IMAGE: A MAP OF THE STARS OF THE ORION CONSTELLATION

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Erik Fontenele Nybo, Lorena Cristina Dutra Cardoso, Laura Mattos Fernandes & Jeronimo Roveda

ABSTRACT

Quilombola communities in Brazil have been interacting with Public and private sectors to develop carbon offset projects. However, governance in these initiatives faces structural challenges due to the technical jargon used in formal written documents and one-sided decision-making models. Issues like these conflict with the oral tradition, collectivity, and cultural practices of these quilombola communities, barring the exercise of their rights and hindering their development. This article analyses how the use of Legal Design techniques help to strengthen the political autonomy and self-management capacity of quilombola communities. By removing language barriers from carbon offset agreements that help the development of quilombola communities, these communities may reach higher levels of understanding of the project's governance, and result in better agreements for the community.

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Empowering Quilombola Communities Through Legal Design and Accessible Governance

Erik Fontenele Nybo[α], Lorena Cristina Dutra Cardoso[σ], Laura Mattos Fernandes[ρ] & Jeronimo Roveda[ↀ]

ABSTRACT

Quilombola communities in Brazil have been interacting with Public and private sectors to develop carbon offset projects. However, governance in these initiatives faces structural challenges due to the technical jargon used in formal written documents and one-sided decision-making models. Issues like these conflict with the oral tradition, collectivity, and cultural practices of these quilombola communities, barring the exercise of their rights and hindering their development. This article analyses how the use of Legal Design techniques help to strengthen the political autonomy and self-management capacity of quilombola communities. By removing language barriers from carbon offset agreements that help the development of quilombola communities, these communities may reach higher levels of understanding of the project's governance, and result in better agreements for the community.

Keywords: legal design, governance, carbon credits, quilombola community, autonomy.

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I. INTRODUCTION

"Governance" means "to steer" or "to lead," especially in the context of navigation[1] . Just as in the command of a ship, where a structure (the vessel) is managed for the sake of common goals, in modern society, the term "governance" refers to the instruments and models of self-management through which a group of people regulates its relations[2]. Historically, we have moved from simpler structures of power to highly robust, political and bureaucratic systems.

Despite this definition, there is no single model that is universally applicable to all groups of people, given that governance is directly influenced by factors such as the historical, economic, political, and cultural context in which it will be applied[3] . Thus, these elements shape the mechanisms through which management will occur, resulting in different models of governance that vary according to the social organisation and needs of each group.

In Brazil, quilombola communities are ethnic groups that define themselves based on their relationship with the territory, their ancestry, and their own cultural practices[4] . The lands occupied by these communities are protected by federal law and are part of a historical and political reparation, in order to preserve their own culture[5].

[1] GOUVÊA, Carlos Portugal. The Structure of Corporate Governance. São Paulo: Quartier Latin, 2022, p.27.
[2] GOUVÊA, Carlos Portugal. The Structure of Corporate Governance. São Paulo: Quartier Latin, 2022, p.28.
[3] DE ABREU, Jorge Manuel Coutinho. Corporate Governance. 2nd ed. Portugal: Coimbra, 2010, p.20.
[4] INCRA. Quilombolas. Available at: https://www.gov.br/incra/pt-br/assuntos/governanca-fundiaria/quilombolas. Accessed on: 10 Dec. 2025.
[5] *Ibid.*

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Inside these communities, oral tradition and symbolism persist in their cultural and organisational manifestations. However, they are not segregated from the current economy. Therefore, they have to enter into governance structures and documents that are not natural to the quilombola tradition. Most of these government documents assume that its readers will have a high level of technical education to understand the legal terms. Meanwhile, the illiteracy rate in quilombola communities is 2.7 times higher than the average for the general Brazilian society, according to the 2022 Demographic Census[6] . In this context, the application of a governance model that is not familiar to quilombolas and makes excessive use of technical jargon represents a significant obstacle to the internalisation of legal concepts in these communities. Thus, the difficulty in understanding this content can be an obstacle to the exercise of quilombola rights and hinder the integration of the community with other subjects of law.

At the same time, concerns about the comprehension of legal documents have led to the creation of new methodologies within the law, in order to incorporate knowledge from other areas into this science. Research conducted around the world has already found out that most people face challenges understanding legal terms and documents[7] . In this context, legal design emerged as a technique of creating legal documents according to the users needs by using design principles[8].

In this sense, a question emerges: in quilombos, where oral tradition is highly valued, could it be possible to combine law and design to increase transparency about governance and facilitate the integration of this kind of community with other subjects of law?

The hypothesis is that the intersection is possible due to the techniques and resources present in design. By its nature, Legal Design has the ability to translate complex information into more understandable formats. Thus, the combination of visual, audiovisual, and narrative resources can assist in the construction of structured governance and foster these communities' right to understanding.

Therefore, this article aims to examine the extent to which design, through audiovisual resources, can support the understanding of quilombola communities' governance by its own members and decision-makers. To this end, we will conduct a literature review of topics related to this research. In addition, we will analyse its application in a specific case, in which the private sector negotiates carbon credits with quilombola communities.

II. QUILOMBOLAS AND GOVERNANCE IN CARBON OFFSET PROJECTS

Quilombola communities are Afro-Brazilian settlements that originated in the 16th century, primarily in the northeastern region of Brazil. These communities were formed by escaped slaves (quilombolas) who resisted the transatlantic slave trade and the oppressive regime of slavery in Brazil.

[6] IBGE. 2022 Census: illiteracy among quilombolas is almost three times higher than in the country's total population. Available at: https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/40703-censo-2022-analfabetismo-entre-quilombolas-e-quase-tres-vezes-maior-do-que-na-populacao-total-do-pais. Accessed on: 11 Dec. 2025.

[7] World Commerce & Contracting, in empirical research, found that 9 out of 10 managers find contracts in general difficult to read or understand. World Commerce & Contracting. 10 Pitfalls to avoid in contracting. Available at: < https://www.worldcc.com/Resources/Content-Hub/details/Ten-Pitfalls-to-Avoid-in-Contracting. Accessed on 11 January 2025.
In a survey conducted by Bits Academy (2020) with 463 anonymous volunteers from different regions of the country, 92% of respondents opted for the document with design elements over the traditional version. In addition, when analysing the reading pattern of the documents, it was concluded that users interacted more with documents that had Legal Design elements compared to traditional documents, which means that, in some way, it is able to retain the user's attention for longer. BITS ACADEMY. Survey analysing the behaviour of users of legal documents. Accessed on: 8 October 2024.

[8] HAGAN, Margareth. Law By Design. Available at: https://lawbydesign.co/. Accessed on: 4 Jan. 2025.

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During the transatlantic slave trade, millions of enslaved Africans were forcibly brought to Brazil. Many of these enslaved individuals resisted their captivity, and some managed to escape to remote regions, such as forests, mountains, and swamps. These escaped slaves, known as quilombolas, formed their own settlements, called quilombos. The quilombos became autonomous communities, often with their own systems of governance, agriculture, and cultural practices.

Brazil abolished slavery in 1888, with the signing of the Lei Áurea (Golden Law) by Princess Isabel. However, the abolition of slavery did not lead to significant changes in the social and economic structures of the country, and quilombola communities continued to face significant challenges, including land expropriation, violence, and marginalisation.

In the 20th century, quilombola communities faced increasing pressure from government policies aimed at modernising agriculture, expanding infrastructure, and promoting economic development. Many quilombola lands were expropriated, and their inhabitants were forced to migrate to urban areas, where they faced racism, poverty, and social exclusion.

The 1988 Brazilian Constitution recognised the rights of quilombola communities to their ancestral lands[9] , marking a significant turning point in the struggle for quilombola rights. Article 68 of the Constitution states that "quilombola communities are entitled to the definitive ownership of their lands, and the state shall ensure their protection and the protection of their cultural heritage."

Since then, several government agencies and non-governmental organisations (NGOs) have worked to support quilombola communities, including the creation of the National Programme for the Sustainable Development of Quilombola Communities (Programa Nacional de Desenvolvimento Sustentável das Comunidades Quilombolas, or PNDSCQ) in 2003.

These traditional communities are important vectors in the protection of tropical forests[10] . Roveda and Suruí point out that "recognising the value of forests is also recognising the rights of the peoples who have protected them for centuries"[11] . Thus, several initiatives have emerged through public-private partnerships with these communities in order to find viable alternatives to protect the environment. These possibilities include carbon projects, which assign economic value to environmental conservation, promote income generation for traditional communities, and strengthen their autonomy in managing their territories.

Focusing on the particular case analysed by this article, the AWA REDD+ Project aims to use the resources generated by the sale of carbon credits to finance activities that protect forests and develop the quilombola communities of Gurupá, in Pará.

The AWA Project is a partnership between the Association of Remaining Quilombo Communities of Gurupá – Pará (ARQMG), which owns the territory, and Carbonext, a company that implements and manages carbon projects by providing technical support, monitoring emissions and facilitating the sale of carbon credits generated.

To ensure efficient and transparent management of resources, the governance of the AWA Project was collectively structured by quilombo leaders through two community organisations, which divide the proceeds from the sale of carbon credits equitably: ARQMG and the Agroextractivist Cooperative of the Remnants of Quilombos Defenders of the Forest of Gurupá (COOPAWA). Each of these institutions has its own responsibilities, but they converge towards the ultimate goal of the Project.

[9] BRAZIL. Constitution (1988). Constitution of the Federative Republic of Brazil. Articles 215, 216 and 68 of the Transitional Constitutional Provisions Act (ADCT). Official Gazette, Brasília, 5 Oct. 1988.

[10] ROVEDA, Jerônimo; SURUÍ, Almir. REDD+ in collective territories: potential, challenges and the right to understanding. In: DALLAN, Janaina; FONSECA, Luciano Corrêa da (Eds.). Nature-based solutions: the market that can save the planet. São Paulo: Carbonext, 2025. p. 40.

[11] *Ibid.*

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Among the various materials inherent to the project, a Governance Manual was created to serve as a guiding tool in complying with the rules for the use of financial resources. In addition, other materials were used to support the leaders' decisions and explain how carbon credits would be traded, as well as the rights and duties of those involved.

Despite significant advances in forms of communication, from radio programmes to social networks, maintaining a constant understanding of the project and updating information is imperative for the success of the partnership. Projects that do not have transparent and clear communication with such groups run the risk of "reproducing inequalities, reinforcing power asymmetries, and even compromising the credibility of carbon markets[12] ". In analysing the challenges faced by REDD+ projects, Roveda points out that, in order to build something assertive and permanent, such initiatives must be led by the communities themselves[13] .

Protecting the forest begins with protecting the right of indigenous peoples to fully understand the projects that impact their lives and territories. Only then can the dialogue between indigenous and non-indigenous knowledge promote a true balance between economy, culture, environment, and social justice.[14]

In this regard, within quilombola communities, oral tradition plays a central and structuring role. It is an ancestral system that allows for the transmission of knowledge, the negotiation of conflicts, the legitimisation of authority and the building of collective consensus. Legitimacy is not based on written rules, but on social ties, reputation, community recognition, and experience. Meetings, conversation circles, celebrations, and assemblies are deliberative spaces in which important decisions are discussed, experiences are shared, and collective memory is preserved.

Given this scenario, could it be possible to enhance the results of carbon projects through governance that is widespread and understood by the quilombolas? Can audiovisual resources be allies in the quilombola community's understanding of this governance? These are some of the points that will be analysed in the following sections of this article.

III. THE TURNING POINT: FROM WRITTEN TEXT TO VISUAL NARRATIVE

The documents used to structure governance are based on legal frameworks that follow a comprehensive reading pattern for those who are not accustomed to their language[15]. So, how can this legal content be brought closer to the quilombolas in a way that facilitates its assimilation?

The proposal of legal design is precisely to combine user experience and design to build documents, narratives, and resources that are intuitive, useful, and engage the end user[16] . To this end, the expectations and characteristics of the audience that will receive the message are taken into account[17] .

There are several cases around the world that already demonstrate the power of this methodology for democratising legal and overly technical content. In 2016, Robert de Rooy created comic book contracts so that illiterate fruit pickers in South Africa could understand the terms of the

[12] ROVEDA, Jerônimo; SURUÍ, Almir. REDD+ in collective territories: potential, challenges and the right to understanding. In: DALLAN, Janaina; FONSECA, Luciano Corrêa da (Eds.). Nature-based solutions: the market that can save the planet. São Paulo: Carbonext, 2025. p. 40.
[13] *Ibid, p. 41.*
[14] *Ibid, p.43.*

[15] NYBO, Erik Fontenele. Legal Design: The application of design resources in the drafting of legal documents. In: FALEIROS JÚNIOR, José; CALAZA, Tales (Coord.). Legal Design:theory and practice. 2nd ed. São Paulo: Editora Foco, 2023. p. 3-14.
[16] HAGAN, Margareth. Law By Design. Available at: https://lawbydesign.co/. Accessed on: 04 Jan. 2025.
[17] HAAPIO, Helena. Lawyers as designers, engineers and innovators: better legal documents through information design and visualisation. In: SCHWEIGHOFER, Erich et al. (Eds.). Transparency. Proceedings of the 17th International Legal Informatics Symposium IRIS 2014. Available at: https://ssrn.com/abstract=2651066. Accessed on: 12 Dec. 2024.

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contracts they were signing[18]. To this end, he used cultural elements characteristic of that community, both to bring the content closer to the reader and to facilitate its absorption[19].

With the support of Carbonext, Bits Legal Design accepted the challenge of using simple reading elements and graphic resources to facilitate the understanding of the governance of the AWA Project by the quilombola communities of Gurupá – Pará. Understanding governance in a quilombola community requires, among other analyses, a special focus on community communication, in order to ensure indigenous peoples' right to self-determination and participation in decisions that affect their lives. In other words, recognising the ancestry, autonomy and deliberative citizenship of these peoples.

From cooperatives and associations to traditional committees and leaders, different organisations coexist in the territory. The community association and the cooperative have fundamental and different institutional roles in the economic and political development of the community, but they remained misunderstood by a large part of the local population. There is therefore a need to fill a gap in the definition of responsibilities in the day-to-day management of the community.

The absence of visual narrative mechanisms in the traditional governance of the project created obstacles to the exercise of rights and understanding of content. Among the possible communication strategies, the audiovisual format was chosen for its greater compatibility with the communication practices of quilombola communities, in which oral tradition and visual resources play a central role in the transmission of knowledge and collective organisation.

Initially, we sought to map the level of local understanding of governance in order to identify gaps in the community's perception of the topic. We observed that formal documents were read and interpreted by few, and for the vast majority, the vocabulary caused confusion and doubts. The use of technical terms and jargon created a disconnect between the normative content and the community's everyday experience, sometimes taking on a tone of authority that reinforced mistrust and widened the gap between what was formally envisaged and what was actually practised in the local context.

The low level of understanding of issues related to quilombola community governance directly affects the community's autonomy and participation in decision-making, leading to confusion about institutional roles, a lack of identification with positions, and dependence on third parties to interpret rules.

In developing the legal design project, rather than simply interpreting the community's culture, we sought co-authorship between the community, Carbonext, and Bits. The legal design application process occurs in two major stages: reformulation of the text and application of the design to the content. Initially, the script was developed, with the organisation of information and application of techniques such as plain language and UX writing (user-focused writing). Next, a preliminary version of the video was produced, used to validate the narrative and communication elements, which later culminated in the delivery of the final version. All stages were conducted collaboratively, with continuous exchanges with Carbonext, especially through the contributions of Jeronimo Roveda and Andressa, who helped align the material with the reality and dynamics of the quilombola community.

The video was conceived using the design thinking methodology, i.e., based on three pillars: empathy, collaboration, and experimentation, to generate a user-centred experience. The methodology is not only convenient but necessary, given the cultural and comprehensive barriers caused by the historical marginalisation of these people, who need to be placed at the centre of the narrative.

[18] DE ROOY, Robert. Financial Services Provider Contract, Creative Contracts. Available at: https://creative-contracts.com/fsp. Accessed on 12 Dec. 2025.

[19] ROSENVALD Nelson. Contracts in comics. FALEIROS JÚNIOR, José; CALAZA, Tales (Coord.). Legal Design: theory and practice. 3rd ed. São Paulo: Editora Foco, 2023. p. 139-151.

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Design thinking applied in the context of indigenous peoples has already proven effective in other instances. One example is a study conducted by three researchers from the Federal University of Western Pará (UFOPA) that investigated how design thinking could strengthen female entrepreneurship in a traditional community in the Tapajós National Forest (FLONA) in Pará. The results show that design thinking contributed to adding value to bio-businesses, increasing income generation, strengthening female leadership and traditional knowledge[20].

Thus, the audiovisual structure was built with simple oral language, close to community speech, visual metaphors representing institutional roles, a soundtrack corresponding to local cultural elements, characters inspired by the community itself, scenes that show "how it works" and not just "what it is," and narration in a human voice with a characteristic accent.

The prototype stage is essential for collectively validating the audiovisual material. This makes it possible to assess the level of understanding of the message, as well as the degree of identification and representativeness of the content with the audience, enabling adjustments in communication, the identification of information gaps, and the guarantee of cultural legitimacy. As a result of this participatory process, direct contributions from the community were incorporated, such as the inclusion of local statistical data in the script.

With the completion of the prototyping, the actual audiovisual production begins, incorporating footage of real scenes from everyday community life, the use of regional soundtracks to generate identification, and a combination of real scenes with animations based on the iconography validated in the prototype to generate a hybrid pedagogical effect. Audiovisual production transforms texts that were initially difficult to understand into a methodological bridge that recognises the quilombola community and transforms the community's relationship with rules and management, that is, it becomes a tool for the autonomy of a people. In this way, the community's understanding of the content was not an end in itself, but a means to strengthen collective organisation and the cohesion of the group as a whole.

[20] TAPAJÓS, Bárbara Fonseca Pinheiro Leão; LOBATO, Fábio Manoel França; NUNES, Kariane Mendes. Design thinking as a tool for generating biobusinesses with social impact and female entrepreneurship in the Amazon. *Estudos em Design*, Rio de Janeiro, v. 32, n. 2, p. 112–130, 2024. ISSN 1983-196X.

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IV. RESULTS: UNDERSTANDING AS A FORM OF AUTONOMY

As explained above, the transition from overly technical content to audiovisual content seeks to redefine the way of communicating in institutional documents within the quilombola community, arising from a diagnosis of the limits of understanding in relation to governance and the community's engagement with carbon projects.

The results of using these audiovisual resources in carbon credit projects should be understood as medium- and long-term processes, especially in community contexts marked by their own cultural dynamics. Considering that the project analysed is still in the early stages of implementation, it was not possible, at the time of completion of this research, to quantitatively measure its impacts in a systematic way. The consolidation of these participatory practices requires a broader time horizon for observing their effects.

Even so, the qualitative evidence observed during and after the presentation of the audiovisual material reveals significant receptivity on the part of the community. Participants demonstrated greater clarity regarding institutional obligations, the roles played by the different organisations involved, as well as the decision-making flows and implications of the carbon credit project. Spontaneous reports indicated that the audiovisual content contributed to reducing previously existing doubts and bringing formal governance concepts closer to the everyday reality of the community.

These initial signs, although tentative and not statistically measured, are relevant from a methodological and analytical point of view, as they indicate the capacity of audiovisual resources to enhance understanding of the rights and obligations involved in the governance of these projects. Improved understanding of governance mechanisms tends to have a positive impact on community participation, decision-making autonomy, and the internal legitimacy of institutional structures over time. Thus, preliminary results indicate that the use of audiovisual resources can have broader and more lasting effects on the consolidation of governance that is understood, participatory, and culturally aligned with quilombola communities.

V. CONCLUSION

The present research aims to analyse the extent to which the application of legal design, especially through audiovisual resources, can contribute to the understanding of governance in quilombola communities involved in carbon projects, strengthening their political autonomy and self-management capacity. It started from the recognition that governance is not limited to a set of normative techniques, but constitutes a sociocultural practice, deeply influenced by the modes of organisation, communication and production of meaning in each community.

In this sense, the intersection between governance and legal design proved to be viable and relevant for the creation of communication resources capable of translating complex legal structures into accessible narratives aligned with the quilombola oral tradition. The initial results show that legal design is not restricted to aesthetics or textual simplification, but operates as a methodology for the systemic reconstruction of legal communication, repositioning community members at the centre of the decision-making process.

The experience analysed demonstrates that understanding governance instruments is an indispensable condition for the exercise of autonomy. Understanding institutional roles, decision-making flows and responsibilities is not a secondary step, but a prerequisite for democratic participation and the internal legitimisation of collective decisions. The use of visual and audiovisual narratives pointed to a scenario that can contribute to strengthening community engagement in these projects and reducing dependence on external intermediaries for the interpretation of rules.

Finally, the quilombola experience presented in this study offers an important reference for the construction of more inclusive public policies, for the development of participatory models of

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governance in traditional communities, and for the consolidation of new legal epistemologies that break with colonial paradigms of documentation and authority. By integrating law, design, and culture, this work points to possible paths toward a more accessible, democratic law that is committed to the self-determination of traditional peoples.

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Financial Socialization and Personal Financial Management Behaviour of Women of Punjab: The Mediating Role of Digital Financial Literacy

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ABSTRACT

Personal financial management is a crucial concern for everyone in the society especially women as they have lack of financial skills needed for financial decisions. The current study aims to examine the influence of various financial socialization agents including family, peers, financial education, media and self-learning on personal financial management behaviour and also to determine the mediating role of digital financial literacy on this relationship. The study used quantitative techniques to collect data from 390 women respondents aged 18-45 to check their financial socialization through a self-administered structured questionnaire. The results of multiple regression revealed that various financial socialization agents significantly influence personal financial management behaviour and digital financial literacy partially mediate this relationship. This study's importance lies in its careful examination of the mediation pathways, which offers useful information to financial institutions, educators, and legislators. The uniqueness is in how digital financial literacy is combined with financial socialisation to provide a comprehensive grasp of the mechanisms driving women's personal financial behaviour and empower them in the digital age.

Keywords: financial socialisation agents, personal financial management behaviour, digital financial literacy, women.

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Kuldip Kaur

ABSTRACT

Personal financial management is a crucial concern for everyone in the society especially women as they have lack of financial skills needed for financial decisions. The current study aims to examine the influence of various financial socialization agents including family, peers, financial education, media and self-learning on personal financial management behaviour and also to determine the mediating role of digital financial literacy on this relationship. The study used quantitative techniques to collect data from 390 women respondents aged 18-45 to check their financial socialization through a self-administered structured questionnaire. The results of multiple regression revealed that various financial socialization agents significantly influence personal financial management behaviour and digital financial literacy partially mediate this relationship. This study's importance lies in its careful examination of the mediation pathways, which offers useful information to financial institutions, educators, and legislators. The uniqueness is in how digital financial literacy is combined with financial socialisation to provide a comprehensive grasp of the mechanisms driving women personal financial behaviour and empower them in the digital age. This study addresses the complex relationships examined in this multiple regression investigation, which helps to guide the creation of focused interventions to promote favourable financial outcomes.

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Keywords: financial socialisation agents, personal financial management behaviour, digital financial literacy, women.

I. INTRODUCTION

Financial Socialization refers to the process of acquiring financial knowledge, behaviour and norms from social agents like parents, peers, media, and educators. The complexity of financial products from physical to digital makes financial choices more difficult. People with lower levels of financial literacy find it difficult to understand digitalised financial products and make the right financial decisions. Digital Financial Literacy enhances one's ability to apply this knowledge in a digital environment—such as using mobile banking, UPI payments, budgeting apps, or digital investment platforms. Individuals who are socialized financially may not always be able to act effectively unless they are digitally literate. Especially in rural or underprivileged settings, DFL enables better access to formal financial services, thereby amplifying the effect of financial socialization. Basically, financial socialisation starts from home through interaction and communication on financial matters among family members. According to Ward (1974), individuals acquire the abilities, information, and mindset from family which is necessary to optimize their position as financial market consumers. (Gudmunson and Danes 2011; Kim & Chatterjee, 2013; Serido and Deenanath 2016) Financial socialization theory points out that children receive financial knowledge from their parents, which shapes their financial comprehension as they grow up and results in financial capacity, behaviour, and financial wellness. (Antoni et al, 2019; LeBaron, Marks,

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Rosa & Hill 2020) As individuals grew up, they learned the importance of money from their families, which helped them form lifelong positive attitudes toward personal financial management.

Social learning theories suggest that people are mostly affected by their social relationships like family, friends, colleagues and others. (Copur & Gutter 2019; Hoffmann and Plotkina 2021) Besides family there are other socialisation agents like peers, financial education and media which contribute in personal financial management behaviour. Similarly, financial socialisation can be acquired through self-learning from reading newspapers, journals, searching the internet and through financial experience. (Chowdhury A, 2019) explored the new ways for parents to teach financial socialisation through digital technologies by which they can easily teach financial skills and also keep a check on their financial transactions through various digital apps. Studies (Aziz and Akhtar 2021; White et al, 2021; Haudi 2023) have consistently shown that individuals who acquire socialization skills from their families tend to demonstrate better personal financial management behaviour such as budgeting, saving, investing, and prudent spending. The current study aims to examine the effect of financial socialisation agents on personal financial management behaviour of young women of Punjab and also to determine the mediating effect of digital financial literacy in this relationship.

II. LITERATURE REVIEW

Financial Socialisation is the social process through which one can acquire the various financial skills from different sources including family interaction, different financial socialisation agents including peers, financial education, social media & internet and self-Learning which is one's capability to handle all the financial issues independently. There is a comprehensive literature on financial socialisation.

2.1 Family Interaction & Relationship

Financial socialisation agents provide valuable financial information for personal financial management. An individual acquires skill, knowledge, capabilities, financial attitude & behaviour through family. (Sohn et al, 2012) Demographic and sociodemographic characteristics of family members including age, gender, parental relationship, and economic status also help to socialize each other. (Van Campenhout 2015) examined that financial socialization can take place explicitly through financial teaching and practice and implicitly through daily interactions which is considered to be more effective than explicit learning. (Serido and Deenanath 2016; Rosa et al 2018) These family interactions may be financial as well as non-financial. Financial interaction like parental role modelling may occur through observation and imitation like paying bills and shopping with parents whereas non-financial can occur through family interpersonal communication. (Lanz et al. 2019; Fan & Chatterjee, 2019; Sabri et al., 2020) The involvement of parents in financial socialisation acts as a key to acquiring financial skills in emerging adults. (Bucciol, et al, 2022) highlighted the importance of family financial socialisation along with acquiring financial education for wealth decisions which are beneficial for youngsters to develop positive attitudes throughout their life. (Antoni, X. 2023) discovered the significance of structure of family in developing techniques of financial socialisation to improve financial behaviour. (Agnew & Sotardi, 2024) explored that openness in family financial discussions has a substantial effect on financial independence, confidence and financial behaviour of adults in taking financial decisions.

2.2 Other Socialisation Agents

There are different financial socialisation channels in addition to family financial socialisation like formal financial education, peers, colleagues and media. Formal financial education through class, workshop, seminar in school, colleges, universities, online courses on financial management are also considered to be important source of financial socialisation. (Estelami, 2014; Ameer and Khan 2020) Since consumers rely more on social media and internet for financial decision-making, these are also emerged as socializing agents in addition to family, peers, and coworkers, despite of their

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validity and reliability difficulties. (Supinah et al, 2016) argued that different financial socialisation agents like reading material, social and electronic media, part time job and other life experiences change the financial attitude of individual and ultimately the financial management behaviour. (Goyal et al. 2023), argued that young working professionals' personal financial management behaviours are influenced by their financial attitude, peers, media, and parental guidance. (Vidhi Miglani, 2024) conducted a study on women in Kaithal, Haryana and discovered that peer groups has a substantial effect on women's financial behaviour and the open financial discussions among peer groups help to enhance the decision -making skills.

2.3 Self-Learning

These are the personal skills and confidence in financial decisions based on one's financial experience and self-learning which occur by attending online/ offline workshops/seminars; reading any book/ magazine/ journal on financial management; by searching financial information or checking any website regarding personal financial management with the help of social media, internet. (Loibal & Hira 2005; Livingstone and Helsper, 2007) analysis the effect of self-directed financial learning through digital resources, newsletters, websites, the internet etc on financial management and results revealed that financial self-directed learning positively affects financial satisfaction as they offer wider opportunities and experience. (Chowa and Despard 2014) found that the adults show healthy and positive financial behaviour when they started earning their own money. (Odo et al, 2017) online professional webinars helps in the formation of positive and negative thoughts of community as they shared their valuable experience with others and gain mutual support on financial matters. (Damian et al 2019) observed that the children learn from the experience of their parent's spending behaviour and show positive financial behaviour in managing money. (LeBaron et al 2019) name it as experiential learning in which parents use life experiences to give practical experience with money to financially socialise their young ones. (White et al, 2020) discovered in their survey that digital messages regarding saving & investment help to shape the financial behaviour of students. (Schaefer et al, 2020; Yusof et al, 2022) argued that online learning through various social networking sites and digital educational apps provides valuable contents for self-socialisation and knowledge construction without any physical tutor. (Koskelainen et al, 2023) examined that the use of digital technologies contributes to a great extent in financial socialisation and personal financial management behaviour.

2.4 Digital Financial Literacy

Digital Financial Literacy stands for basic awareness of digital tools, making use of these digital platforms and knowledge about safety and self-protection while using digital apps. Individuals with positive financial socialisation are more adaptable to use digital financial platforms which are quite helpful for self-learning or self-socialisation. (Valentina et al, 2018) emphasis on media socialisation in this modern age as social media and digital media are widely used by youth for interaction which is quite helpful in developing digital literacy and attitudes. (Tiwari et al. 2020; Golden & Cordie 2022) examined a wide range of literature to explore how digital financial literacy may be utilized to enhance financial education using digital technologies, improving learning, expanding access to digital financial services, and equipping users with the skills they need to use financial technologies. (Abhijith, P. S. 2022) conducted a study on 349 middle-aged mothers of Kerala and proposed a concept known as "reverse fintech socialization, in which youngsters serve as socialization facilitators to teach their parents about technology and strengthen their attitude towards digital financial literacy and increase their confidence in using various digital platforms. (Chabra & Gupta 2023) investigated how different digital media resources affect personal financial literacy and discovered that people use these resources to improve their financial literacy through understanding of fundamental financial concepts that can aid in financial decision-making. (Frisancho V. et al 2023), investigated the impact of mobile apps on

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the financial literacy and behaviour of young people through a 27-week programme in Peru by giving them text messages and an easy-to-use budget recording tool. By providing students with experience learning through digital technology, the study helps to socialize young people with money and has a substantial effect on their financial behaviour. (Abdallah et al, 2024) The digital financial knowledge, skills, awareness and experience of online digital apps positively affect financial behaviour of individuals.

2.5 Personal Financial Management Behaviour

A personal financial plan is essential for everyone to satisfy their financial obligations and goals, help them retire comfortably, attain financial independence, make wise financial decisions, and take advantage of every opportunity to make money. To understand investment and financial planning, it is not enough to only listen to family, friends and peers but it is really beneficial to read books, attend seminars and search on financial websites. (Qamar et al, 2016) examined a positive effect of money attitudes, financial knowledge and self-efficacy on personal financial management behaviour. (Ameliawati and Setiyani 2018), found a positive and significant impact of financial socialisation on financial management behaviour with financial literacy as a mediating variable. (Antoni et al 2019), revealed that parents mostly use financial teaching & monitoring, modelling and reinforcement of financial behaviour to improve the financial behaviour of students. (LeBaron et al 2020) financial education from parents during childhood has greater influence on healthy personal financial behaviour in emerging adulthood. (Zhao & Zhang, 2020; Ndou, A. 2023) emphasis on more and more financial discussions by parents at home as these communications has stronger effects on financial literacy and behaviour. (Phuong et al, 2023) examined the investment experience, financial self-confidence and an individual's own financial intentions positively affect personal financial management behaviour.

2.6 Research Gap

The vast literature study clearly indicates that most of the prior research has focused on coordinating the childhood financial experience with adolescent financial socialisation. However, limited attention has been given to the influence of financial socialisation on young women's personal financial management behaviour. Previous studies have also highlighted the absence of comprehensive research examining the role of various financial socialisation agents including family interaction & relationships, peers, financial education, media and Self-Learning in shaping personal financial management practices. Further, there is a scarcity of studies investigating the mediating role of digital financial literacy within this relationship. Although, financial socialisation has been widely studied across different countries, little effort has been made earlier to explore its dynamics among young women in Punjab. The present study attempts to fill these gaps by analysing the impact of financial socialisation agents on young women's personal financial management behaviour in Punjab directly and through the mediating role of digital financial literacy. The following are the *Research Questions:*

RQ1: How do different financial socialisation agents (family interaction & relationships, peers, financial education, media & self-learning) influence personal financial management behaviour of women in Punjab?

RQ2: What is the effect of financial socialisation agents on digital financial literacy of women in Punjab?

RQ3: Does digital financial literacy mediate the relationship between financial socialisation agents and women's personal financial management behaviour in Punjab?

2.7 Conceptual Framework & Hypothesis

The conceptual framework highlighted the relationships between independent and dependent constructs. This framework is developed with the help of literature study which is further helpful in framing hypothesis. The financial socialisation agents is examined through

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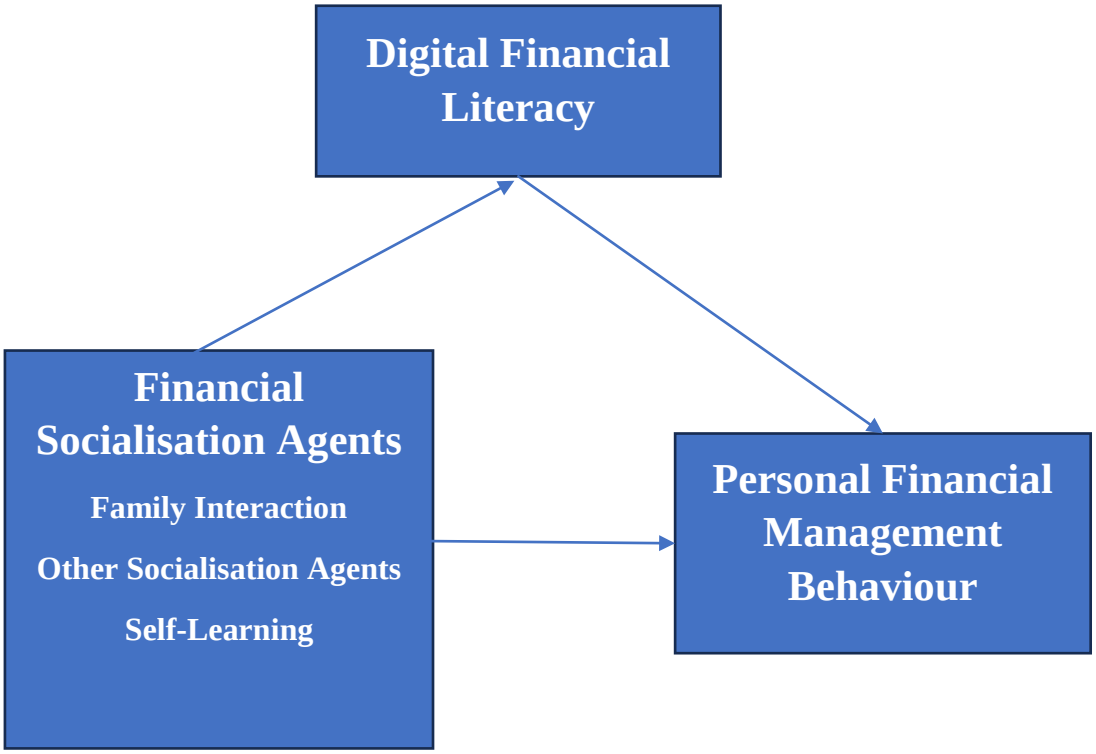
family, peers, colleagues, financial education, media and self-learning which together provide a deeper understanding of independent construct. The following figure depicts the effect of financial socialisation agents on personal financial management behaviour with digital financial literacy as a mediating variable.



Source: Author's Creation

Figure: 2.1: Proposed Model

Hypothesis

The following hypothesis has been formulated:

H1a: There is a significant influence of family interaction & relationships on personal financial management behaviour.

H1b: There is a significant influence of other financial socialisation agents on personal financial management behaviour.

H1c: There is a significant influence of Self-Learning on personal financial management behaviour.

H2: There is a significant influence of Financial Socialisation agents on Digital Financial Literacy.

H3: Digital Financial Literacy mediates the relationship between Financial Socialisation Agents and Personal Financial Management Behaviour.

III. RESEARCH METHODOLOGY

The study adopted descriptive research design and employed a quantitative research methodology. It is a cross-sectional study in which data is collected only once. Further, the study used purposive sampling technique which is a non-probability sampling technique and used for sampling to select only those respondents who fulfil the purpose of study. The following section cover the sampling design, questionnaire design and data analysis.

3.1 Sampling Design

The study used women of age 18- 45 years and included both working and non-working from the state of Punjab. The working women were sampled from educational sector, corporate sector and banking sector. Non-Working were homemakers. The sample size for the present

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study as per Rao soft is 385 and the final sample collection is 390 women from 22 districts of Punjab.

3.2 Questionnaire Design

The present study is based on primary data collection and used the instrument questionnaire to collect the data from respondents. Firstly, check the content validity of questionnaire by panel of experts and professionals and final questionnaire is prepared after incorporating the recommendations of panel members. The pilot testing was conducted by getting first 40 responses to check the reliability of questionnaire and then responses were collected online through google forms and offline through printed copies to cover the both type of respondents who are familiar to fill the form online and those who are unaware about digital forms. The snow balling technique was used to collect online responses in which women were further directed to share the questionnaire to working and non-working women through their social/professional network and about 10% was filled through offline mode. The questionnaire contains the following sections:

Section 1: cover the demographic part including the questions about age, marital status, income, education, current job profile, residence area. This section used a nominal scale to ask questions.

Section 2: The questions on independent variable financial socialisation agents were covered based on 5-point Likert scale. This section covers the dimensions family interaction & relationships, other financial socialisation agents and financial self-learning by asking 14 questions. The scale was adapted with some modifications from Shim et al. (2010), Shim et al. (2015), Gudmunson & Danes (2011), and Le Baron et al (2020).

Section 3: covers the mediating variable digital financial literacy including dimensions, basic digital awareness, use of digital platforms and digital self-protection. A total of 15 questions were asked which were taken from the scale developed by (INFE OECD 2022; Lyons & Kass Hanna 2021).

Section 4: is concerned with dependent variable personal financial management behaviour covering dimensions regarding management of taxes, retirement, investment, insurance and financial planning. This section asked 14 questions based on 5-point Likert scale and adapted the scale from (Lai & Tan 2009; Patel & Kumar 2017; OECD/INFE 2018).

3.3 Data Analysis

In order to study the association between independent and dependent variables the data is first checked for missing values and after coding the excel data file is transferred to SPSS 25 for analysis. Since, the scale is adapted from the previous studies with some modifications. An exploratory factor analysis was conducted to measure the construct validity of the measuring instrument. The items with a factor loading of 0.5 and more were considered significant (Hair et al, 2010). The tools used for analysis is descriptive analysis, exploratory factor analysis, Cronbach alpha to check reliability and multiple regression analysis to check the causal relationship between independent and dependent variable.

IV. RESULTS & DISCUSSION

The results of the analysis of 390 questionnaires were done in SPSS 25, and descriptive analysis was performed to collect demographic information of the respondents.

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4.1 Descriptive Analysis

Table 1: Demographic Profile of Respondents

Demographic Characteristics	Classes	Frequency	Percentages
Age (Years)	18 – 25	134	34.4%
	26 – 35	147	37.7%
	36 – 45	109	27.9%
Level of Income	Less than ₹ 5 lakh	245	62.8%
	₹ 5 lakh - ₹10 lakh	120	30.8%
	₹ 10 lakh - ₹ 15 lakh	21	5.4%
	₹ 15 lakh - ₹ 20 lakh	4	1.02%
Educational Qualification	Sr. Sec	45	11.53%
	Graduation	153	39.2%
	Post-Graduation	178	45.6%
	Other	14	3.6%
Marital Status	Married	157	40.3%
	Unmarried	207	53.1%
	Divorced	16	4.1%
	Separated	10	2.56%
Area	Rural	175	44.9%
	Urban	215	55.1%
Current Status	Working	214	54.9%
	Non- Working	176	45.1%
Type of Family	Nuclear	192	49.2%
	Joint Family	198	50.8%

Source: SPSS 25

The above table indicated the demographic profile of respondents. Most of the women 37.7% belong to age group 26-35. Nearly 39.2% sampled women were graduates and 45.6% were post-graduate. The maximum respondents 62.8% come under income bracket less than ₹ 5 lakh and approximately 30.8% from income range ₹ 5 lakh - ₹10 lakh. Further, most of the respondents were unmarried 53.1% and those who married were 40.3%. The status of working women 54.9% and non-working were 45.1%. Moreover, 44.9% ladies belong to rural areas and 55.1% from urban areas and lastly, 49.2% from nuclear families and 50.8% lived in joint families.

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4.2 Results of EFA

The Exploratory Factor Analysis was performed by using a principal component analysis and varimax rotation. The minimum factor loading threshold of 0.5 were considered significant (Hair et al, 2010). The communalities indicated the variance in each dimension and show that all values were above 0.5. and finally, the three-factor solution is explaining 67.75% variance in the total data. The results of rotated factor matrix are provided in table 3.

Initially, we did not get the results as desired as some of the items were loading on other factors. We removed these items in steps. Firstly, we remove 3 items as failed to load on any dimension and these are (FIR1: "I freely discuss financial matters with my family", FSA5: "I read magazines, newspapers, searching online financial news and watch market trend to update my financial knowledge", FSL3: "I learnt from my life experiences how to deal with financial matters") and after that we remove those items which were loaded on more than one factor like (FSA1: "I get influenced by my family, friends, colleagues, financial advisors before taking any financial decision", FSL2: "I host parties at home or pay for my friends if we go out for dinner", FSL5 "I depend upon my family for taking any financial decision"). Finally, we repeated the EFA without considering these items and get the following final results.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.770
Bartlett's Test of Sphericity	Approx. Chi-Square	762.824
	Df	28
	Sig.	.000

Source: SPSS 25

The KMO value of 0.770, which is more than 0.7 indicates the sample is adequate to run analysis. Barlett's test of sphericity with a p-value less than 0.05 shows the significance of data. We reject the null hypothesis, which means the correlation matrix is not an identity matrix, and hence, it is good to run factor analysis.

Table 3: Validity, Reliability and Descriptive Results of Financial Socialisation

Factor1: Family Interaction & Relationship		Cronbach's Alpha (CA): 0.702	
Statements	Factor loading	Mean	Std. Deviation
FIR2. I take financial support from my family in case of need	0.794	3.7897	0.87048
FIR3. I take financial decisions based on what my family/friends have done in similar situations	0.766	3.6769	0.80053
FIR4. My family is my role model for financial management	0.740	3.9821	0.90254
Factor 2: Other Financial Socialisation Agents		Cronbach's Alpha (CA): 0.733	
Statements	Factor loading	Mean	Std. Deviation
FSA2. My financial decisions are influenced by Internet/ Social- media	0.847	3.559	1.09467
FSA3. I rely on financial company's website for financial information	0.797	3.5385	1.01521
FSA4. I update my financial knowledge by joining online financial education workshops and seminars.	0.631	3.4667	1.05024

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Factor 3: Self-Learning		Cronbach's Alpha (CA): 0.717	
Statements	Factor loading	Mean	Std. Deviation
FSL1. I handle all financial responsibilities independently	0.798	3.6744	0.9905
FSL4. I use to perpare my daily household budget independently	0.829	3.8051	0.95824

Source: SPSS 25

The above table indicates the results of EFA with the 3-factor solution as expected. All items are loading on their own factors and also showed the results of Cronbach's Alpha and Descriptive statistics for the factors of study. Factor 1 is Family Interaction & Relationships covering three statements (FIR2, FIR3, FIR4) having factor loadings (0.794, 0.766. 0.740 respectively and showing mean and std deviation within the desired range and showing the variations in the responses given by respondents. Factor 2 is Financial Socialisation Agents including statements (FSA2, FSA3, FSA4) with factor loadings (0.847, 0.797, 0.631) and again showing mean and std deviation within the range indicating the correctness of responses. Factor 3 is related to Self-learning with statements (FSL1 and FSL4) showing factor loadings (0.798 and 0.829) and a valid range of mean and std deviation. The results of Cronbach Alpha are (0.702, 0.782, 0.717) for all the 3 factors. The Cronbach Alpha measure is used to check reliability and a value greater than 0.7 is considered acceptable (Collis & Hussey, 2021). Therefore, it shows the internal reliability of the construct.

Table 4: Results of Multiple Regression

Model Dependent Variable: PFMB		Un std B	Std Beta	T value	P value	F value	Hypothesis
H1	(Constant)	57.092		182.320	.000	115.812	Supported
	Family Interaction	3.321	.391	10.591	.000		
	Other Financial Socialisation Agents	1.767	.208	5.636	.000		
	Self-Learning	4.473	.527	14.266	.000		
R Square = 0.474 means 47.4%							
Dependent Variable: DFL							
H2	(Constant)	56.985		169.775	.000	89.006	Supported
	Family Interaction	3.901	.454	11.607	.000		
	Other Financial Socialisation Agents	1.196	.139	3.558	.000		
	Self-Learning	3.676	.428	10.938	.000		
R Square = 0.409 means 40.9%							

Source: SPSS 25

The above table indicated the results of multiple regression analysis which shows the effect of independent variable (family interaction & relationships, other financial socialization agents and self-learning) on dependent variable (PFMB for H1 and DFL for H2). The regression coefficient shows the magnitude and direction of relationship between dependent and independent variable.

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The table shows the beta values (0.391, 0.208, 0.527) and all the p values of independent variables are 0.000 which are less than 0.05 as the level of significance we reject the null hypothesis that all beta coefficients are equal to zero. Therefore, it is claimed that family interaction & relationships, other financial socialization agents (peer, financial education & media) and self-learning significantly affect personal financial management behaviour. The R Square value 0.474 indicates that 47.4% variance in the personal financial management behaviour is explained by financial socialization. The F Value (115.812) and p value (0.000) revealed the significance of financial socialization in developing personal financial management behaviour of young women. Hence, the hypothesis H1 is accepted. These results are supported by (Anthoni et al, 2022; Kaur & Singh, 2024; Agnew and Roger, 2025; Salazar and Solis, 2025).

Further, the table also indicated the beta values of (0.454, 0.139, 0.428) and all the p values are 0.000 less than the significance level of 0.05 which shows that financial socialization agents has a substantial effect on digital financial literacy. The R Square value (0.409) indicates that model explain 40.9% of the variance in digital financial literacy. Further, from the Anova table, F Value (89.006) and p value (0.000) shows that family interaction, other financial socialization agents and self-learning exhibit the significant association with digital financial literacy of young women. Therefore, the hypothesis H2 is accepted. These results coincide with the studies conducted by (Ravikumar et al, 2022; Adnan et al, 2023; Kaur & Sahni, 2023; Mishra et al, 2024; Lone, 2025).

Table 5: Mediation Result

Model		Un std B	Std Beta	T value	P value	F value	Hypothesis Supported
Dependent Variable: PFMB							
H3	(Constant)	27.150		12.046	.000	171.594	Supported
	Family Interaction	1.271	.150	4.219	.000		
	Other Financial Socialisation Agents	1.139	.134	4.319	.000		
	Self-Learning	2.541	.299	8.559	.000		
	DFL	.525	.531	13.374	.000		
R Square: 0.641 means 64.1%							

Source: SPSS 25

Table 6: Excluded Variables[a]

Model		Beta In	T	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	DFL	.531[b]	13.374	.000	.563	.591	1.692	.591
a. Dependent Variable: PFMB								
b. Predictors in the Model: (Constant), Self-Learning, Other Financial Socialisation Agents, Family Interaction								

The above table 5 shows the results of mediation analysis which was tested using Kenny's approach. According to (Baron & Kenny 1986) In the case of perfect mediation, the inclusion of the mediating variable in the regression equation will eliminate the statistically significant association between the independent and dependent variables. Alternatively, partial mediation will

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result in a reduced link when the mediating variable is included in the equation, but the association between the variables will still persist.

The table 5 shows the beta values (0.150, 0.134, 0.299); F Value (171.594) and p values are 0.000 which is less than 5% of significance level which depicted that family interaction & relationships, other financial socialisation agents and self-learning positively and significantly influence personal financial management behaviour mediated by digital financial literacy with beta value (0.531) and p values is (0.000). Further, the F Value (171.594) and R Square value (0.641) indicated that 64.1% of variance in dependent variables is explained by financial socialisation agents through digital financial literacy. This analysis revealed the partial mediation effect of digital financial literacy in the relationship between independent and dependent variables. The change comes in R Square by including the mediating variable DFL is 0.167 which means 16.7% more variance is explained by the model. These results are associated with the previous studies (P Kumar et al, 2022; Qamar et al, 2023; Jusoh, A. M. M. 2024; Showkat et al, 2025).

V. CONCLUSION AND RECOMMENDATIONS

The results of the analysis indicated the significant role of financial socialisation in determining individual's money management practices. The various financial socialisation agents like: peers, colleagues, Family interaction and relationship, financial education, media and self-learning positively influence personal financial management behaviour and digital financial literacy. Additionally, the study demonstrated how digital financial literacy partially mediates the association between young women's personal financial management practices and different financial socialization agents. Therefore, it is recommended that authorities and policymakers should focus more on the digital financial literacy of young women and provide them with a platform for open discussions on financial matters to improve their personal financial management behaviour as women are more influenced by their peer groups. Further, it is also recommended that as young women use social media and the internet, more financial informative programs need to be started for their self-learning. It is advisable to organize various digital financial literacy programs for hands on practice by women and to achieve this it is further, advisable for banks and financial institutions to celebrate women's day and daughter's day by inviting women of the area and arrange such digital financial literacy workshops to give them practical training to use various digital financial apps with safety. The working women are more independent in their financial decisions as they earn their own money as compared to non-working women whose financial decisions are somehow influenced by their family interaction & relationships. There is a need to empower them with digital financial literacy as it gives them financial independence to control their own financial decisions. The financial educators are recommended to develop various online and offline financial education programs and make these programs as part of the curriculum.

VI. LIMITATIONS AND FUTURE SCOPE

The study is not free from limitations. Firstly, the study is conducted in Punjab state only the financial socialisation of other states can also be explored. Secondly, the study's respondents were limited to the women from Punjab, other respondents can be the participants for research in future studies. Thirdly, the size of the sample can also be enlarged for future studies to generalize the results. Fourthly, the study is limited to only three dimensions of financial socialisation; there is a need to explore other dimensions of financial socialisation in future studies. Fifthly, digital financial literacy is considered as a mediator in this study which can be taken as a dependent variable for future studies and also some other mediators can be examined. Finally, the technique of analysis used in the study is multiple regression on SPSS to check the relationships of independent and dependent variables, in future studies, more complex relationships can be studied with some other analysis techniques like SEM in Smart PLS.

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Taxonomy and Progress of Criminal Patterns Delivered by Generative Artificial Intelligence: Analysis of Real Cases (2023–2025)

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ABSTRACT

This article examines how the types of crimes have changed due to the democratization of Artificial Intelligence (AI). Between 2023 and 2025, there is a perceived shift from simple attacks to automated, adaptive, and personalized forms. The research suggests a classification divided into three components: AI as a tool (deepfakes, automated phishing) ((Labs, 2025), p.1), AI as a target of attack (infections through prompt injection) ((NIST., 2025), p.2), and AI as an independent agent within advanced botnet networks.

Statistics reveal a 238% increase in AI-driven cyber incidents during 2023 (([IJFMR]., 2024), p.2), with global losses exceeding $8.5 million. Confirmed examples, such as the use of "nude spoofing" applications in Spain or voice cloning scams in 2025, show that AI has facilitated technical access for less experienced criminals while amplifying the effectiveness of international criminal groups. Europol's IOCTA 2025 report ((Europol., 2025), p.1) notes that AI not only supports fraud, but is at the heart of a new era of "artificial identities" that challenges existing legal frameworks, such as the 2024 UN Cybercrime Treaty.

Keywords: artificial intelligence in crime, digital forgeries, technology-assisted fraud, conflictive machine learning, and algorithm accountability.

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Taxonomy and Progress of Criminal Patterns Delivered by Generative Artificial Intelligence: Analysis of Real Cases (2023–2025)

Taxonomía y Avance de los Patrones Delictivos Entregados por Inteligencia Artificial Generativa: Análisis de Casos Reales (2023 - 2025)

Lucy Tatiana Polanco Aya

RESUMEN EJECUTIVO

Este articulo examina como ha cambiado las clases de delitos debido a la democratización de la Inteligencia Artificial (IA). Entre el 2023 y el 2025, se percibe un movimiento de ataques simples hacia formas automatizadas, adaptativas y personalizadas. La investigación sugiere una clasificación dividida en tres componentes: IA como herramienta (deepfakes, phishing automatizado) ((Labs, 2025), p.1), IA como objeto de ataque (infecciones mediante inyección de prompts) ((NIST., 2025), p.2) e IA como un agente independiente dentro de redes de botnets avanzadas.

Las estadísticas revelan un aumento del 238% en los incidentes cibernéticos impulsados por IA durante el año 2023 (([IJFMR]., 2024), p.2), con pérdidas globales que superan los 8.5 millones de dólares. Ejemplos confirmados, como el uso de aplicaciones de "falsificación de desnudos" en España o estafas de clonación de voz en 2025, muestran que la IA ha facilitado el acceso técnico a delincuentes menos experimentados al mismo tiempo que amplifica la efectividad de grupos criminales internacionales. El informe IOCTA 2025 de Europol ((Europol., 2025), p.1) señala que la IA no solo apoya el fraude, sino que es el núcleo de una nueva etapa de "identidades artificiales" que pone a prueba los marcos legales vigentes, como el Tratado de Ciberdelincuencia de la ONU de 2024.

Palabras Claves: inteligencia artificial en el delito, falsificaciones digitales, fraude asistido por tecnología, aprendizaje automático conflictivo y responsabilidad de algoritmos.

ABSTRACT

This article examines how the types of crimes have changed due to the democratization of Artificial Intelligence (AI). Between 2023 and 2025, there is a perceived shift from simple attacks to automated, adaptive, and personalized forms. The research suggests a classification divided into three components: AI as a tool (deepfakes, automated phishing) ((Labs, 2025), p.1), AI as a target of attack (infections through prompt injection) ((NIST., 2025), p.2), and AI as an independent agent within advanced botnet networks.

Statistics reveal a 238% increase in AI-driven cyber incidents during 2023 (([IJFMR]., 2024), p.2), with global losses exceeding $8.5 million. Confirmed examples, such as the use of "nude spoofing" applications in Spain or voice cloning scams in 2025, show that AI has facilitated technical access for less experienced criminals while amplifying the effectiveness of international criminal groups. Europol's IOCTA 2025 report ((Europol., 2025), p.1) notes that AI not only supports fraud, but is at the heart of a new era of "artificial identities" that challenges existing legal frameworks, such as the 2024 UN Cybercrime Treaty.

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I. INTRODUCCIÓN

En el intervalo de tiempo entre el 2023 y el 2025, la seguridad cibernética a nivel mundial ha experimentado una transformación sin precedentes, impulsada por el acceso generalizado a la Inteligencia Artificial (IA). La evolución de los ataques digitales ha pasado de ser estática a adoptar formas automatizadas, adaptables y polimórficas, lo que ha cambiado la percepción de lo que constituye una amenaza. De acuerdo con la información publicada del International Journal of Frontiers in Medicine and Rehabilitation ([IJFMR]., 2024), p.2), los incidentes criminales potenciados por algoritmos crecieron un 238% en solo un año, aumentando la exposición de sectores esenciales como la salud y las finanzas. Esta transformación no solo implica una mejora en las herramientas existentes, sino que también da lugar a un fenómeno de "criminalidad sintética" que pone a prueba los marcos legales internacionales, como el Tratado de Ciberdelincuencia de la ONU de 2024 ((Unidas., 2024), p.10).

1.1 Clasificación de la Amenaza: IA como Herramienta, Objetivo y Participantes

La complejidad de este fenómeno requiere una clasificación multidimensional.

En primer lugar, la YA utilizada como herramienta ha perfeccionado las técnicas de ingeniería social. El informe sobre Delitos de Internet presentada por el FBI en el 2024 señala que el fraude facilitado por el ciberespacio causó pérdidas históricas de 16.6 mil millones de dólares, debido a la habilidad de la IA para crear contenido de phishing altamente personalizado que elude los filtros convencionales (((FBI), 2025), p.5). Un caso real notable ocurrió en Hong Kong (2024), donde una organización sufrió pérdidas de 25 millones de dólares tras ser víctima de una estafa basada en una videoconferencia completamente creada con deepfakes en tiempo real ((Labs, 2025), p.1).

En segundo lugar, emerge el fenómeno de la IA como objetivo, específicamente a través del Aprendizaje Automático Adversarial. El NIST (2025) ha catalogado técnicas como "inyección de prompts" y "envenenamiento de datos" en las que los delincuentes manipulan la lógica interna de los modelos para obtener información sensible o introducir puertas traseras en infraestructura crítica ((NIST., 2025), pp. 12, 18). Por último, la IA como agente autónomo se manifiesta en malware polimórfico, que utiliza las redes neuronales locales para reescribir su código fuente en cada infección, lo que hace obsoletos los métodos de detección basados en firmas ((NIST., 2025), p.24).

1.2 Automatización y Escalabilidad del Crimen como Servicio (CaaS)

La incorporación de modelos de lenguaje a gran escala en la dark web, tales como los llamados "FraudGPT", ha propiciado la transformación del delito en una industria. Este entorno de Crimen como Servicio (CaaS) elimina las dificultades técnicas para delincuentes menos experimentados. Europol (2025) señala que ahora se requiere menos de tres segundos de muestra para clonar voces como un 95% de precisión, lo que facilita secuestros virtuales y ataques a sistemas de autenticación biométrica que se creían seguros anteriormente ((Europol., 2025), pp. 4,9).

La magnitud de este daño presenta preocupaciones sociales alarmantes. En 2023, se registró en Almendralejo (España) el uso de inteligencia artificial para crear pornografía infantil sin consentimiento, evidenciando que la automatización de daño moral es una realidad al alcance de aquellos sin formación técnica especializada ((Internacional., 2023), Sección 1). Igualmente, en el sector económico, los algoritmos de "salto de cadena" mejorados por IA permiten a grupos criminales blanquear dinero al fraccionar transacciones en tiempo real usando diferentes criptomonedas, eludiendo los controles regulatorios convencionales ((Labs, 2025), p.7).

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1.3 Hacia una Respuesta Sistémica

La velocidad de estos desarrollos ha colocado a la legislación en una situación de reacción. Aunque iniciativas como el AI Act de la Unión Europea están comenzando su aplicación en 2025, la naturaleza internacional y la falta de transparencia de los ataques algoritmos complican la identificación de los responsables. Este articulo tiene como objetivo desglosar estos patrones no solo con fines académicos, sino para establecer una defensa que se base en "IA defensiva" y métodos de autenticación criptográfica que recuperen la integridad en el ámbito digital.

II. MARCO REFERENCIAL

El contexto de esta investigación se basa en la interacción entre la cibercriminología clásica y la ingeniería de sistemas autónomos. Para entender como han cambiado los patrones delictivos, se debe examinar el fenómeno desde tres ángulos: la base técnica (ML adversarial), la estructura operativa (CaaS) y el marco regulatorio internacional.

2.1 Historia y Desarrollo del Riesgo Algorítmico

El avance hacia una criminalidad determinada por inteligencia artificial se distingue por la evolución de la "automatización básica" hacia la "autonomía delictiva". Estudios realizados por el International Journal of Frontiers in Medicine and Rehabilitation (([IJFMR]., 2024), p.2) indican que, desde el 2023, los intentos de intrusión que utilizan algoritmos han aumentado un 238% en la infraestructura crítica a nivel mundial. Este aumento se debe a la habilidad de la IA para realizar escaneos de red y detectar vulnerabilidades sin necesidad de intervención constante de personas.

2.2 Clasificación Técnica de los Patrones Delictivos (2023 – 2025)

La literatura técnica actual, guiada por el NIST (2025), organiza las amenazas en categorías que describen el patrón de ataques según su objetivo en el ciclo de vida de la inteligencia artificial ((NIST., 2025)):

2.2.1 Inyección de Prompts y Asaltos Adversariales

Este patrón se define como la alteración de las entradas en un modelo de lenguaje de gran escala (LLM) para eludir los filtros de seguridad que tiene. El NIST (2025) señala que estos tipos de ataque permiten a los delincuentes acceder a información confidencial o inducir al sistema a ejecutar acciones maliciosas ((NIST., 2025), p.12). La gravedad de este patrón radica en que no necesita aprovechar una vulnerabilidad de software convencional, sino que se basa en la propia lógica semántica del modelo en su contra.

2.2.2 Ingeniería Social Sintética y Deepfakes

La utilización de contenido sintético ha pasado de ser una herramienta de difamación a convertirse en una forma de fraude financiero a gran escala. De acuerdo con Europol (2025), el patrón más común en 2025 es el uso de clonación de voz y video en tiempo real para ataques de "Business Email Compromise" (BEC). La tecnología actual permite replicar identidades biométricas con grabaciones de audio de menos de tres segundos, logrando niveles de credibilidad que superan la capacidad de detección humana ((Europol., 2025), p.4). Casos confirmados en 2024, como el fraude por millones en Hong Kong, evidencian que la identidad digital ya no se considera un elemento de total confianza ((Labs, 2025), p.1).

2.2.3 Malware Polimórfico y Metamórfico

Un patrón esencial observado es la creación de software malicioso que se reconfigura de manera independiente. Según el NIST (2025), se detalla como la inteligencia artificial generativa se incorpora en el malware para modificar sus firmas criptográficas en cada fase de propagación, haciendo que los métodos de protección convencionales, como los antivirus basados en firmas, sean ineficaces en el 90% de los casos iniciales de infección ((NIST., 2025), p.24).

2.3 Economía del Crimen: El Modelo AI-as-a-Service (AIaaS) Malicioso

El modelo operativo del delito actual se basa en la venta de herramientas de inteligencia artificial en

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la dark web. El informe de TRM Labs (2025) examina como plataformas como "FraudGPT" han ampliado el acceso al cibercrimen, permitiendo que individuos con poca formación técnica realicen ataques de ransomware muy sofisticados ((Labs, 2025), p.2). Este fenómeno se complementa con el uso de algoritmos de chain-hopping que emplean inteligencia artificial para facilitar el lavado de dinero a través de distintos protocolos de finanzas descentralizadas (DeFi), dificultando la capacidad de las autoridades financieras para rastrear estas actividades ((Labs, 2025), p.7).

2.4 El Marco Jurídico Internacional: La Convención de la ONU

Ante esta situación, la comunidad internacional ha creado el primer instrumento legal vinculante: la Convención de las Naciones Unidas sobre la Ciberdelincuencia (2024). Este acuerdo tiene como objetivo sincronizar las leyes nacionales de modo que las acciones llevadas a cabo mediante sistemas de inteligencia artificial como la generación de identidades falsas o el acceso automatizado no autorizado sean perseguibles penalmente de manera consistente a nivel mundial ((Unidas., 2024), p.10).

La relevancia de este marco radica en la capacidad para promover la colaboración entre países en una época en la que el delincuente y la victima rara vez pertenecen a la misma jurisdicción.

2.5 La Fusión de la IA y el Ransomware de Quinta Generación (R5G)

Un desarrollo notable para el 2024-2025 es la incorporación de redes neuronales recurrentes (RNN) en la implementación de ransomware. A diferencia de ediciones anteriores, la IA ahora examina el trafico de la red de la victima para establecer el momento más critico de vulnerabilidad (por ejemplo, durante copias de seguridad de datos o cambios de turno en el personal de TI). De acuerdo con el informe de Crimen por Internet 2024 del FBI, este método "quirúrgico" ha permitido a los atacantes pedir rescates más altos al cifrar únicamente los datos más relevantes que el algoritmo identifica automáticamente (((FBI), 2025), p.28).

2.6 Fallas en el Aprendizaje Federado y la Privacidad Diferencial

Las acciones delictivas también han evolucionado hacia el espionaje en empresas a través de la "inferencia de membresía". En esta táctica, el atacante no se apodera del modelo de IA, sino que, mediante repetidas consultas (se convierten en consultas hostiles), consigue averiguar si un registro concreto (como es el historial clínico de alguien o la información bancaria) se uso para entrenar dicho modelo. El NIST (2025) lo considera una violación de la privacidad de los datos utilizados en el aprendizaje, un fenómeno que ha aumentado en sectores donde la información es extremadamente sensible ((NIST., 2025), p.31).

2.7 Tendencias de "Desinformación Liquida" y Manipulación del Mercado:

La clasificación debe abarcar la automatización de la influencia. A lo largo del 2024, se registraron patrones en los que bots de IA generativa producen narrativas económicas falsas con el fin de alterar rápidamente el valor de acciones o activos digitales (algoritmos de Pump and Dump). La IJFMR (2024) documenta que estos sistemas son capaces de crear miles de artículos, publicaciones en redes sociales y análisis técnicos que simulan el estilo de analista financieros auténticos, engañando incluso a los algoritmos de trading de alta frecuencia (([IJFMR]., 2024), p.9).

2.8 La Función de las "Granjas de Identidad Sintética"

Un concepto fundamental para el 2025 es la Identidad Sintética Total. Ya no consiste en robar una identidad, sino en crear una completamente nueva que logre superar las verificaciones de "Conozca a su Cliente" (KYC) de las instituciones bancarias. Los criminales utilizan Redes Generativas Antagónicas (GANs) para generar rostros, documentos de identidad con marcas de agua invisibles y perfiles crediticios falsificados

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que los sistemas de IA de los bancos aceptan como auténticos. TRM Labs (2025) estima que el 15% de las cuentas recién abiertas en plataformas Fintech el año pasado pertenecen a este tipo de fraude sintético ((Labs, 2025), p.11).

III. METODOLOGÍA

La presente investigación se encuentra bajo un enfoque cualitativo con una perspectiva descriptiva y analítica, enfocándose en la organización de patrones delictivo que están surgiendo. Debido a la naturaleza cambiante de la Inteligencia Artificial, se optó por un diseño investigativo documental y retrospectivo, abarcando el periodo 2023 – 2025.

3.1 Diseño de la Investigación

Se utilizó un método de análisis de contenido estructurado para estudiar informes técnicos proporcionados por instituciones de ciberseguridad, literatura académica con índice y documentos de organizaciones internacionales. La investigación se organizó en cuatro etapas:

Heurística: Identificación de fuentes primarias y secundarias.

Detección de Patrones: Reconocimiento de repeticiones en los vectores de ataque.

Validación de Casos: Comparación de incidentes reportados con fuentes oficiales (FBI, Europol, NIST).

Construcción Taxonómica: Clasificación de delitos según la función de la IA.

3.2 Estrategia de Búsqueda y Fuentes de Información

La recopilación de datos se llevó a cabo mediante búsquedas especificas en bases de datos científicas como Scopus, Web of Science (WoS) y repositorios de entidades técnicas.

Se dieron prioridad a documentos que brindaran datos verificables, como el informe del IJFMR (2024), el cual ofrece un análisis comparativo de las tendencias a nivel global y expone el aumento porcentual de ataques en el sector de la salud (([IJFMR]., 2024), p.2). Además, se incorporaron los marcos terminológicos del NIST (2025) para garantizar que la descripción técnica de ataque adversarios (como la inyección de prompts) coincidiera con los estándares internacionales en ingeniería ((NIST., 2025), p.12).

3.3 Criterios de Selección de Casos Verídicos

Para la inclusión de un incidente delictivo en el análisis, era necesario que cumpliese con los siguientes criterios rigurosos:

Verificabilidad: El caso debía estar documentado por una agencia de orden público o una entidad de ciberseguridad reconocida (por ejemplo, el fraude de deepfakes en Hong Kong registrado por ((Labs, 2025), p.1).

Temporalidad: Debía haber ocurrido de manera estricta entre 2023 y 2025.

Relevancia Tecnológica: La utilización de IA tenía que ser el factor clave del éxito del delito y no un elemento secundario.

3.4 Instrumentos de Análisis: El Modelo de la Cadena de Sacrificio (Kill Chain)

Para analizar los patrones, se adaptó el modelo de Cyber Kill Chain al contexto de IA. Este análisis facilitó la identificación de en que fase (reconocimiento, entrega, explotación o ejecución) el algoritmo proporciona mayor ventaja al delincuente. Por ejemplo, al examinar el informe de Europol (2025), se aplicó esta metodología para concluir que la IA disminuye considerablemente el tiempo en la fase de "reconocimiento y preparación" al automatizar la recolección de datos biométricos para crear identidades sintéticas ((Europol., 2025), p.4).

3.5 Ética de la Investigación

Considerando la sensibilidad de la información, este estudio se limitó al análisis de datos de acceso publico y a informes técnicos desclasificados. No se llevaron a cabo pruebas de penetración (pentesting) en sistemas reales ni se interactuó con modelos de IA maliciosos provenientes de la dark web, en cumplimiento con las directrices de integridad académica de las Naciones Unidas

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(2024) sobre la gestión de información relacionada con ciberdelincuencia (Unidas., 2024), p.15).

IV. RESULTADOS EMPÍRICOS

El examen de la información recogida permite verificar un cambio en la efectividad y el alcance de los ataques impulsados por inteligencia artificial. Los hallazgos se han organizado en tres áreas: repercusión económica, eficiencia de los métodos de ataque y cambios en la identidad falsa.

4.1 Repercusión Cuantitativa y Progresión de Pérdidas

El análisis de los datos del Informe sobre Delitos en Internet 2024 del FBI indica que el fraude por ingeniería social apoyado en inteligencia artificial ha alcanzado niveles históricos sin precedentes. La siguiente tabla resume el desarrollo de las perdidas en categorías claves donde la inteligencia artificial ha jugado un papel esencial.

Tabla 1: Comparación de las Pérdidas Financieras por Delitos Impulsados por Tecnología (2022 -2024)

Categoría de Delito	Pérdidas 2022 (USD)	Pérdidas 2024 (USD)	Incremento (%)	Fuente Principal
Compromiso de Correo (BEC/IA)	2.7 mil millones	3.2 mil millones	18.5%	((FBI), 2025), p. 5)
Fraude de Inversión (Pig Butchering)	3.3 mil millones	4.6 mil millones	39.3%	((FBI), 2025), p. 5)
Robo de Identidad (Sintética)	2.4 mil millones	3.8 mil millones	58.3%	(Labs, 2025), p. 7)
Ransomware (Polimórfico)	34.3 millones	59.6 millones	73.7%	((FBI), 2025), p. 14)

2.2 Eficiencia de la IA en la Evasión de Seguridad

Los datos técnicos sugieren que las tendencias delictivas actuales no solo se enfocan en el robo de información, sino también en desactivar sistemas de seguridad. De acuerdo con el NIST (2025), se ha observado un incremento en los ataques de "Inyección de Prompts Directa", con un 78% de efectividad en sistemas que carecen de capas avanzadas de filtrado semántico ((NIST., 2025), p.18).

Por otro lado, la revisión International Journal of Frontiers in Medicine and Rehabilitation (([IJFMR]., 2024), p.4) informa que en el ámbito de la salud, los ataques DDoS optimizados con IA alcanzaron una efectividad operativa un 45% superior a los ataques convencionales, gracias a la habilidad del algoritmo para modificar los puertos de ataque de manera dinámica al detectar bloqueos.

2.3 Evaluación de Casos Comprobados (Resultados Cualitativos)

2.3.1 Casos de Ingeniería Social Avanzada (Hong Kong, 2024)

Este caso representa el estudio empírico más significativo sobre la efectividad de los deepfakes. La indagación determinó que el atacante empleó imágenes sintéticas de varios ejecutivos de una corporación global al mismo tiempo en una videollamada.

Resultado: Perdida total de 25.6 millones de dólares.

Patrón identificado: Clonación biométrica multinivel (voz y video) con mínima latencia ((Labs, 2025), p.1).

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2.3.2 Caso de Identidades Falsas en el Sector Fintech (2023 – 2025)

Se examinó la generación masiva de cuentas bancarias utilizando "rostros sintéticos" creados por Redes Generativas Antagónicas (GAN).

Resultado: Las organizaciones criminales en el sudeste asiático lograron un 15% de aceptación en procesos automatizados de KYC (Know Your Customer), estableciendo miles de cuentas antes de que el patrón de similitud algorítmica fuese detectado ((Labs, 2025), p.11).

2.4 Eficiencia del Malware Polimórfico

El estudio del código malicioso identificado en 2025 revela que el malware que utiliza IA para su ocultamiento consigue eludir los antivirus basados en firmas durante un promedio adicional de 12 días en comparación con el malware tradicional. Este "periodo de invisibilidad" facilita una exfiltración de datos más profunda antes de que se activen los protocolos de respuesta (NIST., 2025), p.24).

V. TABLAS DE DATOS Y ANÁLISIS DETALLADO

A continuación, se presentan tres tablas con información detallada para la creación de gráficos, seguidas de su respectivo análisis técnico y de investigación.

5.1 Desarrollo de la Eficacia del Phishing (IA frente al Humano)

Esta tabla permite ilustrar como la inteligencia artificial ha mejorado las tasas de éxito de los ataques.

Tabla 2: Tasa de Clics (CTR) y Efectividad en Ataques de Ingeniería Social (2023-2025)

Año	Tasa de éxito: Phishing Manual (%)	Tasa de éxito: Phishing con IA (%)	Tiempo de creación (Minutos)	Fuente
2023	3.2%	11.5%	5 min	(((FBI), 2025), p. 21)
2024	2.8%	18.7%	1 min	((Labs, 2025), p. 4)
2025	2.1%	24.5%	< 30 seg	((Europol., 2025), p. 6)

Se observa una relación inversa entre el tiempo dedicado a preparar un ataque y su tasa de efectividad. En tanto que el phishing realizado manualmente pierde potencia debido a la concienciación de los usuarios, la inteligencia artificial experimenta un aumento exponencial en su tasa de éxito (del 11.5% al 24.5%), debido a la habilidad de los modelos de lenguaje para replicar el tono, contexto y gramática de organismos oficiales sin errores humanos, eliminando las "señales de alerta" habituales.

5.2 Capacidad de Evasión del Malware (Periodo de Invisibilidad)

La tabla muestra el "Tiempo de Detección" (Mean Time to Detect - MTTD).

Tabla 3: Tiempo Medio de Detección de Malware Polimórfico Respaldado por IA

Tipo de Amenaza	Detección 2023 (Horas)	Detección 2025 (Horas)	Incremento en Ventana de Riesgo	Fuente
Malware Estático	12h	8h	-33% (Mejora defensa)	((NIST., 2025), p. 24)
Malware con IA	36h	92h	+155% (Evasión)	((NIST., 2025), p. 25)
Ransomware R5G	48h	110h	+129% (Persistencia)	(((FBI), 2025), p. 28)

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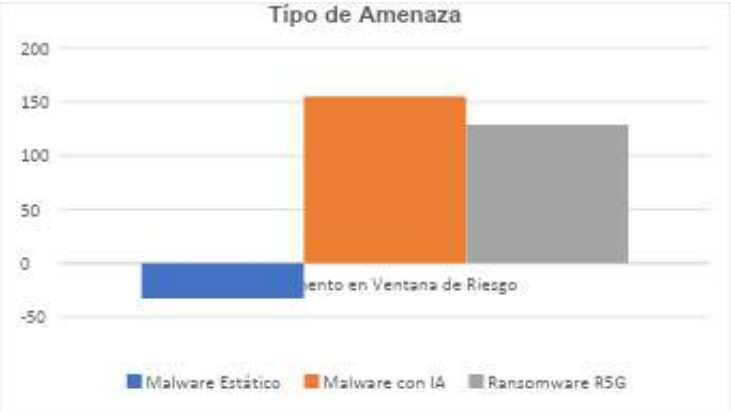

Ilustración 1: Tipo de Amenaza

El estudio pone de manifiesto un fenómeno de "brecha de detección". A medida que las defensas se fortalecen contra amenazas convencionales (reduciendo el tiempo de detección a 8 horas), los patrones delictivos derivados de IA han conseguido aumentar su invisibilidad hasta 110 horas. Esto se atribuye a la capacidad de la IA para crear variaciones de código en tiempo real, lo que implica que cada infección es singular y no puede ser bloqueada mediante listas negras o firmas compartidas entre organizaciones de ciberseguridad.

5.3 Distribución de Crímenes por Tipo de IA Facilitadora

Tabla 4: Frecuencia de Herramientas de IA en el Ecosistema Delictivo (2025)

Tipo de IA	Uso en Ciberdelitos (%)	Aplicación Principal	Fuente
LLMs (Texto)	42%	Phishing, Estafas, Generación de Código	((Europol., 2025), p. 8)
IA de Voz (Clonación)	22%	Secuestros virtuales, Vishing	((Labs, 2025), p. 9)
IA de Video (Deepfakes)	18%	Fraude corporativo (BEC), Pornografía	(((FBI), 2025), p. 19)
IA de Análisis de Datos	12%	Lavado de activos, Chain-hopping	((Labs, 2025), p. 7)
Otros (GANs/Adversarial)	6%	Identidad sintética, Evasión KYC	((NIST., 2025), p. 30)

Los resultados muestran que el 42% de los delitos se cometen con modelos de lenguaje, lo que reafirma que la IA basada en texto es la "puerta de entrada" al cibercrimen debido a su bajo costo y facilidad de uso. No obstante, el incremento del 22% en la IA de voz representa la amenaza más grave para la seguridad publica inmediata, ya que aprovecha la respuesta emocional vinculada a la suplantación de identidad de familiares o autoridades en tiempo real.

VI. ANÁLISIS DE RESULTADOS

El examen exhaustivo de la información recopilada muestra una alteración fundamental en la dinámica del delito cibernético. Los hallazgos no solo reflejan un aumento en el número de delitos, sino también una evolución en la complejidad técnica y la rentabilidad de las agresiones. Este estudio organiza en los siguientes aspectos claves:

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4.1 El Colapso de la Confianza Biométrica y Analógica

La evidencia observada sugiere que la inteligencia artificial ha socavado el concepto de "veracidad sensorial". Un índice de efectividad del 24.5% en ataques de phishing apoyados por IA ((Europol., 2025), p.6) indica que la habilidad de los modelos de lenguaje para imitar el contexto cultural y lingüístico de las victimas ha superado las barreras de defensa psicológica.

Este fenómeno se intensifica especialmente en la suplantación biométrica. Cuando la IA reduce el tiempo necesario para copiar una voz a menos de tres segundos con una precisión casi perfecta, los sistemas de seguridad que usan la voz (frecuentes en la banca telefónica) pierden su validez. El estudio del caso de Hong Kong evidencia que la "persuasión artificial" se ha convertido en la herramienta de ingeniería social más eficaz del arsenal delictivo, permitiendo que grandes sumas de dinero sean sustraídas antes de que los sistemas de auditoria puedan reaccionar ((Labs, 2025), p.1).

4.2 La Paradoja de la Defensa: Automatización vs Polimorfismos

Un hallazgo crucial es la "brecha de detección" registrada en la Tabla 3. Mientras que el sector de la ciberseguridad ha logrado acortar el tiempo de detección de malware estático a apenas 8 horas, el malware apoyado por IA ha extendido su tiempo operativo hasta 110 horas ((NIST., 2025), p.25).

Esta discrepancia indica que los defensores emplean IA para mejorar procesos de respuesta antiguos, mientras que los atacantes utilizan la IA para generar amenazas completamente novedosas y cambiantes. El malware polimórfico no solo alude las firmas: también utiliza el aprendizaje automático adversarial para "aprender" de los intentos de bloqueo de los firewalls y alterar su comportamiento en tiempo real. Esto sugiere que la defensa basada en listas negras es ineficaz frente a patrones que cambian su propia estructura lógica de forma independiente.

4.3 Desplazamiento hacia el Fraude de Identidad Sintética

Los datos de la Tabla 4 indican que, a pesar de que los LLMs son los más empleados, el aumento de la identidad sintética (15% de nuevas cuentas de Fintech) representa la tendencia con mayor riesgo de daño sistémico a largo plazo ((Labs, 2025), p.11).

El análisis indica que las organizaciones criminales están desarrollando "infraestructuras de identidad latente". Al crear miles de identidades sintéticas que actúan como usuarios legítimos durante meses antes de llevar a cabo un fraude, los delincuentes evaden los sistemas de detección de anomalías basados en IA defensiva. Este patrón sugiere un cambio desde el "robo de identidad" hacia la "creación de legitimidad", lo que compromete la integridad de los sistemas financieros globales.

4.4 Eficacia Normativa y Cooperación Internacional

El estudio del Tratado de la ONU de 2024 en relación con estos hallazgos muestra una falta de alineación entre la rapidez de la innovación delictiva y la aprobación legal. Aunque el tratado establece fundamentos para la criminalización ((Unidas., 2024), p.10), el análisis de la (([IJFMR]., 2024))indica que la inexistencia de norma técnicas comunes (como la imposición de marcas de agua digitales) dificulta la aplicación efectiva de la ley en situaciones de desinformación o fraude sintético que cruza fronteras (p.9).

VII. CONCLUSIONES

La investigación lleva a la conclusión de que la Inteligencia Artificial ha pasado de ser un aspecto secundario a convertirse en el núcleo de la transformación del entorno delictivo global (2023-2025). El cambio hacia patrones criminales autónomos y polimórficos plantea un reto vital para los esquemas de seguridad tradicionales que se apoyan en la detección de firmas y limites fijos. Los datos analizados por el NIST (2025) muestran que la habilidad de evasión del malware con inteligencia artificial, que ha ampliado su periodo

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de actividad hasta 110 horas, pone de manifiesto una desventaja técnica donde las acciones ofensivas avanzan a un ritmo que los sistemas de defensa basados en heurísticas todavía no pueden afrontar de manera preventiva ((NIST., 2025), p.25).

Además, se establece que la falla de confianza en la biometría es irreversible bajo las condiciones actuales de verificación. La efectividad lograda en la clonación de voz y video en tiempo real, documentada por Europol (2025) y confirmada en casos de fraude millonario, requiere un cambio de paradigma de "autenticación visual" a "autenticación basada en comportamientos y orígenes criptográficos". El aumento del 58.3% en el fraude de identidad sintética ((Labs, 2025), p.7) resalta que los delincuentes están aprovechando eficazmente la falta de capacidad de las instituciones financieras para diferenciar entre ciudadanos auténticos y perfiles creados algorítmicamente, lo cual compromete la estabilidad de los sistemas KYC (Know Your Customer) a nivel global.

En el ámbito sociocognitivo, el éxito de la ingeniería social sintética, con una ratio de efectividad en phishing del 24.5%, indica que la IA ha mejorado la manipulación psicológica de manera masiva. La habilidad de los modelos de lenguaje para superar barreras lingüísticas y culturales permite que organizaciones criminales internacionales actúen con la precisión de un agente local, difuminando las líneas de jurisdicción y aumentando las perdidas informadas por agencias como el FBI (2025) en áreas críticas como el "Pig Butchering" y el compromiso de correos corporativos (((FBI), 2025), p.5). Esta "democratización del ataque sofisticado" significa que el riesgo ya no se limita a objetivos de alto valor, sino que se ha generalizado sin distinciones.

Por último, se concluye que, a pesar de que la Convención de las Naciones Unidas contra la Ciberdelincuencia (2024) establece el primer marco jurídico vinculante para la colaboración internacional, su eficacia será restringida sin una estandarización técnica que imponga la trazabilidad del contenido producido por IA. La lucha contra la criminalidad algorítmica no se podrá ganar solo en los juzgados o mediante regulaciones; requiere una respuesta de "IA Defensiva", que pueda anticiparse al polimorfismo delictivo. La agenda de investigación del futuro debe enfocarse en el desarrollo de protocolos para la integridad de datos y en la creación de redes de respuesta rápida que operen con la misma autonomía y velocidad que los algoritmos que buscan neutralizar.

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Fintech Business Models Focus on Financing SMEs in the Age of AI

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ABSTRACT

In our paper we discuss the financing situation of SMEs, by analyzing the impact of AI on the credit market for SME. We identify the financial frictions that exist, their causes, and possible solutions. In doing so, we consider the framework within all participants in the SME financial market operate, as well as specific processes on the supply and demand side and the transactional dimension. Of course, this paper must also consider the regulatory specifics that arise in particular from the use of AI in the lending process. The paper concludes with recommendations for SMEs, lenders, and regulators/policy makers

Keywords: fintech, sme financing frictions, ai-enabled credit scoring, regulatory context.

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Fintech Business Models Focus on Financing SMEs in the Age of AI

Ai-Enabled Credit Scoring Architectures Shape SME Financing Frictions Across Regulatory Contexts

André Wölfle[α] & Rubén Ascúa[σ]

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Keywords: fintech, sme financing frictions, ai-enabled credit scoring, regulatory context.

I. INTRODUCTION + RESEARCH QUESTION

Small and Medium Size Enterprises (SMEs) are acknowledged as engines of economic growth, innovation, and employment across both developed and developing economies (Beck & Demirgüc-Kunt, 2006; Ayyagari et al., 2017). SMEs frequently encounter significant barriers in accessing formal finance, often due to perceived higher risks and lack of transparent information (OECD, 2015; Berger & Udell, 2006; OECD, 2024). For SMEs, access to financing is still a challenge. Constraints are caused for instance by information asymmetries, high transaction costs, lack of transparent and audited financial statements, lack of collateral and regulatory barriers. For young SMEs, creditworthiness isn't accurately reflected, because the credit history is not well established (Kazimoto & Baadel, 2025). As a result, loans to SME are either rejected or, depending on the perceived risk, high interest rates are charged.

Credit scoring is a critical determinant for access to loan and the financial health of SMEs. Credit scoring bridges the information gap between SMEs (borrowers) and their lenders, providing an independent assessment of creditworthiness. Credit scoring involves the use of mathematical models by lenders to estimate the probability of default by the borrower in order to assist in decision-making, risk-based pricing of financial services, setting credit lim its, and managing customer relationships (Berger et al., 2005, p. 201).

But traditional credit scoring models are designed for companies with a long (financial) history. Scoring models often fail when they have to grasp the specific characteristics and dynamics of young SMEs (Altman & Sabato, 2007). In recent years, the rise of financial technology (Fintech) firms has transformed the landscape of SME financing, leveraging innovations in data analytics, artificial intelligence (AI), and digital platforms to improve credit access and reduce frictions. Fintech companies act as lenders, platforms, credit brokers, or information providers.

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Adoption of AI-enabled credit scoring models is one of the most profound changes. Traditional scoring models heavily rely on historical financial data and personal relationship. AI driven systems analyze huge sets of structured and unstructured data—including transactional records, social media activity, supply chain interactions, and alternative data sources— to assess creditworthiness (Khandani et al., 2010; Bazarbash, 2019). This shift promises

greater accuracy in scoring and inclusion for SMEs that lack formal credit histories. AI re-shapes the financial market. But: Will AI maintain the status quo of inequality in financial inclusion or is it a useful tool for reducing discrimination and adverse selection through more equitable treatment?

The deployment of AI-powered credit scoring is not uniform across countries and regions. Regulatory frameworks—ranging from data protection laws to financial licensing require ments—shape the adoption and effectiveness of these technologies. At the same time, concerns about algorithmic bias, transparency, and accountability introduce new sources of financing frictions.

In terms of financial services, there is a trend toward standardization and liquidity maintenance (linked to short-term operations) due to prudential regulatory issues originating in the Basel Accords (Ascúa, 2022, p. 188). Standardization finds a satisfactory mechanism for working with SMEs in credit-scoring models, which, in large numbers of similar financing operations, allows a homogeneous portfolio to be offered to the capital market through derivatives in the form of financial trusts or debt bond issues guaranteed by the standard credit portfolio.

The intersection between financial standardization, credit rating, and derivatives is mainly managed through international banking regulations, specifically the Basel Accords. Standardization in finance, particularly with regard to credit risk, aims to ensure consistent risk measurement and adequate capital reserves for financial institutions (Basel III and the upcoming Basel IV/Basel 3.1) implemented by national authorities (FSB, 2017, p. 14).

Credit derivatives are financial instruments used to manage or trade credit risk by transferring it between parties. The global financial crisis highlighted the need for greater transparency and standardized rules for these instruments. Credit ratings and external ratings are used within regulatory frameworks to determine the risk weighting of the counterparty, which in turn influences the capital that a bank must hold against derivative exposures.

The transfer of standardized financing portfolios to SMEs based on credit scoring through the issuance of securities (derivatives) in the capital market allows financiers to distribute the inherent risk and maintain a balance between liquidity, short-term investments, and long-term financing for SMEs (Berger et al. 2005, p. 203).

This paper analysis the role of Fintech in the intersection of financing frictions, special requirements of SMEs in terms of financing, AI-enabled credit scoring architectures, and regulatory contexts. It examines how these factors interact to shape financing frictions for SMEs and explores policy implications for fostering inclusive and efficient SME credit markets. This leads to our *research question:* What are the opportunities and limitations of AI in shaping and solving the (formal) financing problems of SMEs?

II. METHODOLOGY

This study employs a multi-case research design to analyze how AI-enabled credit scoring architectures shape SME financing frictions across diverse regulatory contexts. The research incorporates mainly qualitative approaches, uses some empirical data, and secondary literature to derive findings. We follow a multistep research process. After collecting data about SMEs out of published articles in different journals, we can show the economical relevance of SMEs. One limitation will be whether we consider all SMEs, including informal ones, and how to classify SMEs—they are divergent, e.g., size, age and industry. In our next step, we analyze financing

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frictions SMEs are confronted with: Status (international overview), reasons (and a mapping with different SME segments), and goals and constraints in solving financing frictions. This includes a first look into the framework constraints, Fintech have to work in. Finally, we discuss a wide range of regulatory contexts with conclusion for Fintech enterprises, regulatory, and policies. To discuss approaches of solving the financing problems, we use the concept of business models. Credit scoring architectures, based on financial data as well as on non-financial data helps us to have a closer look on—and to develop deduc tively—the challenges, Fintech enterprises are confronted with.

III. ECONOMIC IMPORTANCE OF SMES

We understand SMEs in the definition of the European Commission:[1] Medium-sized companies show (1) a headcount less than 250 and (2) either a turnover of EUR 50 m (or less) or a Balance sheet total of EUR 43 m or less. Small companies show (1) a headcount less than 50 and (2) either a turnover of EUR 10 m (or less) or a Balance sheet total of EUR 10 m or less.[2]

In several research papers—their selection should be understood as spotlights and do not claim to be exhaustive—we found indications for the importance of SMEs in selected economies. SMEs account for 95-99.9% of total business population, 47.5-70% of private sector employment, 30-60% of the national GDP (Lu, 2018, p. 314 for the UK, Cornelli et al., 2019, p. 1 for the Asian economy, Gopal & Schnabl, 2020, p. 1 and p. 37 for the U.S. and the Euro pean Commission, 2024,[3] for the EU). SMEs constitute over 90 % of businesses and contribute to more than 50 % of employment worldwide (World Bank, 2025). The World Economic Forum estimates the number of SMEs worldwide with around 400 million that account for approximately 90 % of all global firms, generating 70% of employment.[4] 80% of them are located in developing economies. These statements do not include *informal* SMEs.

The previous description of SMEs neglects the fact of different types of SMEs, each with different financing requirements. We divide industry sector, business age, size of SME, ownership structure, financial health, and legal status (Table 1).

[1] https://single-market-economy.ec.europa.eu/smes/sme-definition_en
[2] https://ec.europa.eu/docsroom/documents/42921
[3] https://single-market-economy.ec.europa.eu/smes/sme-definition_en
[4] https://initiatives.weforum.org/sme-resource-hub/home, visited on Dec. 12, 2025.

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Table 1: SME Segments

Industry Sector	Manufacturing	Service	Trade/Retail
Business Age	Start-ups	Growth/Expansion	Established
Size of SME	Micro	Small	Medium
Ownership structure	Sole Proprietorship	Partnership	Corporations
Owner	Age		Gender
Financial Health	High Creditworthiness		Low Creditworthiness
Legal Status		Formal	Informal

IV. FINANCING FRICTIONS

4.1 Status

As it is known, for various reasons, access to financing is and has been one of the main obstacles to the expansion of SMEs (Binks & Ennew, 1996, p. 17-25; Ascúa, 2009; ICF, 2013, IMF, 2024). The World Bank specifies the extend of the problem by about 50 % of formal SMEs with no access to formal credit (World Bank Group, 2022, p. 5).

For *Asian Economy,* Cornelli et al. (2019, p. 1) found that SMEs are often asked to provide collateral for loans, lacking mutual guarantee institutions. Especially the importance of *trade finance* must be emphasized for *People's Republic of China and India* (Cornelli et al., 2019, p. 6). Lots of SMEs substituted their lending from banks through lending via FinTech in the U.S. since 2008 (Gopal & Schnabl, 2020, p. 1 and p. 37. Wagner (2019, p. 748 f.) shows roughly a medium level of problems related to access to finance all over *Europe*. On the other hand, Aristei & Angori (2022, p. 52) report, with 58 % of the cases, bank loans as very important sources of finance for SMEs in 11 *European countries*. Lu (2018, p. 317) shows for the UK that SMEs receive only 17 % of total business loans from the banking industry.

"Access to finance remains one of the greatest barriers to SME growth. The latest IFC–World Bank MSME Finance Gap Report (March 2025) estimates that across 119 emerging markets and developing economies (EMDEs), there is a finance gap of about US$ 5.7 trillion, equivalent to 19 percent of GDP and 20 percent of total private sector credit." (World Bank Group, 2025). As they show, the MSME (Micro, Small and Medium Size Enterprises) finance gap grew by +6 % annually, independent of the growth of credit supply by 7%. The finance gap concentrates on developing countries. Observable SME dept financing constraints are credit rejections, quantity restrictions (Aristei & Angori, 2022, p. 48) and interest rate increases, not related to a solid risk observance in SME.

4.2 Reasons of financing frictions

Now we want to have a closer look on the reasons for financing frictions and the requirements of SMEs in terms of financing. In the first step we look at common *issues* in financing SMEs. Financing frictions refer to obstacles that impede the efficient allocation of loans to firms (World Bank Group, 2022, p. 4 f.). We show supply-side, demand-side and transactional reasons. Table 2 gives an overview.

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Table 2: Reasons for financing frictions

Supply-side Constraints	Transactional Constraints	Demand-side Constraints
Default risks for lenders (e.g., early-stage borrowers)	Lack of registration (e.g., commercial register), low verifiability	Credit terms and covenants
High transaction costs due to limited disclosure relative to credit volume	Lack of transparent accounting systems	Lack of credit records/history
Highly concentrated banking sector	Missing track record of creditworthiness	Lack of collateral (tangible assets limited; intellectual property undervalued)
Limited microfinance institutions, credit cooperatives, and Fintech platforms	No audited financial statements	Low diversification of financing sources
Regulatory barriers and administrative burdens	No long relationship history with financial institutions and limited credit history	Low financial literacy
Sectoral challenges (e.g., agriculture, creative industries)	Type I and Type II credit assessment errors	Management and organizational problems
Weak legal systems (contract enforcement, bankruptcy procedures)		
Gender and regional financing gaps		

Table 3: SME Segments (Demand-side)

Industry Sector	*Manufacturing*	*Service*	*Trade/Retail*
Financing amounts	Large, long-term for for machinery, plants, in- and ventory, and accounts receivables	Less amount working capital accounts receivables	Short-term need for inventory and accounts receivables
Collateral	Tangible assets, accounts receivables	Intellectual property, accounts receivables	Inventory, accounts receivables
Business Age	*Start-ups*	*Growth/Expansion*	*Established*
Financing amount	Small	Large	Medium
Track record	No	Medium	Long
Collateral	No	Medium	Large
Size of SME	*Micro*	*Small*	*Medium*

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Collateral	Personal assets	Some assets	Easy to provide
Financial literacy	limited	limited	more
Ownership structure Collateral	*Sole Proprietorship*	*Partnership*	*Corporations*
	Personal assets	Pool of partners	Business-owned
Financial literacy	limited	more	extended
Financial Health Collateral	*High Creditworthiness*	*Medium Creditworth.*	*Low Creditworthiness*
	Unsecured loans, less collaterals required	Less strict collaterals required	Strict collaterals required, maybe
Legal Status	*Formal*		*Informal*

Own elaboration

Information asymmetry means imperfect information distribution among market participants—SMEs provide less (formal) information to lenders in financial markets. The degree of information asymmetry depends on several factors: age (invers correlation) size (invers correlation) and legal status (Stiglitz & Weiss, 1981; Lehmann & Neuberger, 2001). Type 1 errors (lenders accept bad prospects) and type 2 errors (lenders reject good prospects) arises from this (Altman, 1968; Roy & Shaw, 2021).

After showing common issues, we want to explain in a second step in what cases it's impossible to find easy solutions when assuming one SME equals another. Therefore, we use *different SME segments*, as introduced in chapter 3. Here we want to go deeper than in chapter 3 and discuss necessities out of different SME segments (Table 3).

Out of our analysis, for the green-colored type of (S)MEs the financing problem could be solved by traditional banks on traditional ways. But lately if the SME counts to the yellow- or red-colored types, Fintech comes in with new solution approaches for the financing problem.

4.3 Goals and constraints in solving financing frictions

Before we start to look on the solution approaches for the above-mentioned problems, we want to define goals and constraints in the solution process. In our model, we show a framework and, in its frame, the supply-side, the demand-side and in between the transactional view (Figure 1). Ensure ethics is part of the framework. Ethics mean there should be no bi ases, no discrimination, clear accountability, transparency and explainability/predictability of credit scoring results (Lee & Sohn, 2017; Oware & Junior, 2025; Pokholkova et al., 2025, p. 1293 f.). But there also exist methodological solutions for AI-based credit scoring that allow an evaluation of effectiveness, predictability, and justification mechanisms of tool's decision (Pokholkova et al., 2025, p. 1302; Kumar et al., 2021). Some enterprises in the broader field of Fintech have developed their frameworks for ensuring ethical principles with important market participants (Pokholkova et al., 2025, p. 1302; IBM "AI Fairness 360"; EY "Responsible AI"; JP Morgan Chase "Explainable AI Centre of Excellence").

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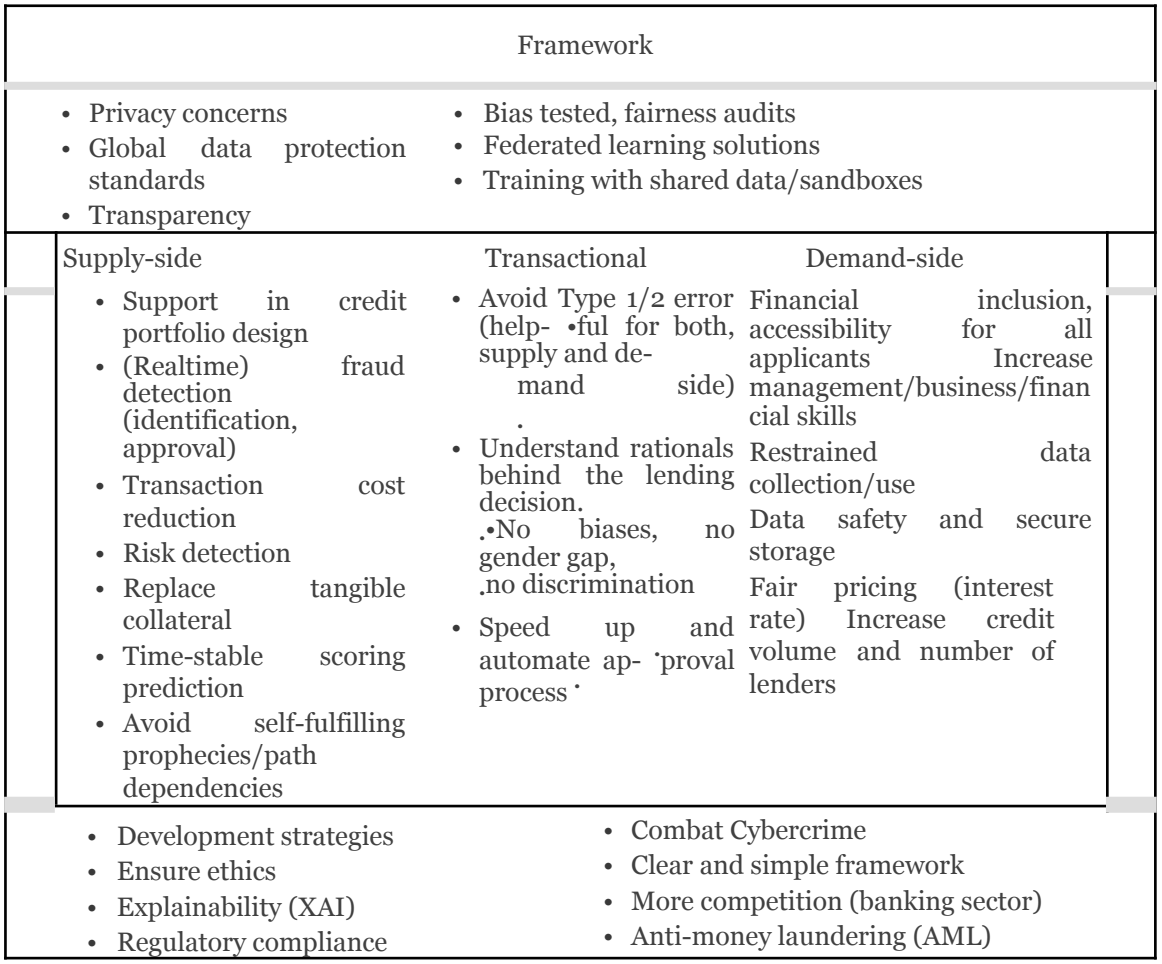
Figure 1: Framework and market



V. REGULATORY CONTEXTS

In the years following the 2008 financial crisis, authorities have begun to regulate Fintech activity, both from a monetary/financial and fiscal perspective (the Financial Stability Board – FSB, 2017, p. 25). Regulators must play a fundamental role in the development of the Fintech industry and fulfill the fundamental mission of preserving the stability of the financial system in the age of AI (Crisanto et al., 2024, p. 6).

Despite the transformative potential of financial technologies, their fast development has introduced significant regulatory challenges for regulators around the world. Traditional regulatory frameworks, designed for conventional financial institutions, struggle to adapt to the complex dynamics of financial technology innovations. In addition, the cross-border nature of many Fintech activities has brought significant jurisdictional challenges, as regulatory authorities must coordinate financial supervision at the international level (Toluwalase et al., 2024, p. 29). Most important objectives are financial inclusion, customer protection and financial stability. Many jurisdictions have specific Fintech regulations for digital pay

ment services, online lending, and digital currencies (BIS, 2020, p. 35). Meanwhile, increasing regulation limits the development of new digital players in the financial system if they do not meet the requirements. These requirements are oriented on traditional entities, so regulation strengthens the position of large, traditional financial institutions and large technology platforms with disadvantages for small/young Fintech SMEs.

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Traditional regulatory approaches prioritize prudential regulation and consumer protection. It more focuses on capital requirements, risk management, and disclosure obligations than on specific risks and characteristics of Fintech such as data privacy, Cybersecurity threats, algorithmic biases.

The *United States* has a complex regulatory environment for financial technologies, with multiple federal and state agencies responsible for overseeing different aspects of the industry (Deloitte, 2017, p. 3; Deloitte, 2024, p. 20). The Office of the Comptroller of the Currency (OCC) is responsible for regulating national banks and federal savings associations; Consumer Financial Protection Bureau (CFPB); Securities and Exchange Commission (SEC): The SEC regulates the securities industry, including initial coin offerings (ICOs) and digital securities; Federal Reserve System is responsible for regulating and supervising banks and other financial institutions to promote the stability of the financial system. In addition to federal regulation, Fintech companies must also comply with state regulations.

The *European Union (EU)* has implemented several regulations that apply to Fintech companies operating within its member states, including the General Data Protection Regulation (GDPR), which came into effect in 2018 and regulates the collection, use, and storage of personal data within the EU; the Payment Services Directive 2 (PSD2); the Anti-Money Laundering Directive (AMLD); the Markets in Financial Instruments Directive 2 (MiFID II for trans parency); and the Electronic Money Directive (issuance). The EU has also created a regulatory sandbox environment for Fintech companies to test new products and services in a controlled setting. This environment offers Fintech companies exemptions from certain regulations and access to regulatory guidance.

In *Asia, China* has a large and rapidly growing Fintech industry, with companies like Alipay and WeChat Pay dominating the mobile payments market. However, the Chinese government has recently cracked down on the industry, implementing new regulations on online lending and requiring Fintech companies to obtain licenses for certain activities (CCAF, 2021, p. 38). *Singapore* offers a favorable regulatory environment that includes a sandbox. The Monetary Authority of Singapore (MAS) has also introduced a comprehensive framework for digital banking, including strict capitalization and risk management requirements. *Japan* has a highly regulated financial sector, and Fintech companies must obtain licenses from the Financial Services Agency (FSA) to operate, and it has also established measures to promote Fintech innovation (digital currencies). *India* has a rapidly growing Fintech industry, with companies such as Paytm and PhonePe dominating the mobile payments market. However, the industry is subject to a complex web of regulations regarding e-KYC (know your customer), data protection, and payment processing. *South Korea* has recently introduced new regulations to encourage innovation in financial technology, including a sandbox and new rules on digital currencies (Lawrence et al., 2023, p. 13).

In *Africa,* Fintech is growing rapidly, where it has the potential to increase financial inclusion and stimulate economic growth. *South Africa, Egypt, and Nigeria* have developed financial sectors, but Fintech companies face significant regulatory hurdles (anti-money laundering regulations, financial services licensing, data protection, and consumer protection).

Kenya is a leader in mobile payments, with companies like M-Pesa, but the regulatory framework for Fintech companies is still developing. These companies must obtain licenses from the Central Bank of Kenya (CBK) to operate and comply with consumer and data protection regulations. In *Ghana,* Fintech companies must obtain licenses from the Bank of Ghana to operate and comply with various regulations regarding data protection, anti-money laundering, and consumer protection (CCAF, 2021, p. 51).

In *Latin America,* progress is being made across the region, with certain asymmetries among the largest countries. The main areas of intervention in the Fintech industry are Instant Payment Systems: Countries like *Brazil, Argentina, and Mexico* are leaders with systems like PIX, MODO,

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and CoDi, which enable real-time transactions and improve financial inclusion (Carvajal, 2024, p. 15). Cryptocurrency regulation establishes legal frameworks to protect consumers and maintain the integrity of the financial system.

Sandboxes: In *Mexico,* as part of its Fintech Law, a regulatory environment was established to foster innovation and maintain oversight. This has allowed Fintech companies to test new products and services in a controlled environment, driving the sector's growth (IADB, 2024, p. 101). In *Brazil*, the Central Bank of Brazil launched a sandbox initiative to support innovative financial solutions, particularly those aimed at increasing financial inclusion and improving payment systems. In *Colombia,* the Colombian sandbox has been instrumental in promoting collaboration between Fintech companies and regulators, enabling the development of innovative financial products tailored to local needs.

Consumer Protection: New regulations seek to ensure transparency, security, and fairness in financial transactions, strengthening consumer confidence.

For its part, regulation must involve various levels of oversight and monitoring of the application of AI and Machine Learning (ML) in the Fintech industry. Authorities around the world are now focusing on the ethical and legal implications of AI, and Fintech must navigate an ever-expanding network of requirements surrounding transparency, data privacy, non discrimination, and corporate responsibility.

5.1 The Role of Artificial Intelligence (AI)

AI is redefining the financial technology industry, highlighting operational scaling, productivity improvements, early fraud detection, and improved risk assessment. AI regulations vary significantly across jurisdictions, covering critical areas such as data privacy, anti-dis crimination, algorithmic transparency, and accountability for AI-based decisions (BIS CGRM, 2025, p. 85).

The *United States* takes a decentralized approach to AI regulation, with a combination of federal agency guidelines and state-level laws shaping the enforcement landscape. While there is no overarching federal law on AI, key regulators such as the Federal Trade Commission (FTC) and the Department of Commerce have issued guidelines emphasizing transparency, accountability, and fairness in AI systems. Key areas of regulatory focus include mitigating discriminatory bias, algorithm accountability and clarity, and transparency.

The *European Union (EU)* is leading the way in establishing comprehensive AI regulations to ensure the ethical, transparent, and responsible use of AI. The AI Act, a groundbreaking proposal, classifies AI systems into risk levels. It prohibits certain high-risk applications, such as social scoring, and imposes strict requirements for others, such as financial services and critical infrastructure. The Artificial Intelligence Act (Regulation (EU) 2024/1689 laying down harmonized rules on artificial intelligence) is the first comprehensive legal framework on AI worldwide. The aim of the rules is to promote trustworthy AI in Europe.

The AI Act ensures that Europeans can trust what AI has to offer. While most AI systems pose little or no risk and can contribute to solving many societal challenges, certain AI systems create risks that we must address to avoid undesirable outcomes. For example, it's often not possible to figure out why an AI system made a decision or prediction and took a particular action, so it can be difficult to assess whether someone has been unfairly disadvantaged, such as in a hiring decision or an application for a public benefits plan.

Once an AI system is commercialized, authorities are responsible for market surveillance, implementers ensure human oversight and control, and providers have a post-market monitoring system. Suppliers and implementers will also report serious incidents and malfunctions. The AI Act entered into force on August 1, 2024, and will be fully applicable two years later, on August 2, 2026, with some exceptions.

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The *Asia-Pacific region* is emerging as a global leader in AI adoption. Countries such as Singapore, Japan, South Korea, and China are implementing regulatory frameworks to foster innovation while also promoting the responsible use of AI. Key regional focus areas include data privacy; bias and fairness (emphasis on ensuring algorithms do not discriminate); and cross-border collaboration. The Asia-Pacific region demonstrates a balanced approach, combining innovation-friendly policies with a growing focus on ethics.

Thus, the Fintech regulations have been evolving and presenting the following features of emerging trends in regulation (BIS CGRM, 2025, p. 115): Digital Identity; Open Banking; Cryptocurrencies; Regulatory sandboxes; International cooperation.

In that direction, the Fintech ecosystem incorporated an additional component, known as RegTech, which combines specific Fintech regulations with technology focused on helping improve compliance with existing regulations (this trend typically involves reducing operational costs for regulatory compliance). In turn, new challenges arose for regulators, most notably the clash between traditional financial institutions and Fintech as new competitors. Furthermore, technology also presented regulators with the challenge of facilitating comprehensive access to technology for all members of the financial system (open-source APIs).

RegTech solutions emerged in the financial services sector as a response to increased regulatory complexity, leveraging advanced tools such as AI, ML, big data analytics, cloud computing, and blockchain. RegTech automates tasks that were traditionally performed manually and were time-consuming, significantly reducing the potential for human error and operational costs. Key applications include regulatory reporting; risk management; identity management; anti-money laundering (AML); compliance management; and regulatory intelligence. Adopting RegTech offers system advantages such as increased efficiency and speed; reduced costs; greater accuracy; scalability; and improved risk mitigation (Deloitte, 2024, p. 1).

Especially when addressing Fintech companies, if they are SMEs themselves, it's necessary to map the challenges and the regulation, just to check if and where they meet. The question to be answered is, how does regulation influence the development of Fintech-SMEs or how are Fintech-SMEs influenced by regulations? It is necessary to avoid systematic disadvantages for Fintech-SMEs. Therefore, the components of Fintech business models must take into account the following regulatory objectives: No bias or ethical incorrectness (audits of AI, automated compliance process), safety (data protection, fraud prevention, risk management), innovation support (sandboxes, digital/crypto currencies, fair and increased competition, sharing customer data), access (licenses from state institutions) and international (cross border collaboration).

5.2 The Role of Regulatory Sandboxes

Also, as reaction to these challenges, regulators in various jurisdictions have been adopting a more flexible and adaptable approach to financial technology regulation, with significant regulatory experimentation, the introduction of policies that promote innovation, and collaboration with stakeholders in the Fintech ecosystem. Regulatory sandboxes, together with regulatory innovation hubs, provide an environment conducive to Fintech companies testing new products, services, and business models under regulatory supervision (Olawale et al., 2024, p. 119; Uzougbo et al., 2024, p. 9). Innovation tables take the form of forums in which Fintech companies interact with authorities and members of the ecosystem, obtaining development guidance and optimizing the influence of regulatory requirements.

In this regard, some features of regulatory initiatives can be mentioned, such as: Clear legal frameworks (Mexico and Australia for sandbox operations, which reduces regulatory uncertainty for participants); Thematic sandboxes: Some countries focus on specific themes, such as financial inclusion or blockchain technology, to address specific challenges and maximize impact;

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Cross-border collaboration: Initiatives such as the Global Financial Innovation Network (GFIN) facilitate collaboration between countries, enabling cross-border testing and harmonizing regulations; Feedback loops: Regulators in countries such as Brazil and India actively engage with sandbox participants to refine policies and address scalability issues.

These areas of experimentation facilitate cooperation, interaction, and knowledge exchange between stakeholders and authorities in order to structure a proactive and innovative regulatory framework. Examples of international experiences include Singapore Fintech Regulatory Sandbox; Australia's Open Banking Policy (ACCC); Financial Conduct Authority Sandbox UK; IoRS (Interoperable Regulatory Sandbox) of the Reserve Bank of India (RBI); Spain's Financial System Digital Transformation Law Sandbox Fintech (Bank of Spain + CNMV + DGSP); Argentina's BCRA Financial Innovation Roundtable; Germany's Fintech Innovation Center supervised by BaFin in collaboration with the Bundesbank and following European Union directives. The case of the US is interesting because, although some states, such as Utah, have set up regulatory testing environments for Fintech, the country does not have a unified national program due to its fragmented regulatory structure.

5.3 Regulatory Framework

Hence, what level of security is necessary and sufficient? The experience of BITCOIN is illustrative of the security of the system and its vulnerability to speculative financial attacks, although it has made a great contribution in terms of Cyber technology. For its part, the tradition of banking regulation tends to avoid risks and strengthen the security of the system.

More recently, prudential supervision has included protecting customers from collateral damage to the system, preventing fraud, and shielding the system from illicit business. The lessons of successive financial crises in 1997, 2002, and 2008 have taught us those financial regulations were partial and unable to prevent these crises. For their part, financial supply agents repeatedly call for less regulation and bureaucracy and greater market freedom as the main incentives for a healthy financial business.

The following diagram (Figure 2) describes the necessary balance that regulators are trying to maintain in the regulation of financial services.

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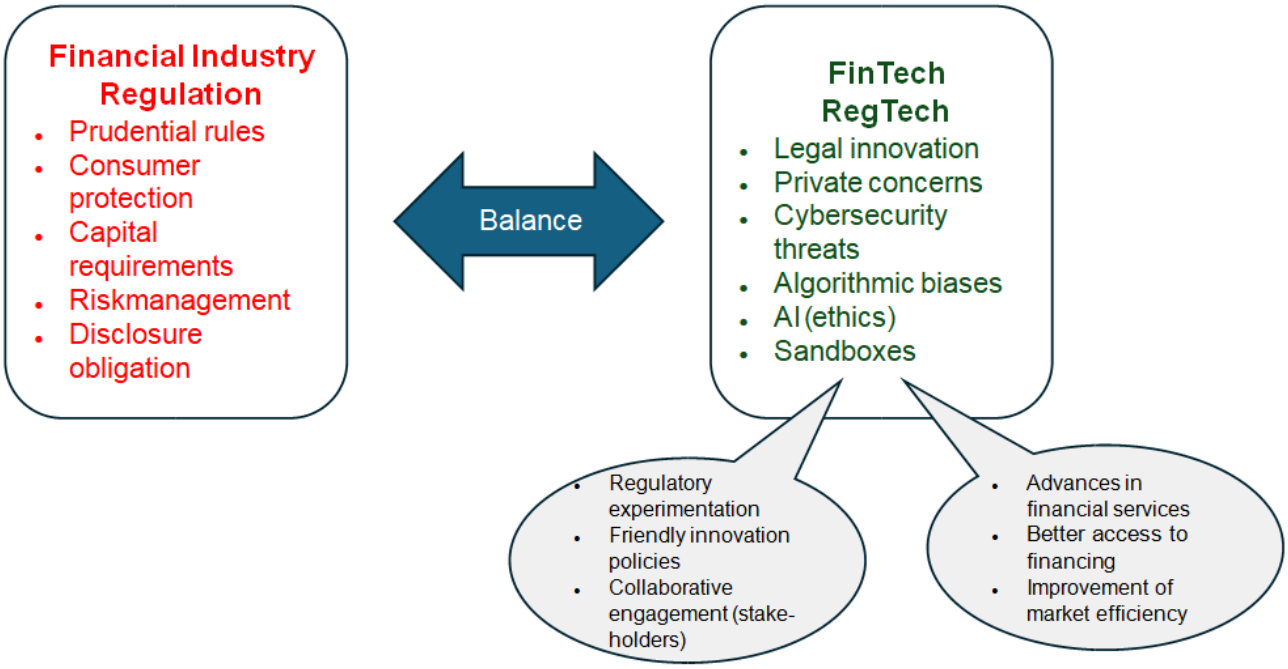

Source: Own elaboration

Figure 2: Regulators' balance

5.3 The Cases of Germany and Argentina in Perspective

Germany regulates Fintech under the same legal framework as traditional financial institu tions, based on their specific business models. While there is no single law for Fintech, the regulatory landscape is a combination of national and EU legislation. Key areas of regulation include banking, financial and payment services, investment and securities, and anti-money laundering. The Federal Financial Supervisory Authority (BaFin) and the Deutsche Bundes bank are the primary regulators.

The following is the legislative framework:

- Markets in Crypto-Assets Regulation (MiCA): This EU regulation, now fully applicable in Germany, establishes a harmonized authorization and conduct regime for crypto-asset service providers and issuers of certain tokens. It largely replaces prior national crypto regulations. Fintech providing regulated services, such as crypto custody or payment services, require authorization from BaFin.

Digital Operational Resilience Act (DORA): Fully applicable since January 17, 2025, DORA aims to standardize rules on managing information and communication technology (ICT) risk, incident reporting, and oversight of ICT third-party service providers. Many Fintech startups outsource back-office functions. This is permitted but subject to strict rules, particularly for critical functions, and must comply with DORA requirements.

German Banking Act (KWG) and Payment Services Supervision Act (ZAG): These laws these acts must obtain authorization from BaFin. govern banking and payment services. Fintechs providing regulated services under Securities Institutions Act (WpIG): This is relevant for Fintechs offering investment services, such as robo-advisors or neo-brokers.

Anti-Money Laundering Act (GwG): This law imposes obligations on Fintechs for customer due diligence, transaction monitoring, and reporting suspicious activity. German AML laws require strict identification procedures for

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customers, with video identification and electronic identity features being approved methods.

Germany's complex and strict regulatory environment, including lengthy and complicated licensing processes, can be challenging and costly for smaller Fintech.

Argentina

Argentina's Fintech regulations are overseen by multiple authorities like CNV, Central Bank, UIF, ARCA (fiscal authority) and have recently seen significant developments aimed at encouraging financial technology while enhancing consumer protection. A new, more liberal administration is working to deregulate the economy, which has impacted the Fintech sector, particularly concerning cryptocurrency and open finance.

The following is the legislative framework:

- Virtual Asset Service Providers (VASPs): Since March 2025, entities that offer services related to virtual assets must register with the National Securities Commission (CNV). This applies to crypto exchanges, crypto asset custodians, and foreign companies targeting Argentine users. Requirements include:

1. Minimum capital, depending on the business type.
2. Segregation of customer and company funds.
3. Strong Cybersecurity and anti-money laundering (AML) controls, with a requirement to report suspicious activity.

The Central Bank (BCRA) has banned traditional banks from offering crypto services directly to customers.

- Open finance: A new Open Finance System was created in 2025. The BCRA is developing the regulatory framework, which aims to give users control over their financial data and the ability to share it with Fintechs and banks. The goal is to promote financial inclusion by enabling individuals without formal credit histories to access loans and other financial products.
- Payments and wallets: The BCRA actively regulate digital payments and e-wallets, including:
  - Transferences 3.0 initiative: Promotes interoperability between bank accounts and digital wallets through standard QR codes.
  - Interoperable QR payments: Merchants are required to accept credit and debit payments from any digital wallet, regardless of the QR code provider.
  - PSP registration: The BCRA regulates and registers various payment service providers, including initiators and aggregators.

- Tokenization: The CNV and the government approved a tokenization regime in 2025, allowing for the creation of digital representations of marketable securities using distributed ledger technology (DLT).
- The Financial Innovation Board of the Central Bank of Argentina (BCRA) is a public private collaboration space designed to promote innovation and competition in financial services through the use of technology. It was promoted to act like a sandbox without its typical formalities. Although it had been operating informally since before, the BCRA Board of Directors officially formalized it in February 2019
  - Public-Private Collaboration: Brings together experts from the BCRA, fintech companies, banks, entrepreneurs, and public and private institutions.
  - Promotion of Innovation: It seeks to develop tools and solutions that improve the quality and efficiency of the financial system.
  - Financial Inclusion: Its purpose is to contribute to greater financial inclusion through the adoption and use of financial technology.
  - Dialogue and Regulation: Serves as a space for dialogue between regulators and market players to define a scenario that combines security and competition with innovation.

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Regulatory approach: There is no single, centralized Fintech law; instead, a blend of general laws and specific regulations apply. The main regulatory bodies include the BCRA, CNV, and the Financial Intelligence Unit (UIF). While there is no official regulatory sandbox, regulators are exploring options in this area.

Deregulation: The Milei administration is focused on deregulation, including measures to simplify financial transactions and increase reporting thresholds for banks. The goal is to reduce barriers for Fintech startups.

VI. APPROACHES TO SOLVE FINANCING PROBLEMS OF SMES

After concentrating in reasons of financial frictions, we try to address possible solutions for these. On the *supply side*, more competition is necessary. Fintech could help in credit scoring/rating and as lending platforms. Adoptions in legal systems and targeted interventions could address or solve further problems. On the *demand side*, business and management training, guarantees, targeted interventions and alternative sources of information could be helpful. Approaches to solve transactional problems can be divided into the market level, the organizational level, and the regulatory level. Table 4 shows some details.

Table 4: Solution approaches

Category	Reasons	Solution Approaches
Supply Side	Default risks for lenders	Guarantees, portfolio design, borrower selection, credit scoring
	High transaction costs compared to credit volume	SME credit rating systems, Credit Risk Database (Japan), credit scoring
	Highly concentrated banking sector	Promote Fintech and alternative providers (microfinance institutions, credit cooperatives, digital platforms)
	Limited microfinance institutions, credit cooperatives, and Fintech platforms	Targeted policy interventions
	Regulatory barriers and administrative burdens	Accept mobile assets as collateral, streamline business registration, licensing and taxation procedures
	Weak legal systems (contract enforcement, bankruptcy procedures)	Strengthening and adoption of effective legal frameworks
	Sectoral weaknesses (e.g., agriculture, creative industries)	Sector-specific targeted interventions
	Gender and regional financing gaps	Targeted inclusive financing policies
Demand Side	Lack of collateral	Credit guarantees, group lending (Rehman et al., 2025)

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	Lack of credit history	Alternative data sources, credit scoring mechanisms
	Restrictive credit terms and covenants	Regulatory and policy reforms
	Low diversification of financing sources	SME credit ratings, Credit Risk Database (Japan), credit scoring
	Low financial literacy	Training on business processes and accounting practices
	Management and organizational weaknesses	Management and capacity-building training
Transaction-Level Issues	Lack of registration and low verifiability	AI-supported creditworthiness assessment, new credit scoring approaches
	Lack of transparent accounting systems	Standardized financial reporting practices
	Missing track record of creditworthiness	Development of credit information infrastructure
	No audited financial statements	Promotion of audit and disclosure practices
	Limited relationship history with financial institutions	Relationship banking and data-based lending models
	Type I and Type II credit assessment errors	Improved risk assessment models and data analytics

Own elaboration, based on World Bank Group (2022); Ascúa & Wölfle (2024); Hossain et al. (2023); Rehman et al. (2023)

Empirical analysis shows some successful examples of supporting SMEs in terms of financing. Hossain et al. (2023) report about a very successful Credit Wholesale Program in Bangladesh: interest rate -3 % points below market, repayment rates of loans +95% (Hossain et al., 2023, p. 2). They also report about skill development for SME borrowers, optimizing loan quantity for SMEs and governmental desired loan default ratio.

The positive impact of Fintech on the financial inclusion of SMEs also emerges from both the adoption of financial technologies that could expand access to financial services for SMEs with difficulties in obtaining financing (Daud et al., 2022, p 37 ff.) and the inclusion of marginalized sectors and/or areas (ethnic, religious and racial minorities, rural areas, etc.). However, literature recognizes that there are still barriers that limit the massive participation of SMEs in this new financial paradigm (Jarusen, 2022, p. 927 ff.). Despite advances in Fintech, risk assessment and collateral remain key constraints in SME financing (Thath sarani/Jianguo, 2022).

To solve the problem of lack of information, financiers usually choose to request collateral from the entrepreneurs, i.e., an asset (if possible, sufficiently liquid) to serve as a hedge in case of

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default. The central bank's own regulations encourage the request for this type of preferred collateral. Collateralization also provides a way for the bank to recoup losses if the firm fails.

From the lender's point of view, taking guarantees provides a self-selection mechanism that ensures that only good projects apply for bank financing. Since business owners are the best judges of the likelihood of success, only those who have confidence in their project will offer guarantees to secure the debt (Keasey & Watson, 1993). In other words, moral hazard will be reduced if the bank loan is secured by the entrepreneur's personal assets (e.g., his own home).

The problem arises when SMEs do not have guarantees satisfactory to the financier. Thus, guarantee systems for SME financing have become widespread, and in many cases involve the direct intervention of the State (Ascúa, 2023).

Table 5: Lender's business model (traditional banks), green-colored case

<table>
<tr><td rowspan="2">Key partners
•Credit bureaus</td><td>Key activities
•Assess collateral
•Calculate default probability and expected losses, credit ratios.
•Select and weight criteria in IRB[5]</td><td rowspan="2">Value proposition
•Enduring partnership with SMEs
•Selecting low-risk borrowers
•Avoid Type 1/2 errors</td><td>Customer relationship
•Long-lasting business relation to SMEs</td><td rowspan="2">Customer segments
•Green colored (S)MEs</td></tr>
<tr><td>Key resources
Disclosed data from SMEs
• Credit application history (Rehman et al., 2025, p. 3003).
• Financial literacy
• Well-trained and experience staff</td><td>Channels
•Traditional</td></tr>
<tr><td colspan="2">Cost structure
•High in relation to the lending volume</td><td colspan="3">Framework
• No biases
• Ensure ethics
• Less regulatory boundaries, low administrative burdens
• BASEL Accords</td></tr>
</table>

Own elaboration, based on the business model approach of Osterwalder et al. (2005); Rehman et al. (2025); Roy & Shaw (2021).

It is no surprise that SMEs are often asked to provide (lacking) collateral for loans, and are also lacking mutual guarantee institutions (Cornelli et al., 2019, p. 1). Eca et al. (2022, p. 3) found in a study related to Portugal that "[...] firms who apply for P2B funding are significantly more likely to already have bank debt in their balance sheet and, at the same time, are firms with less overdue debt". Aristei & Angori (2022) showed for SMEs in 11 European countries a *path dependency* in bank loans between constraints in credit access conditions in the *past* that leads to low credit *demand behavior* of SME in the *future* they call it the self-selection effect. With the same result, credit restrictions in the past increased the likelihood of credit restrictions in the following period, at least because of reducing information asymmetries. They also show an increase of difficulties for smaller firms.

For our green-colored case (Table 3),5[2] we want to structure the tasks and constraints via a business

[5]IRB: Internal Rating Based Approach in BASEL Accords.

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model for lenders (traditional banks). Business models describe, how a firm creates and captures value. Several ideas of business models are discussed in literature. We follow the idea of Osterwalder et al. (2005), but we transformed their idea and integrated the perspective of framework instead of revenue streams (Table 5).

All above mentioned points (Table 5) are vital when using *traditional* criteria for credit scoring. But this seems not sufficient for lending to SMEs counting to the yellow- or red-colored case. The AI age offers new approaches in lending and credit scoring, necessary to control and solve financing problems. We assume as main driving forces, among others, the costs of obtaining information and information asymmetries. These could possibly be controlled and solved by new approaches to information procurement and information use. Among others, blockchain, distributed ledger and AI play significant roles as well as alternative sources of information, then the standard ones like external accounting. Further on in our analysis we want to concentrate in AI. The use of AI in credit scoring has the potential to reduce frictions by improving risk assessment and expanding credit access. However, new frictions may arise from algorithmic opacity, regulatory constraints, and ethical concerns (Bazarbash, 2019).

VII. CREDIT SCORING ARCHITECTURE

Credit scoring addresses the default risk of the lender, arising from capacity and motivation of the borrower to fulfill the credit contract. There are two important metrics: probability of default and expected loss in case of default (Bazarbash, 2019, p. 8). Usually, the line of argument goes like this: lenders are awaiting interest payments and the repayment of the loan. But: in a long-lasting business relationship between lender and borrower, there is a huge interest for the lender to continue the business relationship with the borrower so to grant a following loan—the borrower is well-known and this avoids new searching costs for the lender. So, more important than repayment is the ongoing high creditworthiness of the borrower.

7.1 Scoring based on objective/financial data and collateral (green-colored case)

Credit scoring is the process of evaluating the creditworthiness of potential borrowers. Conventional models rely on financial statements, credit history, and collateral (Altman, 1968). Other sources report about 5 Cs: capacity (dept-to-income ratio), capital structure (more or less capital (equity)), coverage (pledged collateral and loan coverage, with an existing formal market for specific assets), character (borrowers track record about missed payments, previous debts default, fraud etc.) and conditions (macroeconomic changes) (Bazarbash, 2019).

Typical financial data in use out of financial statements are revenue history, profit margin, cash flow, leverage ratio and existing dept levels (Shakila et al., 2025).

A commonly accepted credit scoring model for individuals (and also micro-entrepreneurs) is FICO. They use five categories of data: payment history (35 %), amounts owed (30 %), length of credit history (15 %), credit mix (10 %), and new credit (10 %) (Rehman et al., 2025, p. 2999; FICO, 2025). A well-known SME credit scoring architecture is Moody's KMV RiskCalc(R). For predicting default probability, they use different ratios and measures taken from disclosed information and financial records, compared to a database of 11 million annual financial statements of 2.2 million enterprises (Moody's, 2025).

Credit score calculation based on financial data uses statistical analytical procedures like logistic regression (presupposes linear association between financial behavior and credit worthiness), derivations and decision trees to deep learning (pattern recognition) (Rehman et al., 2025, p. 3003; Accuracy, 2025, p. 10). These methods are often inadequate for some SMEs (yellow-, red-colored case), especially in emerging markets, where formal records are scarce. Here, non-financial data come in the scoring process.

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7.2 Scoring based on Non-Financial Data (Yellow- and Red-Colored Case)

Some SMEs, especially small and young ones with an informal legal status and maybe in sole proprietorship don't serve with financial data. And also more established SMEs can serve with non-financial data. These data can be made usable for credit scoring and default risk management for evaluating SMEs' creditworthiness through a multi-stage multi-objective feature-selection technique (Roy & Shaw, 2021, p. 4 ff.; Kou et al., 2021, p. 2). Literature (Table 6) shows several approaches how non-financial data for credit scoring can be structured (Kou et al., 2021; Roy & Shaw, 2021; Rehman et al., 2025; Shakila et al., 2025; Accuracy, 2025; Khandani et al., 2010; Berg et al., 2020; Bjorkegren & Grissen, 2020; Oware & Junior, 2025). The importance of every single non-financial data is not really clear. Kou et al. (2021) show differences in importance depending on test methods.

Table 6: Non-financial data for credit scoring

Category	Variables / Indicators
Firm-based Variables	Business sector, firm age, company patents, corporate governance indicators, management quality, education and experience, integrity and commitment, succession planning, financial flexibility, geographical location, regulatory compliance, shareholder and board structure, legal form
Business Risk & Market Variables	Market position and risks, development risks, technological risks, production risks, industry outlook, demand–supply gap
Business Performance Variables	Production strength, marketing strength, sales growth, comprehensive business analysis
Network-based Variables	Manager network interactions, shareholder network interactions, payment networks (high-frequency transactional data), credit relationship information, credit history, repayment period, compliance records, government approvals, audited accounts, company relationships, relationship length
Payment and Transaction Variables	Daily transaction records, wages, tax payments, transaction history, supply chain interactions
Behavioral Data	Borrower character and honesty indicators, mobile phone usage for borrowing products, social media activity, text message activity, mobile payment transactions, e-commerce activity, utility bill payments, mobile recharge patterns, professional network stability, social interactions, web browsing patterns
Personal and Biometric Data	Biometric data (fingerprint, facial recognition, voice authentication), psychometric tests (personality characteristics)

Fintech refers to the integration of technology into offerings by financial services companies to improve their use and delivery to consumers (Gomber et al., 2017). In the context of SME financing, Fintech encompasses a range of business models—including peer-to-peer (P2P) lending, crowdfunding, invoice financing, and digital banks—that aim to address long-standing market failures. Here, Fintech is understood as an intermediary actor in credit market. Some of

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these Fintech are able to use and process non-financial data for credit scoring. From this point of view, the lender's business model (Fintech) for the yellow- and red-colored case is developed (Table 7).

Table 7: Lender's business model (Fintech), yellow- and red-colored case

<table>
<tr>
<td rowspan="2">Key partners
•
Data providers
• Financiers
• Algorithm developers</td>
<td>Key activities
•
Federated learn ing
• Realtime fraud detection
• Risk detection
• Score calculation</td>
<td rowspan="2">Value proposition
• Credit volume in crease
• N° of borrowers in crease S(ME)s
• Credit portfolio deci sion for borrowers
• Time-stable scoring • Fair and risk-based pricing (interest rate) Avoid Type 1/2 errors speed-up in decision making</td>
<td>Customer rela Tionship
• Explaining ration als of lending de
• cision
• Skill increases for SMEs</td>
<td rowspan="2">Customer seg ments
• Yellow and red colored SMEs
• Financial inclu sion</td>
</tr>
<tr>
<td>Key resources
• Algorithms
• Staff (IT)
•Data, collection and evaluation</td>
<td>Channels
• Easy to use/ mo bile phone</td>
</tr>
<tr>
<td colspan="2">Cost structure
• Cut cost volume through less human involvement</td>
<td colspan="3">Framework
• Less concentration in banking sector
• Privacy concerns, data protection, data safety • No biases, no gender gaps
• Avoid Cybercrime
• No self-fulfilling prophecies in creditworthiness • Less regulatory boundaries, low administrative bur dens
• Ensure ethics
• BASEL Accords</td>
</tr>
</table>

Own elaboration

VIII. CREDIT SCORING FOR SMES: TRADITIONAL AND AI-BASED

AI-enabled credit scoring uses machine learning algorithms to analyze traditional and non traditional data sources (Bazarbash, 2019; Accuarcy, 2025). These systems can identify patterns and predict default risk with higher precision (Rehman et al., 2021, p. 3003), enabling lenders to extend credit to previously excluded SMEs (Berg et al., 2020).

8.1 Scoring based on Financial and Non-Financial Data

This type of evaluation attempts to solve the problem of credit scoring by using multiple criteria decision-making models (MCDM) which are expert-driven and can *simultaneously* assess financial and non-financial data (Table 7) with limited data available (Abe et al., 2015). Typical concepts in use are decision trees, random forests, BWM/TOPSIS (Accuracy, 2025, p. 10 f.) and fuzzy-logic approaches (Chamochumbi Diaz et al., 2026).

Roy & Shaw (2021, p. 3) successfully tested the best-worst method (BWM) for evaluating the criteria weight and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), with the latter credit scores could be derived. They integrated managerial, industrial, ethical and financial factors *simultaneously,* and derived the weights of these factors. Other possible models are random forest models. They

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could include multiple decision-trees and capture non-linear relationships between criteria—a huge advantage compared to traditional concepts (Kamirova, 2024, p. 8 f.).

8.2 Possible Weaknesses of Algorithmic Lending

Algorithmic bias in financial technology is a real possibility, e.g., using training data with biases. However, algorithmic decision-making can reduce face-to-face discrimination in markets prone to implicit and explicit biases. But the use of algorithms can also lead to inadvertent discrimination (Barocas & Selbst, 2016). Fintechs discriminate approximately one third less than conventional financiers in terms of costs, as Fintech are not influenced by potential discrimination arising from face-to-face interactions between originators and borrowers (Garcia et al., 2024). However, Fintech uses pricing strategies and data analysis that generate discriminatory pricing strategies. Thus, although algorithm-based digital lending can reduce discrimination compared to analog financiers, it is not sufficient to eliminate discrimination in loan pricing. Further possible challenges using algorithms are from the view of the borrower (Figure 1): Privacy concerns, transparency and explainability of the results, regulatory compliance, and Cybercrime.

IX. CONCLUSIONS AND SUMMARY

The financing gap for SMEs worldwide is not easy to understand, due to different types of SMEs and regional differences. Traditional lenders like banks are not very interested in credit granting to SMEs. The ratio between the credit volume and the cost of credit worthiness checks is unfavorable. In addition, lenders usually ask for easily marketable collateral that retains its value. The ability to provide collateral can vary greatly depending on the sector, the age of the company, its size, its ownership structure, the personality traits of its owners, and the financial health of the SME. But also the highly concentrated banking sector is part of the problem, as well as regulatory barriers. On the side of the SMEs, low financial literacy, low diversification of financing and lack of management skills are observable. Depending on the condition of the respective SME and the capital market, the credit shortage is more or less pronounced.

9.1 Improvements on the part of SMEs

For SMEs, AI-supported credit scoring can replace their (often) lacking tangible and marketable collateral for credits via non-financial data supply or through authorized access to it. They must improve the financial and managerial literacy and skills, especially when it is difficult to provide marketable collateral. SMEs could also form a borrower community to reduce the portfolio risk for the lender and mutually guarantee each other's financial obligations in part. This could increase the credit volume and creates a time-stable scoring prediction.

9.2 Improvements on the part of lenders

The use of AI in creditworthiness assessments can reduce dependence on marketable collateral if new approaches can be shown to produce high-quality, fast, time-stable forecasts of credit default probabilities and the extent of credit default. AI could also help to reduce transaction costs in the risk assessment process and ensure a better risk and fraud detection. The fact that credit checks can be carried out more frequently thanks to more easily accessible relevant data and the use of AI can lead to rapid feedback loops between credit checks and the granting of credit, which, in the sense of a self-fulfilling prophecy, can lead to path dependencies and accelerated negative developments for the SMEs.

9.3 Improvements on the Part of Regulators/Policy

Politicians must ensure, through appropriate regulation, that smaller lenders can also establish themselves on the capital markets. To this end, the regulatory requirements for smaller market participants must be reduced. One strategic advantage of large providers is the abundance of data at their disposal – a resource that is only available to smaller providers to a very limited extent. This problem can be solved if legislators require established providers to make tested and distortion-adjusted test data generally available,

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supplemented by federated learning solutions. With specific test environments (sandboxes), legislators can support the development of Fintech as lenders, platforms, or service providers. Regulators must agree on a global regulatory standard if they want to avoid international arbitrage by lenders and Fintech companies. At the same time, regulators have to avoid biases and discrimination (via explainability), money laundering, Cybercrime, global data protection and privacy concerns. Moreover, targeted interventions to solve sectoral, gender and regional weaknesses are helpful.

As elaborated, there is not only one type of SME, as usually taken for granted in literature. Using segmentation criteria like industry sector, business age, size of SME, ownership structure, age and gender of the owner, financial health of the SME and its legal status helps to understand financing frictions in a better way. Problems arise out of different financing needs, collateral, track record, financial literacy of the SMEs, and its legal status. We followed a market-oriented perspective when we tried to solve the problems of underfinanced SMEs. Solutions are developed based on goals on the supply-side, transactional and the demand-side, but in an ethical and regulatory framework.

So far, we can answer our research questions: There are great opportunities to solve (formal) financing problems of SMEs via AI involvement in credit scoring, but regulatory and policy must establish a clear and powerful, worldwide framework in a short term— wait and see is no successful approach! AI rapidly reshapes the financial industry—the financial services sector is expected to significantly increase its investment in AI in the coming years. This change must be actively shaped through political and regulatory measures.

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The Sustainability of Moral Values in Marriage Towards a Nation Building

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ABSTRACT

In the contemporary society, issues relating to moral values cannot be under-estimated as it promotes sanity, progress, growth, development, sanctity of life among others. In view of human perception, moral values are essential for the growth and development of family, organization and the society at large. In the light of this, all veritable variables that could promote moral rectitude need to be given attention and not to be treated with kid gloves by the government or individuals. But, despite the fact that African society lay emphasis on moral values, it is disheartening that the concept is not given a significant place in some families, organisations and institutions which in turn bring retrogression in some areas in the society. Thus, the objective of this work is to look into the significance of moral values in marriage towards the sustainability of a nation building. A historical method was adopted for the study. Findings revealed that there are certain values in marriage which can be used for the growth of the nation. It was also noted from the study that some moral values in marriage in the past are fading gradually from society. The work recommends that moral values that are common to marriage sanctity need to be promoted by each family for the growth of the society, family should inculcate good values in the life of their children by making them to be accountable for every responsibility given to them, this will promote peace, unity and sanity in the society.

Keywords: marriage, moral values, nation building, family, society.

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The Sustainability of Moral Values in Marriage Towards a Nation Building

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ABSTRACT

In the contemporary society, issues relating to moral values cannot be under-estimated as it promotes sanity, progress, growth, development, sanctity of life among others. In view of human perception, moral values are essential for the growth and development of family, organization and the society at large. In the light of this, all veritable variables that could promote moral rectitude need to be given attention and not to be treated with kid gloves by the government or individuals. But, despite the fact that African society lay emphasis on moral values, it is disheartening that the concept is not given a significant place in some families, organisations and institutions which in turn bring retrogression in some areas in the society. Thus, the objective of this work is to look into the significance of moral values in marriage towards the sustainability of a nation building. A historical method was adopted for the study. Findings revealed that there are certain values in marriage which can be used for the growth of the nation. It was also noted from the study that some moral values in marriage in the past are fading gradually from society. The work recommends that moral values that are common to marriage sanctity need to be promoted by each family for the growth of the society, family should inculcate good values in the life of their children by making them to be accountable for every responsibility given to them, this will promote peace, unity and sanity in the society.

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I. INTRODUCTION

The growth and development of an organisation or society depend largely on the product of a good family, this is because family is the basic unit of any organisation. It is described as the microscope by which the larger society depends. It is also regarded as the child's first social environment. In addition, every person is made aware of his role and obligation with a long period of socialization during his childhood, how he/she learns from others peoples; the way to behave, act and demonstrate his attitude in the society. Meanwhile, before family, there is marriage, which is seen as one important institution. It is an institution which dictates how an organisation or society at large looks like whether in the area of exhibiting socio-norm or moral values. Omidiwura (1999) agreed with this submission when he opined that whatever happened in the moral life of a nation is the aggregate of what obtains in the family. Besides, the quality of the family life dictates the worth of the society. In the light of the foregoing, to promote marriage and everything that revolves around it, there are some virtues that need to be put into consideration and hold in high esteem once a marriage is put in place.

Going further, as prominent as moral values are in the fold of the marriage institution, it is disheartening that there are lot of moral decadence which are responsible for the retrogression of the society. Perhaps, this may be the reason why Vasudev (2004) cited by Wahab and Adesupo (2012) stated that societal degeneration is sending shock waves down in

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human spine. The collapse of societal values is apparently driving the masses to the brink of disaster, and if left unchecked it could lead to serious consequences for humanity. In addition, if there is no character training among the youths and the aged there may not be a reputable society. Thus, it is the responsibility of the parents within the confine of a marriage institution to inculcate moral values in the mind of the children before they move to larger society. In the light of the above, the alarming rate at which lack of moral values are being perpetrated by some Christians and non-Christians in the society in recent time calls for re-examinations. It is on this premise that this study examines some moral values that uphold marriage and how such could be inculcated in the mind of the young ones before moving to the larger society. The work also trace the consequence of lack of moral values in marriage institutions and how it could affect the building of a nation.

II. MARRIAGE AS A CONCEPT

Marriage as a concept is seen as the beginning of the family and a lifelong commitment. It is more than a physical union but cover the spiritual and emotional relationship of husband and wife. Marriage is define as a legally recognised relationship and social contract between two people; specifically a man and a woman. This concept is based on a sexual relationship and implying a permanence of the union (https://www.allprodad.com>5reasons). In another dimension, marriages are what create a family and families are regarded as the most basic social unit upon which society is built. Thus, both marriage and family create status roles that are sanctioned by society. In addition, whatever happen to a marriage is likely to affect family and will have either positive or negative effects in the society. The view of Mbiti (1980) is in line with the above submission which stated that marriage is a complex affair with economic, social and religious aspects which often overlap so firmly that cannot be separated from one another. This also states that marriage and family are key structures in building a nation.

As a corollary, Norman (2004) opined that marriage is not a specifically Christian institution but God's gift to mankind. This implies that at creation God ordained a man and a woman to come together and become one flesh. (Gen. 2:24). Kunhiyop (2004) noted that marriage is the unity of man and woman, he acknowledged that the society has an impact on the meaning, expectations and aspiration of the union. This view indicates that marriage is the concept that integrates with other people and relationships in the society. Going further, a look at the scripture in Genesis 2:18-25 revealed that loneliness is not good for man, this made God to create a helper for Adam. Norman (2004) stated that procreation and companionship could be seen as the twin purposes of marriage. He acknowledged that companionship has priority over procreation because it is possible to have a real marriage even if the couple do not have children, but without companionship the procreation of children may not fulfill the divine purpose for marriage. In another dimension Mbiti (1980) is of the view that marriage and procreation in African society are a unity, he added that without procreation marriage is incomplete this states that African society lay emphasis on procreation.

As said earlier, marriage is an institution that cannot be ignored for the sustainability of the society, thus, to uphold its sanctity must be put in place by the couple. Meanwhile, the sanctity of the marriage is safeguarded by the Seventh Commandment in the Bible which says that "you shall not commit adultery". This implies that marriage must be holy as God is holy, besides, God wants ethical values to reflect in marriage as this will assist the couple, children and society at large. To promote unity, progress and development in marriage and society issues relating to moral values remain sacrosanct one. Jesus said in Matthew 5:32 and 19:9 that adultery can damage the relationship between husband and wife which can even leads to divorce and may not be of good interest to the family and the society. Scripture stated in Hebrew 13:4 and I Cor. 6:9-10 that marriage needs to be honoured by all and its intimacies are to be kept exclusively between the spouses. Besides, for marriage to be

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holy there are some virtues to be put into consideration such as faithfulness, loyalty, endurance, obedience, love, commitment, humility, tolerance, accountability, transparency among other factors. These virtues are seen as ingredients that sustain marriage institution. Thus, this work reiterates that if the husband and wife allow the virtues to work between each other it will be easy to inculcate it in the mind of their children which will eventually have a positive impact in the society.

III. MORAL VALUES VIS-A-VIS MARRIAGE SANCTITY

To build a nation, there are series of institutions that are needed such as religion, politics, economy, education, marriage, family to mention a few. In the contemporary world, there is a factor which the society do not take cognizance of when it comes to the issue of nation building, and this could be seen in the area of moral values. Moral is defined by Hornby (2010) as a concept that concerns with principle of right and wrong behaviour. This implies that it is a concept that explains what is right or wrong obligations/responsibilities of a person or group of persons. Norman (2004) is of the view that moral is a concept that seeks to evaluate human conduct, the roles and principles used to control it. Omoregbe (1993) states that for a person to be morally good it means that such person is subject to the moral law or morally responsible from the foregoing, it could be deduced that a man who is conform with moral law can be seen as a responsible being. Omoregbe acknowledged that the concept of moral could mean an attitude that is good or praise worthy. Thus, in a given society, it is expected of an individual to exhibit an attitude worthy of emulation in the community; however, to do this the parents have a good role to play, this is because if the relationship between the couples are not cordial, there is tendency to be problem in the home and the society. However, as a way of sustaining home and the society there are some virtues such as loyalty, commitment, accountability, transparency, unity, love among others that remain sacrosanct to the holiness of marriage in the society and this in turn have impact toward the building of a nation.

Meanwhile, whenever a marriage is put in place, the leadership role of both husband and wife cannot be underestimated, they are the one who built the younger ones before coming to the larger society, and their integrity is very significant in the process of training their children. Ayokunle (2015) corroborates this submission when he submitted that what qualifies a person for leadership is directly related to character. He acknowledged that it is not about style, status, personal charisma, clout or achievement but his integrity makes a difference. This also signifies that honesty is one of the moral principles in marriage sanctity which must be inculcated in the mind of the children for the good of the society. Ayantayo (2017) states that honesty is a virtue that is essential in the course of interaction with others. This implies that to sustain a particular home and the society there should be honesty between the leader and the subjects.

One other virtue that is relevant in the promotion of marriage sanctity and nation building is accountability and transparency. In Genesis 2:24, God ordained that a man and a woman should come together and become one flesh. It is believed among some adherents of religious faith that to sustain marriage there should be transparency between the couples which should be inculcated in the mind of the children for the growth of the society. In the light of this accountability and transparency are needed for the building of the society.

In the Bible, scripture recorded that Joseph was transparent and gave account of the position he holds in Egypt. To develop a nation, both the leader and followers need to be transparent in the management of the resources of the nation; besides, the parent should note that their children are accountable for any assignment, money or position they hold in the family, this will give them the opportunity to aware that accountability is essential in any position they hold in the society. Another virtues that is relevant in the nation building is commitment. In marriage, one of the good virtues that is essential for its

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sustainability is commitment. Norman (2004) holds the view that it is a mean of committing husband and wife to live in an harmonious relationship in their wedlock. To this end, it is expected of the spouse in any given home or area to exhibit this virtue, knowing fully that it is a virtue that will bring progress and development in the society. For instance in the Bible, Nehemiah and Joseph express the spirit of commitment to built their nation. The parent should therefore inculcate the spirit in the mind of their children so that such will be exhibited by them if they found themselves in the position of authority or responsibility. One of the problems facing the nation in recent time is that some leaders are not committed to the progress of the nation. Some are after their own interest which still remains a thing of concern in the nation.

The concept of tolerance is one of the virtues that can bring sanctity into marriage and society at large. This virtue revolves around the willingness or ability to accept or tolerate an opinion or behaviour one is not willing to agree with or a way to accommodate people of different view. To sustain marriage one needs to tolerate each other for the peace of the family. Meanwhile, if tolerance is not allow in a given family, the children may think that it is the best option to cordinate affairs in the family and the society which may inturn resulting to crisis or chaos in the area of exhibiting attitude in the society. Ayantayo (2017) states that in a traditional setting, tolerance has its potentiality to promote cordial relationship for the peace of the society, this could also be seen in Islam and Christianity. Thus, if the concept of tolerance is inculcated in the mind of the children, it will be easy for the young ones to exhibit it in the society and the inculcation must start from the family.

One of those factors that can bring about divorce between husband and wife is lack of faithfulness. Faith is an act of trust in one's ability or knowledge while the act of faithfulness is seen as a means of staying with or supporting a particular person, organization or belief, it is synonymous with the concept of loyalty. This virtue is one of the factors that uphold a family. It is worthy to note that if there is lack of faithfulness between the spouse, such family may not likely stay. Before the young one move to the large society, it is good for the parents to inculcate the virtue of faithfulness in them. One of the problems Nigeria is facing in recent time is lack of faithfulness on the part of leaders. Some Nigerian leaders are not committed, loyal nor faithful to their subjects which is a problem in the nation. It is however good for the family to train and inculcate the virtues that are good for the sustainability of family which will in turn assist the growth of the society.

IV. LACK OF MORAL VALUES IN MARRIAGE VIS-À-VIS THE GROWTH OF THE SOCIETY

One of the concepts that is sacrosanct toward the growth and development of a society is Moral Value. It is a concept that promote the integrity of a person, value the dignity of man, promotion of human heritage and culture of a society. Besides, it promotes the peace and unity in the society. But a look at the society in recent time states that moral values are fading away in a gradual form, thereby leading to inability to obey and respect the constitutional authority. It is also disheartening that lack of moral which originated from some of the individual family have led to series of problems ranging from criminality, corruption, unfaithfulness, moral decadence, lack of tolerance to mention a few. At the early part of this work, it was established that moral values attached to the institutions of marriage can assist the growth of the society, thus, this section consider the inability to uphold some virtues inherent in marriage for the growth of the society.

One of the problems that can emerge if failed to uphold the Moral Values attached to marriage is Moral decadence. Moral decadence is the decline of deterioration of ethical and moral standards and values within a society, leading to a breakdown of established norms that guide proper behaviour. It involves a shift where behaviour previously considered wrong or unacceptable become normalised or even celebrated.

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In a typical African society, Morality is a concept which is recognised, honoured, valued and promoted. The family often serves as a link and regarded as first socializing agent in the training of a child. Adewuyi (2012) argued with this submission when pointed out that the first point of contact for any child is the home, hence, it is expected of the parents to ensure that their children are brought up properly at the formative stage before moving to the larger society. But it is disheartening in our society in recent time perhaps because of education and civilization; some of the young ones lack respect for elders, some are not ready to take to corrections, indecency dressing are common or rampant among some youths in the society leading to problem in the area of exhibition of attitude. Some of these youths had bad behaviour because of inadequate home training, parental negligence, and the breakdown of traditional family structures, issue of media and technology, and society economic issues.

To allow orderliness in the society parents should be ready to give proper training to their children in order to prepare them for the task ahead. Akano and Adesupo (2014) agreed with about submission with the view that parents should not allow the pursuit of materials things at the expense of responsibilities on their children. They acknowledged that proper training need to be given to the children before moving to the larger world in order to promote social order in the society.

One other problem which lack of moral can cause in the society is indiscipline. To allow social order in the society discipline needs to be put in place and this revolves a way of controlling man's passions, emotions, desires and appetites Omoregbe (2000). Dairo (2005) adds that it is generally referred to as training, especially of the mind and character, to produce self-control and habits of obedience. The implication is that discipline implies control of minds and self demonstration of humility for the peace of an organisation. However, where discipline is not in existence, such society shall witness indiscipline which is the lack of discipline. It is also a situation in which people do not control their behaviour or obey rules (https://dictionary.cambridge.org). It is a concept which is characterized by disobedience, disorderly conduct, and failure to maintain discipline in a given environment, such as home, school, work place or in society at large. To promote social order in the society, parents need a lot of work to do, to allow their children to be responsible in the society. Apart from traditional values or custom, the words of God need to be inculcated in the mind of children for this will change their orientation to a positive way in the society.

Criminality is an act which negate the order of the society. It is an act which refers to the quality of state of a criminal, encompassing the totality of behaviours and actions that violate criminal law and are subject to state prosecution and punishment. It is a complex and interdisciplinary subject studied by law, sociology, psychology, and criminology. In Nigeria in recent time, there are various acts of criminal behaviour such as kidnapping, rape, banditry, terrorism, stealing to mention a few. It is disheartening that some youths in Nigerian society are involved in one or more of these crimes. While tracing the involvement of the youths with the act Adewuyi (2012) posits that a family who failed to train a child in the way of God is trying to expose him to the act of lawlessness in the society. He acknowledged that the words of God and African custom needs to be given to the children. As a way of discussing the level of inability to promote moral values, it should be noted that in a society where there is disorderliness, chaos, lack of unity; criminality has a wide-ranging and destructive impact on society as it affects individuals, communities, the economy and the political system. These consequences are physical, psychological, social and economic and they can be both short-term and long term on families, communities, polity and individuals' lives (https://ijeks.com).

V. CONCLUSION

The society we live in is characterized with acts of lawlessness and all kinds of vices. Little or no attention is given to the commandment or exhibition of morals making the society to face

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oppression, corruption, injustice, indiscipline, favouritism, unfair treatment among others. The implications of this is that adequate attention are not given to moral rectitude and they are treated with kid's glove at every societal level making society to face problems which are not even regarded as problems by some Nigerian leaders. One of those things to be noted is that moral values is a concept that is significant in the transformation of any society this is because it is a concept that is valued, honoured and cherished in any typical African society. It is also a concept that promotes and enrich the integrity of an individual if properly exhibited. Thus, to inculcate moral values it should begin from the family as the basic unit of socializing agent of the society. Besides, the worship centres such as Church and Mosque should do the needful in passing moral to the younger ones before they move to the larger society in order to have a good society.

VI. RECOMMENDATIONS

Based on the submission of this work the following suggestions are considered useful.

- To move the society forward, Nigerian government should not allow the digitalization of the world to dominate or have negative impact on the exhibition of moral values in the society. Thus, priority should be given to moral values in the society.
- The Church as the custodian of moral should do everything possible to preach against immoral acts in the society. Reason behind this is that some of the immoral acts that are found in the secular world are also in existence in the Church God.
- The fact that family is the basic unit of a society, it is imperative for the parents not to neglect their responsible on the children. We need to note that some parents because of money and civilization do not train the children the way it ought to be.
- In African culture, there are lots of values such as respect for elders, faithfulness, patriotism, obedience among others that are good for the growth of the society however, if we made use of them it will bring harmonious relationship in the society.
- It is advisable for the parents and government not to neglect or relegate values that are good for the peace of the society.

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