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## ARTIFICIAL INTELLIGENCE IN PRIVATE EQUITY AND NATIONAL INNOVATION: A CONCEPTUAL FRAMEWORK

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### ABSTRACT

This paper develops a conceptual framework to examine how artificial intelligence (AI) integration in private equity (PE) may influence national innovation performance. As AI increasingly transforms financial decision-making and investment strategies, private equity firms are adopting AI-driven tools to improve deal sourcing, due diligence, portfolio management, and resource allocation. At the same time, private equity continues to play a significant role in supporting innovative firms and technological development. Despite growing interest in AI and financial innovation, limited research has explored how AI-enabled private equity may contribute to broader national innovation systems. Drawing upon interdisciplinary literature in artificial intelligence, private equity, financial innovation, and innovation systems theory, this paper proposes that AI-powered PE may strengthen national innovation indirectly through improvements in firm-level innovation. More specifically, AI integration may enhance the ability of PE firms to identify innovative companies, reduce information asymmetry, and support long-term technological development. The framework further suggests that institutional quality, including regulatory effectiveness, digital infrastructure, and financial market development, may shape the effectiveness of AI-enabled investment activities across countries. Rather than providing empirical testing, this study offers a theoretical synthesis that connects firm-level innovation processes with broader national innovation outcomes. The paper contributes to emerging discussions on AI-driven financial transformation and highlights several directions for future empirical research on AI, private equity, and innovation ecosystems.

**KEYWORDS:** *artificial intelligence; private equity; national innovation; firm-level innovation; innovation systems; financial technology; institutional quality.*

## 1. INTRODUCTION

Innovation has become one of the most important drivers of long-term economic growth and national competitiveness in the contemporary global economy. In an increasingly knowledge-based and technology-driven environment, countries are no longer competing solely through natural resources or industrial capacity, but also through their ability to generate, adopt, and commercialize innovation. As a result, governments and businesses worldwide are placing growing emphasis on strengthening innovation ecosystems, technological capabilities, and digital transformation in order to sustain economic development and global competitiveness.

Within this broader context, financial systems play a critical role in supporting innovation by allocating capital to firms with high growth potential and technological capabilities. Among different forms of financial investment, private equity (PE) has emerged as an important mechanism for supporting innovative firms, startups, and high-growth enterprises. Unlike traditional financing sources, private equity firms often provide not only financial resources but also strategic guidance, managerial expertise, and access to professional networks that may facilitate innovation and business expansion (Kaplan & Strömberg, 2009). Through these functions, PE contributes to the commercialization of new technologies and the development of innovation-oriented industries.

At the same time, artificial intelligence (AI) is increasingly transforming the financial sector and reshaping the way investment decisions are made. Advances in machine learning, predictive analytics, and big data processing have enabled financial institutions to analyze vast amounts of information with greater speed and accuracy than traditional analytical approaches (Brynjolfsson & McAfee, 2017). In the context of private equity, AI technologies are gradually being integrated into deal sourcing, due diligence, portfolio management, risk assessment, and market forecasting. These capabilities may improve investment efficiency, reduce information asymmetry, and enhance the ability of PE firms to identify companies with strong innovation potential.

The growing integration of AI into private equity raises important questions regarding its broader implications for innovation and economic development. Existing research has extensively examined the relationship between financial development and innovation, as well as the role of AI in improving financial decision-making. Similarly, a substantial body of literature has explored the contribution of private equity to firm-level innovation and

technological growth. However, these strands of research remain relatively disconnected. In particular, limited attention has been paid to how AI-enabled private equity may influence innovation outcomes beyond the firm level and contribute to broader national innovation systems.

This gap is important because innovation does not occur solely within individual firms. Rather, innovation emerges through interactions among financial institutions, firms, governments, technological infrastructure, and regulatory systems. Consequently, the influence of AI-powered PE on innovation is likely to extend beyond investment efficiency and affect broader national innovation performance through more complex and indirect mechanisms. Furthermore, the effectiveness of AI-enabled investment activities may vary across countries depending on institutional quality, digital infrastructure, financial market development, and technological readiness.

In response to these issues, this paper develops a conceptual framework that explains how AI integration in private equity may contribute to national innovation performance. Drawing upon literature in artificial intelligence, financial innovation, private equity, and innovation systems theory, the paper proposes that AI-powered PE may strengthen firm-level innovation by improving investment selection, resource allocation, and strategic support for innovative firms. These firm-level innovation outcomes may subsequently contribute to broader national innovation performance. The framework further suggests that institutional quality plays an important moderating role in shaping the effectiveness of AI-enabled private equity across different national contexts.

Rather than providing empirical testing, this study adopts a conceptual and theory-building approach. Its primary objective is to synthesize interdisciplinary literature and propose theoretical pathways linking AI-powered private equity to national innovation systems. In doing so, the paper contributes to the emerging literature on AI-driven financial transformation and provides directions for future empirical research on the relationship between artificial intelligence, private equity, and innovation ecosystems.

## **2. LITERATURE REVIEW**

### **2.1. Private equity and innovation**

Private equity (PE) has long been recognized as an important source of financing for innovative firms, particularly startups and high-growth enterprises that often face difficulties accessing traditional forms of capital. Due to high uncertainty, limited collateral, and information asymmetry, innovative firms may encounter significant barriers when seeking

bank financing or public investment (Kortum & Lerner, 2000). In this context, private equity serves not only as a provider of financial capital but also as a mechanism that enables technological experimentation, business expansion, and innovation development.

Beyond financial investment, PE firms frequently play an active governance role in portfolio companies. Kaplan and Strömberg (2009) argue that private equity investors often contribute managerial expertise, operational restructuring, strategic guidance, and access to professional networks. These forms of support may improve organizational efficiency and create conditions that are more favorable for innovation activities. Similarly, Gilligan and Wright (2020) emphasize that PE firms can facilitate long-term business growth by strengthening corporate governance and improving strategic decision-making processes.

Several studies have also linked private equity investment to stronger innovation performance at the firm level. For example, Lerner et al. (2011) found that PE-backed firms may increase innovation efficiency and improve patent quality over time. More recently, He et al. (2024) suggest that private equity market development can positively influence firm innovation, particularly in environments with supportive institutional and financial conditions. These findings indicate that PE may contribute to technological advancement not only through funding but also through strategic involvement in innovation-oriented firms.

However, the relationship between private equity and innovation should not be viewed as uniformly positive. Some scholars argue that PE firms may prioritize short-term profitability and operational efficiency, potentially discouraging long-term investment in research and development (Lerner et al., 2011). Furthermore, the impact of PE on innovation may vary across industries, institutional environments, and levels of technological development. Consequently, the effectiveness of private equity as an innovation-enabling mechanism remains context-dependent.

Taken together, the literature suggests that private equity may play a significant role in supporting innovation activities, particularly by facilitating capital allocation, strategic governance, and technological development. Nevertheless, the extent to which these effects can contribute to broader national innovation outcomes remains insufficiently explored.

## **2.2. Artificial Intelligence (AI) in financial decision-making**

The rapid development of artificial intelligence (AI) has significantly transformed the financial sector in recent years. AI technologies, particularly machine learning, predictive analytics, and big data processing, enable financial institutions to analyze large and complex datasets with greater speed and accuracy than traditional analytical methods (Brynjolfsson &

McAfee, 2017). As a result, AI is increasingly being integrated into investment management, financial forecasting, risk assessment, and portfolio optimization.

Within the financial industry, AI has become particularly relevant in areas that require extensive information processing and decision-making under uncertainty. Gadre-Patwardhan et al. (2016) note that AI technologies can improve financial analysis by automating data processing and enhancing predictive capabilities. Similarly, Kraus et al. (2021) argue that AI applications in business and finance may reduce information asymmetry and improve strategic decision-making efficiency.

In the context of private equity, AI can be integrated into multiple stages of the investment process. During deal sourcing, AI systems may identify potential investment opportunities by detecting patterns in market and financial data. In due diligence processes, AI tools may assist investors in evaluating firm performance, operational risks, and industry trends more efficiently (Krause, 2023). Furthermore, AI technologies may support portfolio management through continuous monitoring and predictive analysis, allowing PE firms to respond more quickly to market changes and operational challenges.

Recent studies also suggest that AI adoption may contribute indirectly to innovation outcomes. Babina et al. (2024), for example, argue that AI-related capabilities may enhance firm growth and product innovation by improving organizational learning and decision-making efficiency. Similarly, Corea (2024) highlights the growing role of AI-driven automation in entrepreneurial finance and private market investment activities.

Despite these advantages, the adoption of AI in finance also raises important concerns. Brennen and Kreiss (2016) emphasize that digitalization may introduce challenges related to transparency, accountability, and governance. In financial decision-making, issues such as algorithmic bias, limited data quality, and excessive reliance on automated systems may reduce the reliability of AI-generated outcomes. Consequently, while AI has the potential to improve investment efficiency, its effectiveness remains dependent on data quality, institutional oversight, and human judgment.

Overall, the literature suggests that AI may substantially enhance financial decision-making capabilities and improve investment efficiency in private equity activities. However, existing studies have primarily focused on operational or firm-level outcomes, with relatively limited attention given to broader innovation systems and macro-level implications.

### 2.3. National innovation performance and innovation systems

At the macroeconomic level, innovation is widely regarded as a central driver of economic growth, industrial competitiveness, and technological advancement. National innovation performance is commonly assessed through composite indicators such as the Global Innovation Index (GII), which evaluates various dimensions of a country's innovation ecosystem, including institutional quality, human capital, infrastructure, technological capability, and knowledge outputs (World Intellectual Property Organization, 2023).

Innovation systems theory emphasizes that national innovation outcomes do not emerge solely from individual firms but from interactions among firms, financial institutions, governments, universities, and regulatory systems. In this sense, innovation should be understood as a systemic and multi-level process shaped by broader economic and institutional conditions.

Financial systems play a particularly important role within innovation ecosystems because they facilitate the allocation of resources to productive and innovative activities. Levine (2005) argues that more developed financial systems can improve capital allocation efficiency and support long-term economic growth by enabling firms to access funding for research and development activities. Similarly, Aghion et al. (2005) suggest that financial development may promote innovation by encouraging investment in technological advancement and entrepreneurial activities.

However, the relationship between finance and innovation is not always straightforward. The effectiveness of financial systems in supporting innovation depends heavily on institutional quality, regulatory effectiveness, human capital, and technological readiness. Countries with stronger institutions and more advanced financial markets are generally more capable of transforming financial investment into innovation outcomes. By contrast, weaker institutional environments may limit firms' ability to utilize financial resources effectively for innovation purposes.

At the firm level, innovation activities such as research and development, technological adoption, and product innovation contribute directly to broader national innovation performance. When innovative activities occur across a large number of firms, their combined effects may strengthen industrial competitiveness, technological progress, and national productivity growth. Therefore, firm-level innovation can be viewed as an important mechanism linking financial investment activities to broader national innovation systems.

## **2.4. Toward an integrated conceptual framework**

Although substantial research has examined private equity, artificial intelligence, and innovation separately, these strands of literature remain relatively disconnected. Existing studies on AI in finance mainly focus on operational efficiency, investment analysis, and financial forecasting, while research on private equity has concentrated primarily on firm performance and innovation outcomes at the company level. At the same time, innovation systems literature has rarely examined how AI-enabled investment mechanisms may contribute to national innovation performance.

More specifically, limited research has explored how AI integration in private equity may indirectly influence national innovation through improvements in firm-level innovation. This gap is important because AI-powered investment decisions may affect not only investment efficiency but also broader technological and innovation ecosystems.

Drawing upon the existing literature, this study proposes that AI integration may enhance the ability of private equity firms to identify innovative companies, allocate resources more efficiently, and provide stronger strategic support for technological development. These improvements may strengthen firm-level innovation activities, including research and development investment, technological adoption, and innovation output. Over time, the cumulative contribution of innovative firms may support broader national innovation performance.

The framework further suggests that institutional quality may shape the effectiveness of this relationship. Countries with stronger regulatory systems, more advanced digital infrastructure, and better-developed financial markets may be more capable of benefiting from AI-enabled private equity activities. Consequently, the relationship between AI-powered PE and national innovation is likely to vary across national contexts.

Overall, the literature indicates that AI-powered private equity may become an increasingly important component of modern innovation ecosystems. Nevertheless, the mechanisms linking AI integration, private equity activities, firm-level innovation, and national innovation performance remain insufficiently theorized. This study therefore seeks to address this gap by developing a conceptual framework that integrates these previously disconnected areas of research.

## **3. Conceptual framework**

Building upon the preceding literature, this study develops a conceptual framework explaining how artificial intelligence (AI) integration in private equity (PE) may contribute to

national innovation performance through firm-level innovation mechanisms and institutional conditions. The framework synthesizes insights from research on private equity, AI-driven financial decision-making, and innovation systems theory to propose several theoretical pathways linking AI-enabled investment activities to broader innovation outcomes.

Existing literature suggests that private equity plays an important role in supporting innovative firms by providing not only financial capital but also strategic guidance, governance support, and managerial expertise (Kaplan & Strömberg, 2009; Gilligan & Wright, 2020). At the same time, AI technologies increasingly reshape financial decision-making processes by improving predictive analytics, information processing, and investment efficiency (Brynjolfsson & McAfee, 2017; Kraus et al., 2021). Drawing upon these perspectives, this paper proposes that AI-enhanced private equity may strengthen innovation ecosystems by improving investment quality and facilitating firm-level innovation activities.

The framework further assumes that national innovation performance is shaped not only by firm-level innovation but also by broader institutional conditions, including financial market development, digital infrastructure, and regulatory quality (Levine, 2005; World Intellectual Property Organization [WIPO], 2023). Consequently, the effectiveness of AI-enabled private equity may vary across different national contexts.

### **3.1. AI integration and private equity capabilities**

Artificial intelligence has increasingly become an important component of financial decision-making due to its ability to process large datasets, detect complex patterns, and improve predictive accuracy. Brynjolfsson and McAfee (2017) argue that AI technologies significantly enhance analytical capabilities by enabling organizations to utilize data more efficiently in strategic decision-making processes. Similarly, Kraus et al. (2021) emphasize that AI applications may improve business and financial performance through automation, predictive analytics, and information optimization.

In the private equity industry, investment decisions often involve substantial uncertainty and information asymmetry, particularly when evaluating innovative firms operating in rapidly changing technological markets. Traditional investment evaluation methods may be limited in their ability to analyze large volumes of financial, technological, and market-related information simultaneously. In this context, AI-driven analytical systems may improve investment processes by identifying hidden patterns and supporting more accurate forecasting of firm performance (Gadre-Patwardhan et al., 2016).

AI integration may also enhance several core PE activities, including:

- deal sourcing,
- due diligence,
- portfolio monitoring,
- risk assessment,
- market forecasting,
- strategic resource allocation.

Krause (2023) notes that AI-supported investment tools may help investors evaluate innovation-oriented firms more efficiently and reduce information-processing limitations in private market transactions. Similarly, Corea (2024) highlights the growing role of AI technologies in entrepreneurial finance and investment management, particularly in environments characterized by high uncertainty and rapid technological change.

As a result, AI-enabled PE firms may become more capable of identifying innovative companies with strong technological potential and long-term growth opportunities. Improved analytical capabilities may also allow PE investors to allocate financial resources more effectively and provide stronger strategic support to portfolio companies.

### **Proposition 1**

*AI integration may enhance the capability of private equity firms to identify, evaluate, and support innovative firms more effectively.*

This proposition is supported by prior studies suggesting that AI technologies improve predictive analysis, financial decision-making efficiency, and investment evaluation processes (Brynjolfsson & McAfee, 2017; Kraus et al., 2021).

### **3.2. Private equity and firm-level innovation**

The literature on private equity consistently suggests that PE firms contribute to innovation not only through financial investment but also through active governance and strategic involvement. Kaplan and Strömberg (2009) argue that private equity investors often provide managerial expertise, organizational restructuring, and strategic guidance that may improve firm performance and long-term growth potential. Similarly, Gilligan and Wright (2020) emphasize the strategic role of PE firms in supporting business expansion and organizational development.

Innovation-oriented firms frequently require long-term investment, technological experimentation, and strategic flexibility. In many cases, traditional financing mechanisms

may be insufficient due to high uncertainty and limited short-term profitability. Private equity investment may therefore create favorable conditions for innovation activities by providing both capital and strategic support (Kortum & Lerner, 2000).

When combined with AI-enhanced analytical capabilities, private equity firms may become more effective in identifying innovation-oriented firms and supporting technological development. AI-supported investment systems may improve the ability of PE firms to monitor market trends, evaluate innovation potential, and allocate resources to firms with strong research and development capabilities. Babina et al. (2024) further suggest that AI-related capabilities may contribute to organizational learning, product innovation, and technological growth within firms.

Firm-level innovation may include:

- research and development activities,
- technological adoption,
- digital transformation,
- product innovation,
- process innovation,
- knowledge commercialization.

Over time, these innovation activities may improve firm competitiveness and contribute to broader industrial and technological advancement.

### **Proposition 2**

*Firm-level innovation may function as an intermediary mechanism through which AI-enabled private equity contributes to broader innovation performance.*

This proposition aligns with prior research emphasizing the relationship between private equity investment, technological development, and innovation performance (Lerner et al., 2011; He et al., 2024).

### **3.3. National innovation performance and innovation systems**

Innovation systems theory suggests that national innovation outcomes emerge from interactions among firms, financial institutions, governments, universities, and regulatory systems rather than from isolated organizational activities. National innovation performance therefore depends on the collective ability of economic actors to generate, diffuse, and commercialize knowledge and technology.

Financial systems play an essential role in this process because they facilitate capital allocation to productive and innovation-oriented activities. Levine (2005) argues that well-developed financial systems may support economic growth and technological advancement by improving investment efficiency and reducing financial constraints for firms. Similarly, Aghion et al. (2005) suggest that financial development may encourage innovation by supporting entrepreneurship and technological investment.

Within this broader innovation ecosystem, innovative firms contribute directly to technological capability, industrial competitiveness, and productivity growth. When a large number of firms engage in successful innovation activities, the cumulative effects may strengthen broader national innovation indicators, including:

- patent development,
- technological diffusion,
- industrial modernization,
- knowledge creation,
- innovation competitiveness.

The World Intellectual Property Organization (WIPO, 2023) further emphasizes that national innovation performance is strongly associated with institutional quality, digital infrastructure, human capital, and technological readiness. Consequently, innovation outcomes should be understood as systemic rather than purely organizational phenomena.

AI-enabled private equity may therefore influence national innovation indirectly by improving the quality and effectiveness of innovation-oriented investment activities at the firm level.

### **Proposition 3**

*The cumulative effects of firm-level innovation supported by AI-enabled private equity may contribute to stronger national innovation performance.*

This proposition is consistent with prior literature linking financial development, innovation activities, and economic competitiveness (Levine, 2005; Aghion et al., 2005).

### **3.4. The moderating role of institutional quality**

Although AI-enabled private equity may support innovation activities, the effectiveness of this relationship is likely to depend heavily on institutional conditions. Institutional quality influences regulatory transparency, investor protection, technological infrastructure, financial

market efficiency, and innovation governance. These factors shape the ability of firms and investors to utilize financial and technological resources effectively.

Countries with stronger institutional environments may provide more favorable conditions for AI adoption and innovation development. More advanced digital infrastructure, effective governance systems, and well-developed financial markets may facilitate the implementation of AI technologies in private equity activities and improve the efficiency of innovation-oriented investment decisions.

By contrast, weaker institutional environments may limit the effectiveness of AI-enabled investment systems. Regulatory uncertainty, limited technological infrastructure, weak investor protections, and insufficient digital readiness may reduce the ability of private equity firms to support innovation effectively.

Previous studies suggest that institutional and financial conditions significantly influence the relationship between finance and innovation (Aghion et al., 2005; Levine, 2005). Similarly, the Global Innovation Index highlights the importance of institutional quality and innovation infrastructure in shaping national innovation capacity (WIPO, 2023).

#### **Proposition 4**

*Institutional quality may moderate the relationship between AI-enabled private equity and national innovation performance.*

This proposition reflects the view that innovation outcomes are shaped not only by investment activities themselves but also by broader institutional and systemic conditions.

### **3.5. Proposed conceptual model**

Based on the preceding discussion, this study proposes a multi-level conceptual framework linking AI integration in private equity to national innovation performance.

The proposed framework suggests the following theoretical pathway:

*AI Integration in Private Equity* → *Enhanced Investment Efficiency and Strategic Decision-Making* → *Stronger Firm-Level Innovation* → *Improved National Innovation Performance*

At the same time, institutional quality moderates the effectiveness of these relationships across different national contexts.

This framework contributes to the literature in several ways. First, it integrates previously disconnected research streams on artificial intelligence, private equity, and innovation systems. Second, it identifies firm-level innovation as a key intermediary mechanism connecting AI-driven investment activities with broader national innovation outcomes. Third,

it highlights the importance of institutional quality in shaping the effectiveness of AI-enabled financial innovation systems.

Overall, the framework provides a theoretical foundation for future empirical studies examining how AI-powered financial investment mechanisms may influence innovation ecosystems and national technological competitiveness.

#### **4. Theoretical implications and future research directions**

The proposed conceptual framework offers several important theoretical implications for the emerging literature on artificial intelligence, private equity, and innovation systems. By integrating previously disconnected research streams, this study contributes to a broader understanding of how AI-enabled financial mechanisms may influence innovation ecosystems at both firm and national levels. At the same time, the framework highlights several areas that require further empirical investigation and theoretical refinement.

##### **4.1. AI as an innovation-enabling financial infrastructure**

One important implication of this study is the conceptualization of artificial intelligence not merely as a technological tool, but as an innovation-enabling financial infrastructure. Existing research on AI in finance has primarily focused on operational efficiency, automation, and predictive analytics (Brynjolfsson & McAfee, 2017; Kraus et al., 2021). However, the present framework suggests that AI may also influence broader innovation systems by reshaping how financial resources are allocated to innovative firms.

Through enhanced information processing and predictive capabilities, AI-enabled private equity may improve the identification of firms with strong technological potential and long-term innovation capacity. This may reduce information asymmetry, improve investment precision, and strengthen the strategic allocation of financial capital within innovation-oriented industries. In this sense, AI becomes not only a technological innovation itself but also a mechanism that facilitates the commercialization and diffusion of innovation across the broader economy.

This perspective extends prior literature on financial development and innovation by emphasizing the role of AI-driven investment systems in shaping innovation ecosystems (Levine, 2005; Aghion et al., 2005). Rather than viewing financial institutions as passive providers of capital, the framework positions AI-enabled PE firms as active participants in technological and innovation development.

#### **4.2. Multi-level innovation mechanisms**

A second contribution of the framework lies in its multi-level approach to innovation processes. Much of the existing literature has examined either firm-level innovation or macro-level innovation systems separately. Research on private equity, for example, often focuses on organizational performance, operational restructuring, and firm innovation outcomes (Kaplan & Strömberg, 2009; Lerner et al., 2011). Conversely, innovation systems literature tends to emphasize national institutions, policy environments, and technological infrastructure (WIPO, 2023).

This study bridges these perspectives by proposing that firm-level innovation functions as an intermediary mechanism linking AI-enabled private equity to national innovation performance. More specifically, the framework suggests that AI-enhanced investment activities may strengthen firm innovation capabilities, which may subsequently contribute to broader technological competitiveness and innovation outcomes at the national level.

The framework therefore highlights the importance of examining innovation as a cumulative and interconnected process rather than as an isolated organizational phenomenon. This multi-level perspective may help researchers better understand how financial technologies interact with institutional and innovation systems across different economic environments.

#### **4.3. Institutional conditions and uneven innovation outcomes**

The framework also emphasizes the moderating role of institutional quality in shaping the effectiveness of AI-enabled private equity. Existing studies suggest that financial development and innovation outcomes are strongly influenced by institutional conditions, including governance quality, regulatory effectiveness, technological infrastructure, and investor protection (Levine, 2005; Aghion et al., 2005).

Building on this literature, the present study argues that the benefits of AI-powered private equity are unlikely to be distributed evenly across countries. Nations with stronger digital infrastructure, more advanced financial systems, and supportive innovation policies may be better positioned to utilize AI technologies effectively within investment and innovation activities. By contrast, weaker institutional environments may limit the capacity of firms and investors to benefit from AI-driven financial systems.

This perspective is particularly important because it challenges technologically deterministic assumptions suggesting that AI adoption automatically generates innovation benefits. Instead, the framework proposes that AI-driven innovation outcomes remain highly dependent on broader institutional and systemic conditions.

Furthermore, institutional variation may contribute to global inequalities in innovation capacity and technological competitiveness. Countries with limited technological infrastructure or weak governance systems may face difficulties integrating AI into financial and innovation ecosystems, potentially widening existing innovation gaps between developed and developing economies.

#### **4.4. Governance challenges and potential risks**

Although AI-enabled private equity may create opportunities for innovation development, the increasing reliance on AI technologies in financial decision-making also raises several governance and ethical concerns. Brennen and Kreiss (2016) emphasize that digital technologies may introduce challenges related to transparency, accountability, and algorithmic governance. In the context of private equity, AI-driven investment systems may create risks associated with biased data, opaque decision-making processes, and excessive reliance on automated analytical models.

Algorithmic bias may distort investment decisions if AI systems are trained on incomplete or historically biased datasets. Similarly, excessive dependence on predictive models may reduce the role of human judgment in evaluating long-term technological potential and innovation uncertainty. Since innovation activities often involve experimentation and unpredictable outcomes, fully automated decision-making systems may struggle to evaluate novel or disruptive technologies effectively.

Another concern involves the concentration of financial and technological power. Large investment firms with superior AI capabilities may gain disproportionate advantages in identifying and financing innovative firms, potentially reinforcing market concentration and limiting competition within innovation ecosystems. Consequently, the integration of AI into private equity may require stronger governance mechanisms, regulatory oversight, and ethical standards to ensure transparency and accountability in financial decision-making processes.

These issues suggest that future discussions on AI-enabled finance should not focus solely on efficiency gains but also consider broader questions of governance, fairness, and institutional regulation.

#### **4.5. Future research directions**

As a conceptual study, this paper provides several directions for future empirical research. First, future studies may empirically examine the relationship between AI-enabled private equity and national innovation performance using cross-country panel datasets. Such studies

may investigate whether AI integration within private equity firms contributes to stronger innovation outcomes across different institutional environments.

Second, future research should develop more precise measurements of AI integration in private equity activities. Existing studies have not yet established standardized indicators for measuring AI adoption within private investment systems. Potential measures may include:

- AI-related investment intensity,
- AI adoption in financial analysis,
- digital investment capabilities,
- AI-driven portfolio management systems.

Third, future studies may examine sectoral and regional variations in AI-enabled innovation outcomes. The relationship between AI-powered private equity and innovation may differ across industries characterized by varying levels of technological intensity, digitalization, and innovation uncertainty.

Fourth, future research should investigate the governance and ethical implications of AI-driven financial decision-making. Issues related to algorithmic transparency, regulatory oversight, and digital inequality may become increasingly important as AI technologies continue to transform financial markets and investment systems.

Finally, future empirical studies may explore potential nonlinear or reciprocal relationships between innovation systems and AI-enabled private equity. It is possible that highly innovative economies may attract greater AI-driven investment activity, creating dynamic feedback loops between financial innovation and technological development.

Overall, these future research directions may contribute to a more comprehensive understanding of the complex relationship between artificial intelligence, private equity, and national innovation ecosystems.

## **5. CONCLUSION**

This paper develops a conceptual framework to explain how artificial intelligence (AI) integration in private equity (PE) may contribute to national innovation performance through firm-level innovation mechanisms and institutional conditions. Drawing upon interdisciplinary literature on artificial intelligence, financial innovation, private equity, and innovation systems, the study proposes that AI-enabled PE may enhance investment efficiency, improve strategic decision-making, and strengthen support for innovation-oriented firms. These firm-level innovation activities may subsequently contribute to broader national

innovation outcomes, including technological advancement, productivity growth, and industrial competitiveness.

The framework further emphasizes that the relationship between AI-powered private equity and national innovation is unlikely to operate uniformly across countries. Instead, institutional quality, digital infrastructure, financial market development, and regulatory effectiveness may significantly shape the effectiveness of AI-enabled investment systems. In this sense, the study highlights the importance of understanding innovation not only as a technological process but also as a systemic phenomenon influenced by broader financial and institutional environments.

This study contributes to the existing literature in several ways. First, it integrates previously disconnected research streams on AI in finance, private equity, and innovation systems. Second, it proposes a multi-level theoretical framework linking AI-enabled investment activities to national innovation through firm-level innovation mechanisms. Third, it emphasizes the moderating role of institutional quality in shaping innovation outcomes within AI-driven financial ecosystems.

As a conceptual paper, this study does not provide empirical testing or causal verification of the proposed relationships. Instead, it offers a theoretical foundation for future empirical research examining how AI-powered financial investment systems may influence innovation ecosystems across different national contexts. Future studies may further investigate measurement approaches, sectoral variations, governance challenges, and cross-country differences associated with AI-enabled private equity and innovation performance.

Overall, the paper suggests that AI-driven transformation in private equity may become an increasingly important component of modern innovation ecosystems. However, the long-term effectiveness and societal impact of AI-enabled financial systems will depend not only on technological advancement but also on institutional capacity, governance quality, and the broader ability of national economies to support innovation-oriented development.

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