommendations and future directions. *Electronic Commerce Research and Applications*. Volume 49, September–October 2021.
- [3] Au, C. H., & Sun, Y. (2019). The Development of P2P Lending Platforms: Strategies and Implications. *ICIS 2019 Proceedings. Crowds, Social Media and Digital Collaborations*.
- [4] Babaei, G., & Bamdad, S. (2020). A multi-objective instance-based decision support system for investment recommendation in peer-to-peer lending. *Expert Systems with Applications*. Volume 150, 15 July 2020, 113278.
- [5] Bachmann, A., Becker, A., Buerckner, D., Hilker, M., Kock, F., Lehmann, M., ... Funk, B. (2011). Online Peer-to-Peer Lending – A Literature Review. *Journal of Internet Banking and Commerce* 16(2).
- [6] Beck, T. (2020). Fintech and financial inclusion: Opportunities and pitfalls. *ADB Working Paper Series*, No. 1165.
- [7] Bellotti, T., & Crook, J. (2009). Support vector machines for credit scoring and discovery of significant features. *Expert Systems with Applications*. Volume 36, Issue 2, Part 2, March 2009, 3302-3308.
- [8] Berentsen, A., & Markheim, M. (2021). Peer-to-peer lending and financial inclusion with altruistic investors. *International Review of Finance*. 2021;21, 1407–1418.
- [9] Berger, S. C., & Gleisner, F. (2009). Emergence of Financial Intermediaries in Electronic Markets: The Case of Online P2P Lending. *BuR - Business Research*. VHB - Verband der Hochschullehrer für Betriebswirtschaft, German Academic Association of Business Research, Göttingen, Vol. 2, Iss. 1, 39-65.
- [10] Can Li, Y. Z. (2016). Game Theory Analysis of P2P Regulation. *13th International Conference on Service Systems and Service Management, ICSSSM*.
- [11] Caplescu, R. D., Panaite, A.-M., Pele, D. T., & Strat, V. A. (2020). Will they repay their debt? Identification of borrowers likely to be charged off. *Management & Marketing: Challenges for the Knowledge Society* 15(3):393-409. September 2020.
- [12] Chen, D., Li, X., & Lai, F. (2017). Gender discrimination in online peer-to-peer credit lending: evidence from a lending platform in China. *Electronic Commerce Research; New York Vol. 17, Iss. 4, (Dec 2017)*, 553-583.
- [13] Chen, D., Lou, H., & Slyke, C. V. (2015). Toward an understanding of online lending intentions: Evidence from a survey in China. *Communications of the Association for Information Systems Volume 36 Article 17*.
- [14] Chen, X., Zhou, L., & Wana, D. (2016). Group social capital and lending outcomes in the financial credit market: An empirical study of online peer-to-peer lending. *Electronic Commerce Research and Applications* 15, 1-13.
- [15] Cho, P., Chang, W., & Song, J. W. (2019). Application of Instance-Based Entropy Fuzzy Support Vector Machine in Peer-To-Peer Lending Investment Decision. *IEEE Access*, vol. 7, 16925-16939.
- [16] Collier, B., & Hampshire, R. (2010). Sending Mixed Signals: Multilevel Reputation Effects in Peer-to-Peer Lending Markets. *Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW*.
- [17] Eisenhardt, K. M. (1989). Agency Theory: An Assessment and Review. *The Academy of Management Review*, Vol. 14, No. 1 (Jan., 1989), 57-74.
- [18] Findex. (2017). 2017 Findex Full Report. *Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution*.
- [19] Gailmard, S. (2012). Accountability and Principal-Agent Models. In *Oxford Handbook of Public Accountability*. Edited by Mark Bovens, Robert E. Goodin, and Thomas Schillemans.
- [20] Giudici, P., Hadji-Misheva, B., & Spelta, A. (2019). Network Based Scoring Models to Improve Credit Risk Management in Peer to Peer Lending Platforms. *Frontiers in Artificial Intelligence* 2. May 2019.
- [21] Guo, G., Zhu, F., Chen, E., Liu, Q., Wu, L., & Guan, C. (2016). From footprint to evidence: An exploratory study of mining social data for credit scoring. *ACM Transactions on the Web* 10(4). December 2016.
- [22] Guo, Y., Zhou, W., Luo, C., Liu, C., & Xiong, H. (2016). Instance-based credit risk assessment for investment decisions in P2P lending. *European Journal of Operational Research* 249, 417–426.
- [23] Hannig, A., & Jansen, S. (2010). Financial Inclusion and Financial Stability: Current Policy Issues. *Asian Development Bank Institute Working Paper Series*. December 2010. No 259.
- [24] He, F., Li, Y., Xu, T., Yin, L., Yin, L., & Zhang, X. (2020). A Data-Analytics Approach for Risk Evaluation in Peer-to-Peer Lending Platforms. *IEEE Intelligent Systems*, vol. 35, no. 3, 1 May–June 2020, 85-95.
- [25] Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in Information System. *MIS Quarterly*. Volume 28, Issue 1, March 2004, 75–105.
- [26] Huang, R. H. (2018). Online P2P Lending and Regulatory Responses in China: Opportunities and Challenges. *Eur Bus Org Law Rev* (2018) 19, 63–92.
- [27] Jagtiani, J. (2017). Fintech Lending: Financial Inclusion, risk pricing, and alternative information. *Working paper No 17-17 Research Department*.
- [28] Jinghua, W., & Rong, F. (2010). An intelligent agent system for borrower's recommendation in P2P lending. *2010 International Conference on Multimedia Communications (Mediacom 2010)*, 179-182.
- [29] Ke, X., Chen, Y., & Du, H. S. (2016). Achieving mobile social media popularity: An empirical investigation. *Pacific Asia Conference on Information Systems, PACIS 2016 - Proceedings*.
- [30] Khan, H. R. (2012). Financial Inclusion and Financial Stability: Are They Two Sides of the Same Coin? *RBI Monthly Bulletin* March 2012.
- [31] Kim, J.-Y., & Cho, S.-B. (2019). Predicting repayment of borrows in peer-to-peer social lending with deep dense convolutional network. *Expert Systems*. 2019; 36.
- [32] Kohardinata, C., Soewarno, N., & Tjahjadi, B. (2020). Indonesian peer to peer lending (P2P) at entrant's disruptive trajectory. *The research journal Business: Theory and Practice*, 21(1), 104–114. 17 February 2020.
- [33] Komarova Loureiro, Y., & Gonzalez, L. (2015). Competition against common sense: Insights on peer-to-peer lending as a tool to allay financial exclusion. *International Journal of Bank Marketing*. Bradford Vol. 33, Iss. 5, (2015): 605-623.
- [34] Kumra, R., Khalek, S. A., & Samanta, T. (2021). Factors Affecting BoP Producer Intention to Use P2P Lending Platforms in India. *Journal of Global Marketing*. 28 Apr 2021.
- [35] Lilienthal, J. F. (2016). Peer to peer lending and financial inclusion in Brazil: a case study. *FGV EAESP - MPGI: Dissertações, Mestrado Profissional em Gestão Internacional* [317].
- [36] Luo, C., Xiong, H., Zhou, W., Guo, Y., & Deng, G. (2011). Enhancing investment decisions in P2P lending: An investor composition perspective. *Conference: Proceedings of the 17th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, San Diego, CA, USA, August 21-24, 2011*.
- [37] Milne, A., & Parboteeah, P. (2016). The Business Models and Economics of Peer-to-Peer Lending. *ECRI Research Report No 17*.
- [38] Ping, H., Yulin, Z., Mengli, H., & Xuemei, L. (2019). Research on the Entry Threshold of P2P Lending Platform Considering the Social Reputation Level of Borrowers. *2019 16th International Conference on Service Systems and Service Management (ICSSSM)*, 1-6.
- [39] Queralt, J. (2016). A Human Right to Financial Inclusion. In S. G. Gaisbauer H., *Ethical Issues in Poverty Alleviation*. Studies in Global Justice, vol 14. (pp. 77-92). Cham: Springer.
- [40] Ravishankar, M. N. (2021). Social innovations and the fight against poverty: An analysis of India's first prosocial P2P lending platform. *Information Systems Journal*.
- [41] Ren, K., & Malik, A. (2019). Recommendation Engine for Lower Interest Borrowing on Peer to Peer Lending (P2PL) Platform. *2019 IEEE/WIC/ACM International Conference on Web Intelligence (WI)*, 265-269.
- [42] Reza-Gharehbagh, R., Hafezalkotob, A., Asian, S., Makui, A., & Zhang, A. N. (2020). Peer-to-peer financing choice of SME entrepreneurs in the re-emergence of supply chain localization. *International Transactions in Operational Research*. Res. 27, 2534–2558.
- [43] Rijmenam, M. v., Schweitzer, J., & Williams, M.-A. (2019). Overcoming principal-agent problems when dealing with artificial agents: Lessons for governance from a conversation with Tay.
- [44] Rizal, M., Maulina, E., & Kostini, N. (2018). Fintech as one of the financing solutions for SMEs. *Jurnal Pemikiran dan Penelitian Administrasi Bisnis dan Kewirausahaan*. Vol.3, No. 2, Agustus 2018, DOI : <https://doi.org/10.24198/adbispreneur.v3i2.17836>, 89-100.
- [45] Sarkar, S. (2021). Centralized Borrower and Lender Matching under Uncertainty for P2P Lending. *WWW '21: Companion Proceedings of the Web Conference 2021*. April 2021, 269-273.

- [46] Serrano-Cinca, C., & Gutiérrez-Nieto, B. (2016). The use of profit scoring as an alternative to credit scoring systems in peer-to-peer (P2P) lending. *Decision Support Systems* 89, 113–122.
- [47] Shi, L., & Zhang, L. (2016). Regional discrimination in P2P lending of China. *Proceedings of the International Conference on Electronic Business (ICEB)*.
- [48] Shi, X., Wu, J., & Hollingsworth, J. (2019). How does P2P lending platform reputation affect lenders' decision in China? *International Journal of Bank Marketing*. 10 September 2019.
- [49] Sulastri, R., & Janssen, M. (2022). The elements of the Peer-to-peer (P2P) lending system. A Systematic Literature Review. *ICEGOV 2022, October 04–07, 2022*.
- [50] Suryanto, S., Tahir, R., & Dai, R. M. (2020). Fintech as a Catalyst for Growth of Micro, Small and Medium Enterprises in Indonesia. *Academy of Strategic Management Journal*.
- [51] Suryono, R. R., Purwandari, B., & Budi, I. (2019). Peer to peer (P2P) lending problems and potential solutions: A systematic literature review. *Procedia Computer Science*. Volume 161, 2019, Pages 204-214.
- [52] Tan, Y., Zheng, X., Zhu, M., Wang, C., Zhu, Z., & Yu, L. (2017). Investment Recommendation with Total Capital Value Maximization in Online P2P Lending. *017 IEEE 14th International Conference on e-Business Engineering (ICEBE)*, 159-165.
- [53] Xia, Y., Liu, C., & NanaLiu. (2017). Cost-sensitive boosted tree for loan evaluation in peer-to-peer lending. *Electronic Commerce Research and Applications*. Volume 24, July–August 2017, 30-49.
- [54] Yan, J., Yu, W., & Zhao, J. L. (2015). How signaling and search costs affect information asymmetry in P2P lending: the economics of big data. *Financial Innovation (2015) 1:19*. DOI 10.1186/s40854-015-0018-1.
- [55] Ye, X., Dong, L.-a., & Ma, D. (2018). Loan evaluation in P2P lending based on Random Forest optimized by genetic algorithm with profit score. *Electronic Commerce Research and Applications*. Volume 32, November–December 2018, Pages 23-36, 23-36.
- [56] Yum, H., Lee, B., & Cha, M. (2012). From the wisdom of crowds to my own judgment in microfinance throughonline peer-to-peer lending platforms. *Electronic Commerce Research and Application*. Volume 11, Issue 5, September–October 2012, 469-483.
- [57] Zhang, N., & Wang, W. (2019). Research on balance strategy of supervision and incentive of P2P lending platform. *Emerging Markets Finance and Trade*. Volume 55, 2019 - Issue 13.
- [58] Zhao, H., Liu, Q., Wang, G., Ge, Y., & Chen, E. (2016). Portfolio Selections in P2P Lending: A Multi-Objective Perspective. *Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*. August 2016, 2075–2084