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DIVERSIFICATION OF BUSINESS THROUGH DIGITAL TECHNOLOGIES: CASE STUDY OF KAZAKHSTAN INDUSTRIAL COMPANIES

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Original article

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ABSTRACT

This article examines the impact of digital technologies on the diversification of industrial enterprises' activities, using the example of industrial firms in Kazakhstan. A literature review was conducted to analyze the influence of digital technologies on financial, human resource, and logistics indicators of enterprises, as well as their effects on activity diversification. Based on the review and expert interviews, the authors developed survey questions and conducted a survey among 230 respondents who are middle and high-level managers of industrial enterprises in Kazakhstan. Using the Smart PLS program, we employed a dual-model approach: one to measure variables like digital technologies, financial performance, HR performance, logistic performance and diversification levels (Formative model), and another to analyze their relationships (Structural Equation Modeling, SEM). The findings indicate strong convergent validity among the variables studied. Interestingly, digital technologies have a significant impact on financial and HR performances, but less so on logistic performance. This highlights a common issue among most industrial enterprises: the limited use of digital technologies in their logistical consolidation. Moreover, while financial and HR performances strongly influence enterprise diversification, logistic has a minor effect. These results underscore the intricate dynamics within enterprise management frameworks and highlight how technological and organizational strategies can affect diversification outcomes differently. The results of the study can be useful for supporting the theory of the relationship between digital technologies and the diversification of enterprise activities, as well as for identifying problem areas that require deeper analysis and intervention by top managers of enterprises.

Keywords: *Diversification, Digital technologies, business performance, multiple regression analysis, industrial firms*

1. INTRODUCTION

Digital transformation has become a critical driver of organizational change and performance improvement in recent years. In the context of accelerating digital transformation and increasing market complexity, industrial and service firms worldwide are actively seeking ways to enhance their performance, resilience, and sustainability. Among the strategies most frequently adopted in recent decades are technological modernization and diversification — both at the product/service level and through geographic expansion. Digital technologies such as Industry

4.0, big data analytics, artificial intelligence, and supply chain integration have become central to this transformation, offering not only potential efficiency gains but also new forms of value creation. At the same time, diversification strategies are often viewed as a hedge against market volatility, though their long-term effectiveness remains a subject of debate. This duality — between the promise of digitalization and the ambiguity of diversification outcomes — forms the core of the problem space this study addresses.

Prior literature has investigated the impact of digital technologies on firm performance and the interplay between diversification and operational capability. Dalenogare showed that while some Industry 4.0 technologies were positively associated with industrial performance, others yielded limited or even negative expectations, particularly in emerging economies (Dalenogare et al., 2018). Similarly, Zhu et al. (2020) emphasized that digital innovation requires alignment with organizational readiness and contextual factors to yield performance benefits. Regarding diversification, Nath found that marketing capability and international diversification had stronger positive impacts on financial performance than product diversification (Nath et al., 2010). Conversely, studies in the banking sector (e.g., Stiroh & Rumble, 2006; Shim, 2013) revealed that revenue diversification may increase exposure to volatile income streams, thus lowering risk-adjusted returns. These mixed findings highlight a key research gap: how do internal capabilities and external digital forces jointly influence the performance outcomes of diversification strategies, especially in transitional economies?

This study addresses this gap by focusing on the role of digital technologies in shaping the effectiveness of industrial diversification strategies in the context of Kazakhstan — an emerging economy undergoing digital modernization (Porter, 2005). Drawing on both resource-based and institutional perspectives, we examine whether and how digital adoption (e.g., big data analytics, supply chain integration, and Industry 4.0 tools) moderates the relationship between diversification and firm performance. The contribution of this paper lies in its empirical investigation of these relationships using firm-level data, offering insights into whether digitalization can serve as a strategic complement to diversification or whether the two strategies conflict under certain contextual conditions. This work provides both theoretical advancements in understanding diversification-performance dynamics in digital settings and practical recommendations for policymakers and industrial managers in developing economies.

This study aims to fill this gap by examining how digital technologies influence various organizational consolidations—financial, HR, logistical—and subsequently affect enterprise diversification outcomes. Using a Formative model approach and Structural Equation Modeling (SEM), the study analyzes these relationships empirically and provides insights into their strategic implications.

The article is structured as follows: first, the literature review was conducted, synthesizing existing knowledge on digital technologies, organizational performance and enterprise diversification. Then, the methodology section outlines the research design, data collection methods, and analytical techniques used. These methods include expert interviews, respondent surveys, and multiple correlation and regression calculations. Next, the results and findings from the empirical analysis are presented and discussed. Finally, the paper concludes the results, discusses study limitations, and suggests avenues for future research. By exploring the interplay between digital technologies, organizational performance, and enterprise diversification, this research contributes valuable insights to strategic management, offering practical guidance to

2. LITERATURE REVIEW

Digital transformation – the integration of digital technologies into business processes – has become a key driver of internal efficiency and performance across various business functions

(Wang, D., & Shaoc, X., 2024; Westerman, 2014; Meena G, & Santhanalakshmi, K., 2025). Industrial firms are increasingly adopting tools like Enterprise Resource Planning (ERP) systems, Human Resource Information Systems (HRIS), digital finance platforms, and supply chain digitization technologies to streamline operations. These digital tools allow organizations to process large volumes of data in real time, breaking down information silos and enabling more informed decision-making (Alawneh et al., 2025). In the last five years, a growing body of literature (especially in emerging markets and industrial contexts) highlights how such technologies improve efficiency, effectiveness, and strategic decision processes within core functional areas like human resources, finance, and logistics.

2. 1. DIGITAL TECHNOLOGIES AND FINANCIAL PERFORMANCE

Digital technologies play a pivotal role in enhancing the financial performance of organizations through improved process automation, data accuracy, and real-time decision-making. Numerous studies have demonstrated that the adoption of enterprise resource planning (ERP) systems, digital accounting platforms, and financial analytics tools leads to better budgeting, reporting, and financial control mechanisms Cerrato et al. (2022). In emerging economies, where firms often face resource constraints and structural inefficiencies, digital finance systems provide a means of overcoming barriers to transparency and accountability.

Moreover, financial digitalization allows firms to allocate capital more effectively and respond more swiftly to external shocks, thus promoting strategic agility. This supports the argument that strong financial systems act as a foundation for broader organizational development, including growth through diversification. Based on these insights, we propose the following hypothesis:

H_1: Digital technologies have a positive impact on financial consolidated performance.

2. 2. DIGITAL TECHNOLOGIES AND HUMAN RESOURCE PERFORMANCE

In Human Resource Management (HRM), digital technologies primarily take the form of e-HRM platforms or HRIS that automate and integrate HR processes. Studies indicate that implementing HRIS yields substantial efficiency gains. For example, the use of HRIS has been shown to reduce administrative costs, improve communication, and shorten the time needed to complete HR tasks, thereby streamlining HR operations. By digitizing functions such as payroll, recruiting, and record-keeping, HRIS minimizes manual paperwork and errors. This allows HR staff to focus on strategic activities like talent development. Modern HRIS are designed not just for record storage but to collect, analyze, and distribute HR data in support of HR management and decision-making. In practice, this means HR managers gain access to real-time workforce analytics – for instance, dashboards on employee performance or turnover – which support more data-driven decisions rather than relying on intuition alone. Recent research on HR analytics echoes that integrating such data-centric tools shifts HR decision-making from reactive or instinctual to proactive and evidence-based, improving outcomes in areas like talent management and performance appraisal.

Critically, digital HR tools have been linked to better organizational performance. Empirical studies in emerging market contexts confirm a positive impact of HRIS on firm performance. The consensus is that digital HR tools improve efficiency and information quality in HR processes, which in turn improves employee management and contributes to overall firm effectiveness. For instance, automating attendance tracking or training management ensures timely, accurate information that helps managers make better decisions regarding workforce planning and development.

It is worth noting that industrial firms have faced some challenges in reaping these benefits

to the fullest. Babelova suggests that manufacturing companies often lag in adopting modern HR technologies due to various barriers (e.g. legacy systems, skill gaps, or change resistance) (Babelova, et al. 2023). Nonetheless, even in these settings, forward-looking firms are investing in advanced HRIS and related technologies. The result is not only internal efficiency but also improvements in HR outcomes like employee satisfaction and retention (through, for example, self-service HR portals and better work-life balance initiatives). Overall, the literature of the past five years reinforces that digital HRM capabilities are integral to boosting internal efficiency and informed decision-making in the HR function, ultimately supporting better organizational performance (Obydiennova, 2024). Therefore, we hypothesize:

H_2: Digital technologies have a positive impact on HR consolidated performance.

2. 3. DIGITAL TECHNOLOGIES AND LOGISTICS PERFORMANCE

Supply chain digitalization involves deploying technologies such as IoT (Internet of Things) sensors, RFID tracking, big data analytics, cloud platforms, and blockchain across procurement, production, and distribution processes (Carter et al., 2008; Parola, et al., 2015). The overarching finding is that these digital tools greatly enhance supply chain efficiency, agility, and integration, leading to better overall performance. For instance, Salamah's study employing a large-scale analysis of firms reports that digitalization significantly enhances supply chain integration and efficiency, which in turn contributes to improved supply chain performance (Salamah et al., 2024). By connecting suppliers, manufacturers, and logistics providers on unified digital platforms, companies can achieve seamless information exchange and coordination. This real-time connectivity promotes faster communication and collaboration, helping to eliminate bottlenecks and reduce delays in the chain. As a result, digital supply chains tend to be more responsive and agile, capable of swiftly adjusting to demand fluctuations or disruptions – a benefit that has been especially noted in the post-COVID era of volatile supply.

Specific performance improvements from supply chain digitalization have been documented across various studies. Digital technologies allow firms to optimize routes and inventory levels, resulting in concrete efficiency gains such as shorter lead times and lower inventory. For example, IoT devices can monitor inventory and in-transit goods in real time, enabling just-in-time restocking and reducing warehousing costs. Big data analytics can improve demand forecasting accuracy, which minimizes overstock or stockouts. One empirical study on Chinese industrial firms found that digital transformation was a key factor in significantly increasing supply chain efficiency (He at al., 2024). Moreover, the efficiency gains from digital supply chain initiatives directly translated into competitive advantages – the same study noted that improved supply chain efficiency lowered transaction costs and strengthened the company's market position and financial performance as a whole. This aligns with other research showing that companies leveraging digital supply chain tools often see improvements in their bottom line through cost reductions (e.g. in procurement and logistics) and enhanced customer service levels.

Another critical benefit of digitalizing logistics is improved decision-making and resilience. With integrated supply chain management systems (often as modules of ERP or specialized Supply Chain Management software), managers have greater visibility into operations, enabling data-driven decisions. For instance, digital dashboards can alert managers to a transportation delay or a spike in demand, upon which they can swiftly reroute shipments or scale production. Such real-time decision support increases resilience: studies indicate that digital supply chain networks can better withstand disruptions by quickly reallocating resources or sourcing alternatives, thereby maintaining service. Additionally, digitalization fosters stronger collaboration among supply chain partners, building trust and information transparency that im-

prove the entire chain's performance. Collaborative platforms and blockchain ledgers allow all parties to access the same data (e.g. shipment statuses, inventory levels), reducing information asymmetry and disputes. This enhanced coordination not only improves operational efficiency but also contributes to higher flexibility and innovation in the supply chain (for example, enabling joint planning or rapid introduction of product changes). In summary, literature from recent years consistently demonstrates that digital technologies in logistics yield lower costs, faster and more reliable deliveries, and better strategic alignment across the supply chain. These improvements collectively boost firm performance in terms of both operational metrics and financial outcomes. Accordingly, we propose the following hypothesis:

H_3: Digital technologies have a positive impact on logistics consolidated performance.

2. 4. INTERNAL CONSOLIDATION AND BUSINESS DIVERSIFICATION

Organizational consolidation—reflected in effective financial, HR, and logistics systems—is a critical enabler of strategic initiatives such as diversification. The resource-based view (RBV) posits that firms with strong internal capabilities are better positioned to exploit external opportunities and pursue new markets. Studies confirm that enhanced financial and HR systems contribute to better strategic execution and allow firms to undertake the risks associated with entering new industries (Guo et al., 2023; Cerrato et al., 2022).

Although logistics capabilities may also support diversification, their impact may be more indirect or contingent on infrastructure quality (He et al., 2021). Nonetheless, this study explores the potential of each subsystem—finance, HR, and logistics—to serve as a bridge between digital transformation and diversification outcomes (Kupalova et al., 2024). This leads to the following hypotheses:

H_4: Financial consolidated performance positively influences business diversification.

H_5: HR consolidated performance positively influences business diversification.

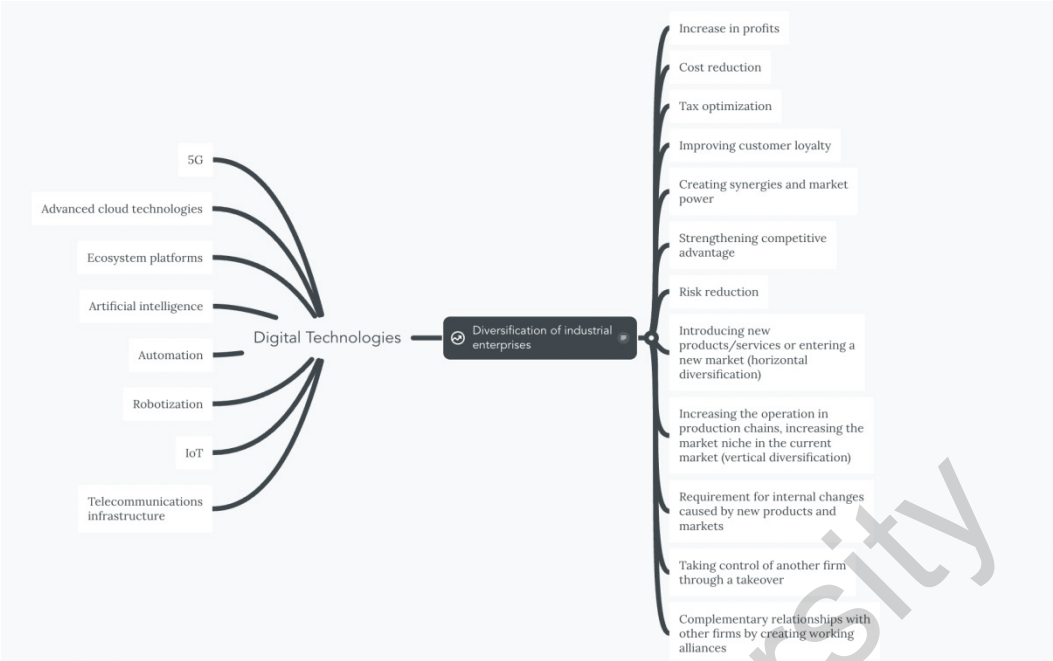
H_6: Logistics consolidated performance positively influences business diversification.

H_7: Digital technologies contribute to the diversification of enterprises in Kazakhstan.

3. RESEARCH METHODOLOGY

The main method used in this article is the survey method and processing of its results through the Smart PLS multiple regression calculation program. However, before that, the authors conducted an interview with the top managers of large industrial firms in Kazakhstan, to identify expert opinion in order to obtain a suggestion and assessment of variables for the development of the model of self-determination, as well as questions for the survey. During the interview, the following was suggested. The strategy of diversifying activities can certainly bear fruit in the long term and there are many examples of the company. However, it is not suitable for every business model. The top manager of a large industrial firm was asked how digital technologies affect the diversification of corporations. The respondent replied that it is difficult to measure direct effect of digital technologies on diversification. However, the respondent added that it would be easier to determine the effect of digital technologies on financial, logistical and HR consolidated performance, and then the effect of the latter on diversification of business. After the interview, a literature review was conducted on the impact of digital technologies on the above-mentioned consolidations, as well as the impact of the latter on the diversification of the enterprise. The scheme of this relationship is presented in Figure 1.

Figure 1. The structure of an interview-based research model.



Source: made by authors using the platform Mind Meister https://www.mindmeister.com/

The results of the expert interview became a prerequisite for conducting a survey among industrial enterprises in Kazakhstan to identify the hypothesis of the study. The criteria of digital technologies and Diversification in Figure 1, and later the variables to the model of the research have been selected through the suggestions from literature review and expert interviews.

1. Digital technologies (use of digital technologies)

To assess the company's use of digital technologies, respondents were asked to rate the level of utilization for each of nine technological tools from a provided list. This list was curated based on recommendations from ITU, OECD, Eurostat, INE, Eustat, and findings from previous studies (Guzmán, Serna, de Lema, Enríquez, & Adame, 2010). The responses were collected using a five-point Likert scale, where managers indicated how extensively each technology was used within the company.

2. Business performance

Business performance was assessed through subjective indicators derived from managers' responses in the survey. These subjective measures, provided by the director's perspective, are used in the absence of objective financial data (Geringer, 1991). Based on the literature review, business performance was considered through the prism of financial, HR and logistic performances.

2.1. Financial consolidation (degree of financial performance)

Financial performance is a measure of profit, growth, productivity, value creation, being a complex indicator that confirms business profitability. Given the complexity of this indicator, we can say that in the activity of measuring financial performance it is necessary to analyze both the ability to obtain profit and the added value, liquidity, solvency and financial balance. The research was limited to the analysis of profitability indicators, such as ROI, ROA, ROE, NPM and the indicators of liquidity and financial balance.

2.2. HR consolidation (degree of HR performance)

Human resources play a central role in every company's operation. The contribution of human resources (HR) to a company's success is essential and cannot be overlooked. Unlike other resources—such as product technology and production processes, which may lose effectiveness over time—human resources offer a lasting competitive edge and are capable of addressing diverse challenges (Sugiyanto et al., 2021). Competencies, which are deeply embedded in an individual's character, reveal themselves through consistent behaviors across different work environments and tasks. These competencies serve as criteria or standards that can help predict which employees are likely. Three indicators of HR performance degree were identified: the ability to ensure business process, the availability of qualified personnel ready for professional development.

2.3. Logistic consolidation (degree of logistic performance)

The logistics concept is today strictly related to commercial activities. In particular, transport and logistics activities are more and more responsible for the success of a company, because their performance strongly influence customer loyalty. Arunsankar (2021) suggested an efficient and updated Logistics performance assessment system. The main indicators used to assess logistics performance are supposed to be transportation cost, warehousing cost, on time delivery and inventory turnover.

3. Degree of diversification

To determine the degree of diversification, three criteria were selected. The first is the extent of expansion into different stages of production and value chains (vertical diversification). The second criterion is the degree of expansion into related industries or markets (horizontal diversification). The third criterion has been measured categorically (dichotomously) and was based on categories proposed by Wrigley and Rumelt (Rumelt, 1974; Wrigley, 1970).

This study follows a hypothetical-deductive approach, which is a scientific method involving seven successive stages: problem identification, problem statement formulation, hypothesis formulation, measure establishment, data collection, data analysis and interpretation of results. The main methodology used in the study is deductive, in which a general theoretical basis is formulated and applied to a specific practical case. This approach has been complemented by a quantitative survey method. Problem identification and hypothesis formulation: Research begins by identifying a specific problem in the field of economics and formulating hypotheses based on existing theoretical frameworks and literature.

Theoretical basis: The theoretical basis was established by synthesizing previous researches and literature relevant to the goals and hypotheses of the study.

Research goals and design: Clear research goals have been identified, and research design has been developed to effectively address them.

Tool development: A valid and reliable research tool system has been created in the form of an e-mail questionnaire to collect data from respondents.

Data collection: A survey was conducted among the top and middle management of industrial firms in Kazakhstan to collect relevant data.

Cross-sectional nature: The study has adopted a cross-sectional approach, focusing on data collected over a period of time, which is convenient for scientific research.

Population and sampling method: The population was made up of top and middle managers of industrial firms in Kazakhstan, and a cluster sample was used for the study.

Sample size calculation: to find optimal number of respondents, we applied inverted square root method proposed by Kock and Hadaya (2018). Assuming the common power level of 80% and significance level of 5%, it is calculated using the following formula:

$$\text{Significance level} = 5\% : n\_min > (2.486 / |p\_min|)^2 \quad (1)$$

where:

- minimum sample size;

p_min- the value of the path coefficient with the minimum magnitude in the model.

Minimum path coefficient was chosen at the level of 0.165, so the minimum sample size is given by:

$$(n)min > (2.486 / |0.165|)^2 = 226.904 \quad (2)$$

This number needs to be rounded to the next integer, so the minimum sample size is 227, but authors rounded it further to the next decimal, resulting in a sample of 230 respondents.

Measurement scale: The results of the survey were processed using coding method. Coding in research refers to assigning numerical values to categories to facilitate measurement and analysis. Precoding assigns numbers to predetermined answer categories in a survey, while post coding is done after data collection, often with open-ended responses. Coding is essential in multivariate analysis, especially for ensuring scale compatibility. For instance, a well-designed Likert scale with equidistant categories can approximate interval-level measurement, allowing for more precise statistical analyses, such as in SEM, where coding consistency impacts result accuracy and interpretability (Hair et al., 2011). The Likert scale with answer options from 1 to 5 was used for measurement, where 1 meant “Completely disagree” and 5 meant “Completely agree”.

3. 1. DATA ANALYSIS

Statistical methods: Partial Least Squares Structural Modeling (PLS-SEM) was chosen for data analysis because of its suitability for testing multiple associations simultaneously, which is common in social science research.

Software: PLS-SEM was preferred over correlation-based SEM (CB-SEM) or AMOS due to its unique features and suitability for research purposes.

Response rate: The study reached a response rate of 76.7%, indicating a significant level of engagement among the selected respondents.

This methodology integrates a theoretical framework with quantitative survey methods to analyze and interpret data in a structured and rigorous manner consistent with the goals of research in the field of economics.

3. 2. DATA COLLECTION

Three comprehensive survey instruments were developed; each tailored to specific respondent groups while maintaining measurement consistency. The instruments comprise:

- Manager Survey: Focuses on strategic implementation aspects and performance outcomes
- HR Professional Survey: Emphasizes system functionality and operational metrics
- Employee Survey: Addresses user experience and service delivery perspectives

Each instrument utilizes 5-point Likert scales for perception measures, numerical inputs for quantitative data, and categorical variables for demographic information. Content validity was established through expert panel review, and construct validity was confirmed through pilot testing with a sample of 30 participants across all three groups.

Target populations were identified within public sector organizations, focusing on departments that have implemented digital HRM systems within the past three years. The data collection procedures involve online survey distribution through secure organizational channels, with follow-up protocols to ensure adequate response rates. Response anonymity is maintained through encrypted data collection systems.

Ethical considerations have been addressed through institutional review board approval and adherence to research ethics guidelines. Written and informed consent is obtained from all participants and the respondent's anonymity is protected by data protection measures. Measures within the research protocol comprise data anonymization and storage of collected data in a secure environment by privacy laws.

4. DATA ANALYSIS AND RESULTS

For the application of Smart PLS, the literature reviews were conducted, including the book of Hair et al. (2022) called "A primer on partial least squares structural equation modeling (PLS-SEM)". In his work Hair mentions that first-generation statistical methods, like regression and factor analysis, have been essential in social science research but come with limitations, such as simplified models and disregard for measurement error. This has led to a shift towards structural equation modeling (SEM), especially PLS-SEM, which allows for more complex, accurate modeling of relationships among theoretical constructs. The adoption of SEM represents a methodological advancement, offering researchers enhanced tools to explore and validate social science theories.

In Smart PLS, we can consider inner and outer models. The outer model, also called the measurement model, is used when we try to measure the validity and reliability of measured variable with the construct. The inner model or also called structural model is used to measure the relationships between multiple constructs. Usually, the structural model is measured after determining the validity and reliability of the outer model.

There are two types of models when using the Smart PLS program: Formative and Reflective. In the Formative model, indicators are the causes of a certain construction, while in the Reflective model, indicators are the consequence. Before building a model, we need to determine whether our statements will be Formative (arrows will be directed at the main structure) or Reflective (arrows will be directed away from the main structure). In a Reflective statement, all characteristics will change simultaneously, so there will be a strong correlation between them. In a Formative statement, on the contrary, all characteristics change independently of each other and the correlation is usually weak. In a Reflective statement, we can easily replace dimensions and this will not greatly affect the overall construct, while in a Formative statement, it is highly undesirable to replace or remove dimensions.

In our study, we measure 5 variables:

- The use of digital technologies in the enterprise
- HR consolidation and its status
- Financial consolidation and its status
- Logistic consolidation and its status
- The level of diversification in the enterprise

Variables numbered 1-4 are independent variables. A Formative model was chosen for their measurement, since by identifying certain measurements from each of the variables, it is possible to make an overall picture of them. Variable 5 is dependent in our model and a Formative model was also chosen to measure it.

After we have figured out which model to use, the next step is to compile questions for each of the variables. The questionnaire was compiled by the authors and was sent to the respondents via e-mail and messengers.

In next step, a model was compiled in the Smart PLS 4 and the next step was to evaluate the model. As described above, first we measure the outer model. When evaluating a Formative model, we need to check convergent validity. To do this, we need a single global item for each variable,

which will be reflective statements. That is, in the Formative statement, after we have asked questions about each component of the variables, we additionally asked an one more question at the end, which is the respondent's opinion and defines the overall picture of each variable. Since we have 5 Formative statements, there will be an additional 5 single global items in our model.

The second criterion for evaluating the Formative model is the Variation Inflation Factor (VIF). As mentioned above, in the Formative statement, measurements should not be collinear with each other, otherwise this will lead to multicollinearity and exacerbate standard errors. The reliable value of VIF is less than 3 (Miles, 2005).

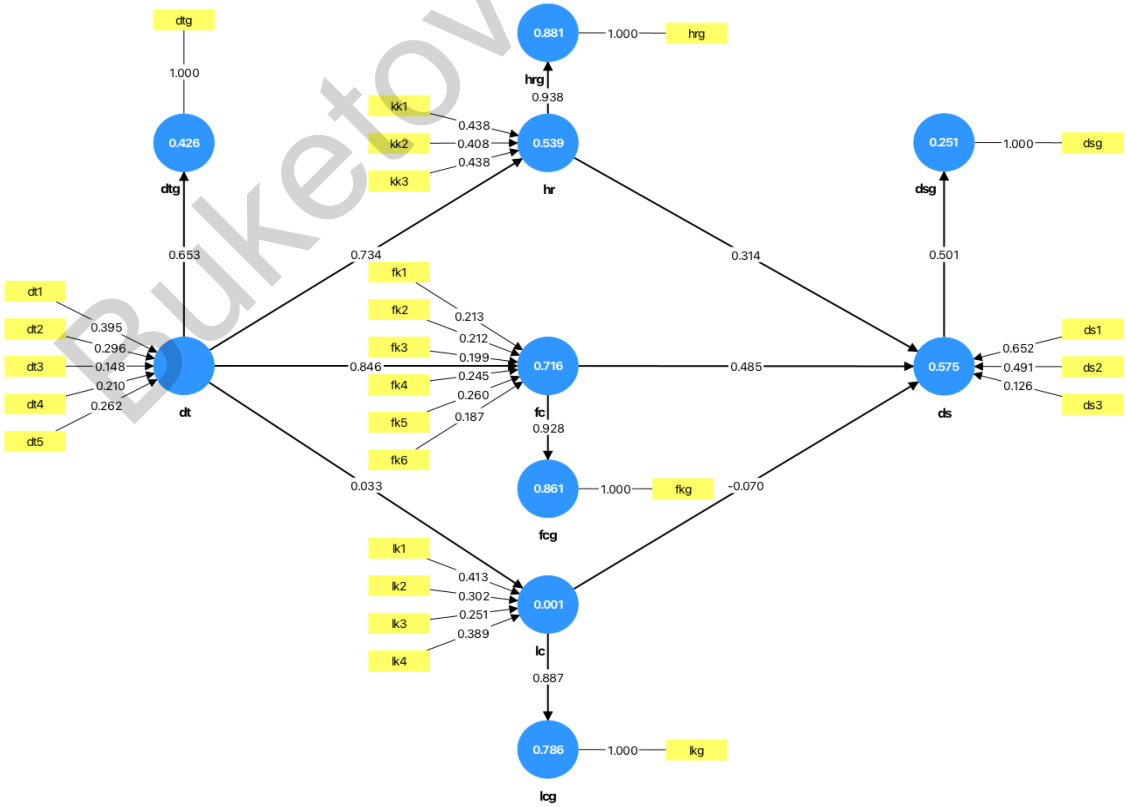
To assess the convergent validity of the formative constructs, global single items (GSI) were included in the model. Each formative construct was regressed onto its corresponding GSI. The results indicate that all constructs demonstrate statistically significant relationships with their respective GSI indicators ($\beta > 0.5$, $p < 0.001$), confirming adequate convergent validity, as recommended by Hair et al. (2022). Additionally, multicollinearity was assessed using VIF values, which were all below the recommended threshold of 3.3.

Table 1. Convergent Validity of Formative Constructs (GSI and VIF)

Formative Construct	GSI Item	Path Coefficient (β)	t-value	p-value / Conclusion	Average VIF
Diversification (ds)	dsg	0.501	8.839	0.000 Supported	1.19
Digital Technologies (dt)	dtg	0.653	10.548	0.000 Supported	1.58
Financial Performance (fc)	fcg	0.928	47.914	0.000 Supported	1.75
HR Performance (hr)	hrg	0.938	77.547	0.000 Supported	1.35
Logistics Performance (lc)	lcg	0.887	49.340	0.000 Supported	1.76

Source: results of survey and authors' calculations

Figure 2. The structural model of the research. Created by authors in the Smart PLS 4 program



Source: results of survey and authors' calculations

After confirming measurement validity, the structural model was evaluated using path coefficients (β), t-values, and p-values. The following hypotheses were tested:

Table 2. Path analysis and Hypotheses Testing Results

Hypothesis	Structural Path	Estimates (β)	T statistics	P values	Decision
H1	Digital Technologies → Financial Performance	0.846	20.340	0.000	Accepted
H2	Digital Technologies → HR Performance	0.734	11.342	0.000	Accepted
H3	Digital Technologies → Logistics Performance	0.033	0.578	0.563	Declined
H4	Financial Performance → Diversification	0.485	6.255	0.000	Accepted
H5	HR Performance → Diversification	0.314	4.294	0.000	Accepted
H6	Logistics Performance → Diversification	–0.071	1.234	0.217	Declined
H7	dt → fc/hr/lc → ds (indirect)	0.640	-	0.001	Accepted

Source: results of survey and authors' calculations

As shown in Table 2, most hypothesized relationships were statistically significant at the $p < 0.05$ level. The strongest path coefficient was observed from hr → hrg ($\beta = 0.938$, $t = 77.55$, $p < 0.001$), confirming the robust impact of digital transformation on HR performance. Likewise, fc → fcg ($\beta = 0.928$) and lc → lcg ($\beta = 0.887$) indicate significant internal consistency within these subconstructs.

The direct effect of digital transformation on financial consolidation (dt → fc) was also substantial and statistically significant ($\beta = 0.846$, $p < 0.001$), supporting the assumption that digital technologies enhance financial integration. Additionally, hr → ds ($\beta = 0.314$, $p < 0.001$) confirms that improved HR processes contribute to diversification outcomes.

In contrast, the path from logistics consolidation to diversification (lc → ds) was found to be statistically insignificant ($\beta = -0.070$, $p = 0.217$), suggesting that current digital logistics capabilities may not yet be sufficient to support diversification strategies in the sampled industrial enterprises.

Specifically, the indirect path from digital technologies to diversification through financial performance (dt → fc → ds) shows a strong and statistically significant effect ($\beta = 0.411$, $p < 0.001$), as does the path through HR performance (dt → hr → ds) with $\beta = 0.231$ ($p < 0.001$).

However, the indirect path through logistics performance (dt → lc → ds) is not significant ($\beta = –0.002$, $p = 0.655$), suggesting that logistics does not mediate the relationship between digital technologies and diversification in this context.

Overall, the total indirect effect of digital technologies on diversification is $\beta = 0.640$, which is statistically significant ($p < 0.001$), thereby supporting hypothesis H7. These findings indicate that the benefits of digital transformation for diversification are realized primarily through enhanced financial outcomes and workforce capabilities rather than logistics improvements.

5. DISCUSSION

The findings of this study provide empirical support for the proposed model linking digital technologies to the internal functions of an enterprise and, ultimately, to business diversification. Specifically, the results confirm that digital technologies significantly enhance financial perfor-

mance (H1) and HR performance (H2), while their direct impact on logistics performance was not supported (H3). These results highlight the differentiated role digital technologies play in shaping organizational capabilities across internal domains.

The strong influence of digital technologies on financial performance aligns with previous research suggesting that IT-enabled financial transparency and automation can improve decision-making, cost control, and long-term profitability. Similarly, the positive effect on HR performance underscores the importance of digital HR tools in enhancing employee engagement, recruitment, and retention. These internal performance improvements, in turn, contribute significantly to a firm's capacity to diversify (H4 and H5), confirming the mediating role of internal functional consolidation in digital transformation outcomes.

Interestingly, the direct effect of digital technologies on logistics performance (H3) and the subsequent impact of logistics on diversification (H6) were not supported. These findings may reflect contextual barriers such as limited digital infrastructure in the logistics sector of Kazakhstan, insufficient adoption of integrated supply chain systems, or organizational inertia in transforming logistics workflows. Moreover, the small domestic market in Kazakhstan and the lack of access to the ocean may also serve as barriers to the development of logistics (Bolyssov et al., 2019). These null findings offer valuable insight into the uneven progress of digital transformation across different operational areas.

Importantly, the indirect effect of digital technologies on diversification (H7) was statistically significant, emphasizing that their influence is channeled through improvements in internal functions, especially finance and HR. This agreee with Wu (2021) and Zhang (2024) findings that digital transformation of enterprises significantly improves the level of enterprise diversification. This finding contributes to the growing body of literature on IT-enabled capability building and confirms that digital transformation efforts can support strategic goals like diversification, particularly in emerging market contexts such as Kazakhstan (Zhanseitov et al., 2020).

Kazakhstan's industrial digital transformation has been uneven, with the logistics sector notably lagging in adopting technologies like electronic Warehouse Management Systems (e-WMS), Internet of Things (IoT) tracking, and Transportation Management Systems (TMS). Evidence suggests that logistics remains one of the most conservative sectors, with a significantly lower digitalization level than areas such as retail or banking. The World Bank's Logistics Performance Index (LPI) reflects some of these challenges: Kazakhstan's overall LPI score is 2.7 (ranked 79th out of 139 countries), indicating only middling logistics performance (World Bank, 2023). In particular, the country scores poorly on international shipments and tracking & tracing (e.g. tracking & tracing score 2.9/5, rank 93), highlighting deficiencies in supply chain visibility and real-time data – areas typically bolstered by digital logistics solutions. Such metrics underscore that the penetration of digital tools in logistics is limited. Indeed, a recent study noted a "low level of digital transformation of the transport and logistics sector" in Kazakhstan, with only passive use of digital technologies in transport operations. Basic digital practices like electronic document management have only begun to spread, as firms only now transition away from paper-based processes. Several factors explain why digital logistics adoption is sluggish. Infrastructure barriers remain significant: the country's vast geography and uneven telecom coverage limit the deployment of IoT devices and connectivity along routes. Physical and IT infrastructure for logistics is still developing – Kazakhstan's LPI infrastructure component is only 2.5/5, suggesting that the foundational systems for digital logistics (such as reliable internet in warehouses, GPS coverage, and modern transport facilities) are not fully in place. There is also a technology access and cost issue: many advanced logistics IT solutions (e.g. RFID tracking systems or AI-driven route optimization) must be imported or customized, which can be prohibitively costly for local mid-sized operators. The lack of qualified IT personnel in the

logistics field further hinders adoption. Interviews with Kazakhstani transport and logistics firms reveal a shortage of digital skills and know-how, meaning companies often do not have personnel who can implement and manage e-WMS or TMS platforms (Baimukhanbetova et al., 2023; OECD, 2023). This skills gap is compounded by limited training programs specific to digital logistics. Another study on emerging economies' 3PL providers similarly found that human capital and organizational issues – such as low digital literacy, resistance to change, and reliance on manual processes – are major barriers to logistics innovation (Mvubu & Naude, 2024). Many logistics companies in developing countries struggle with fragmentation and low transparency in operations, which makes it difficult to integrate new digital systems across the supply chain. In Kazakhstan, these issues are evident in the continued prevalence of manual record-keeping, siloed legacy systems, and a hesitancy to share data across the supply chain. Additionally, external and policy barriers play a role: historically, the logistics sector has not been under the same competitive pressure to digitize as, for example, banking. Government support and incentives for logistics digitalization have been relatively weak until recently. The regulatory environment can also slow innovation – for instance, customs and trade procedures have until recently been heavily paper-based, reducing demand for digital supply chain integration. Despite these challenges, there are signs of progress. The government's "Digital Kazakhstan" program (2018–2022) explicitly recognized the need to modernize logistics. Its successor, the five-year "Digital Era Lifestyle" strategy launched in 2022, continues this agenda with a focus on intelligent transport systems and end-to-end supply-chain digitalization (Government of Kazakhstan, 2017; 2022). This state initiative outlines steps to develop "digital logistics" and intelligent transportation systems, aiming for measures like a unified digital platform for transit freight. Ambitious goals such as implementing a "digital railway" with intelligent control systems were set to increase freight capacity by 50% and cut costs by half. While these targets have yet to be fully realized, they have spurred pilot projects and greater awareness. Notably, some leading companies have begun to invest in logistics IT. For example, the national postal service KazPost has piloted an ecosystem of digital services to eventually digitize all its operations – from parcel tracking to payment acceptance (Mamrayeva, 2022). Large logistics firms are also taking initiative: Globalink (a major Kazakhstan-based 3PL provider) invested over USD 2.5 million since 2015 in a comprehensive digital platform, integrating its ERP, fleet management, HR, finance, and CRM systems into one seamless solution (Globalink Logistics, 2025). This transformation led to a 60% reduction in paper use through digital documents and workflows, demonstrating the efficiency gains from going paperless. Such examples show that digital logistics solutions can succeed in Kazakhstan, but so far, they are the exception rather than the norm. Moving forward, a combination of managerial and policy measures could accelerate digital logistics adoption. First, firms need to address internal barriers by investing in workforce development – e.g. training current logistics staff in digital skills and hiring IT specialists or partnering with tech providers. The talent gap is critical: a surveyed expert panel identified the lack of skilled employees and IT knowledge as a key obstacle to implementing digital systems in Kazakh logistics companies. Second, significant capital investment is required, which many companies cannot afford alone. Here, government incentives like subsidies or tax breaks for adopting approved logistics technologies (such as GPS fleet trackers or warehouse automation) could lower the financial hurdle. Government-backed grant programs or low-interest loans for supply chain digitalization projects would encourage more widespread uptake. Third, public-private partnerships (PPP) can help build shared digital infrastructure – for instance, creating a nationwide logistics data exchange platform or IoT sensor network along major transport corridors in partnership with telecom providers. By spreading costs and pooling expertise, PPP projects (potentially under the umbrella of "Digital Kazakhstan") can tackle large-scale needs that individual firms find daunting. Indeed, policy research emphasizes that strong government support

and an improved business environment are needed to catalyze logistics innovation. Fourth, regulatory and institutional support should continue to evolve: the government can mandate and facilitate the use of electronic documentation and digital customs procedures (as has begun with e-freight and Single Window initiatives) to create an ecosystem where digital is the default. Finally, there is a need for educational programs and industry forums focused on digital logistics. Universities, technical institutes, and organizations like Astana Hub could develop certification courses on logistics IT (covering TMS, WMS, data analytics, etc.), ensuring a pipeline of qualified professionals. In parallel, industry associations might share best practices from pilot projects (such as KazPost's and Globalink's experiences) to build awareness among local 3PLs and shippers about the tangible benefits of digital transformation. By implementing these measures – financial incentives, PPP infrastructure, skills development, and supportive policy – Kazakhstan can begin to close the digital gap in its logistics sector. Over time, these steps would address the current barriers and enable broader adoption of e-logistics solutions, from basic track-and-trace systems to advanced AI-driven supply chain optimization, ensuring the logistics industry fully participates in the country's digital transformation.

6. CONCLUSION

The research involved a literature review on this topic, interviews with the head of a major industrial enterprise, and a survey based on the literature review and interviews. The survey targeted 230 middle and senior managers of industrial enterprises. This study examined the role of digital technologies in enhancing internal organizational performance and enabling business diversification in Kazakhstan. By utilizing structural equation modeling (SmartPLS), the study found that digital technologies significantly improve financial and HR performance, which in turn promote diversification. Although no direct impact was found on logistics performance, the overall indirect influence of digital technologies on diversification was confirmed. These findings highlight the importance of focusing digital transformation efforts on finance and HR systems to drive strategic outcomes.

In conclusion, the study successfully validated the measurement model (outer model) for the selected constructs using the Formative approach, ensuring reliability and validity of the indicators. The findings demonstrate strong convergent validity among the examined variables. Notably, digital technologies significantly enhance financial and HR performance but have a lesser effect on logistical performance. This points to a prevalent challenge for many industrial enterprises: the insufficient integration of digital technologies in logistical consolidation. Additionally, while financial and HR performance play a major role in driving enterprise diversification, logistics have a more limited influence.

The results offer valuable insights for managers and policymakers in emerging markets. Organizations should prioritize digital investments in financial and HR functions, where digitalization shows the strongest performance returns. Policy support for digital training and HR tech adoption may further accelerate diversification strategies at the enterprise level. Logistics systems require more attention and targeted infrastructure development to realize the full benefits of digital integration.

6. 1. LIMITATIONS

Like most survey-based organizational research, this study has several limitations that must be acknowledged. First, our data on digital transformation and performance were self-reported by managers using Likert-scale instruments. Such perceptual measures are susceptible to response biases – for example, respondents might overstate successes due to social desirability or recall errors. We were unable to obtain objective metrics of firm performance (e.g. exact productivity

figures or IT investment amounts) because companies were reluctant to share sensitive data and there is a general lack of transparent public information in this context. The reliance on self-assessed data, while common in business research, means our findings could be influenced by how respondents interpret the questions or wish to present their organization. Second, collecting independent and dependent variables from the same respondents at a single time point raises the concern of common method bias (CMB). We took ex-post statistical steps to evaluate this risk. A Harman's single-factor test was performed as recommended by procedural guides. The factor analysis did not reveal one dominant factor – the first factor accounted for about 30–40% of variance, well below the 50% threshold, indicating that CMB is unlikely to be a serious concern in our data. In addition, we assessed the possibility of multicollinearity and method-induced inflation by examining the variance inflation factors (VIF) for the predictor variables. All VIF values were comfortably below 3.0, which is within accepted limits (far under the conservative cutoff of 5.0), suggesting that no collinearity or common-method artifacts are unduly inflating our results. These diagnostic tests (Harman's one-factor and VIF) bolster confidence that common-method variance is not biasing the observed relationships. Nonetheless, we acknowledge the inherent limitation of using single-respondent, self-reported survey data – the results are based on managers' perceptions, which may not perfectly reflect actual digital capability levels or performance outcomes. Third, the cross-sectional design (data collected at one point in time) limits our ability to make strong causal inferences. We cannot definitively establish the direction of causality between digital transformation and performance improvements, since both were measured concurrently. There is also a potential common source bias since the same respondents provided information on both digital practices and performance; although our statistical tests were satisfactory, common-source bias cannot be entirely ruled out. Finally, the sample is geographically and sectorally concentrated (industrial enterprises in Kazakhstan), which may affect generalizability. The context of an emerging economy with particular cultural and institutional characteristics means our findings should be extrapolated with caution. In sum, due to issues of self-reporting, single-method data, and study design, the results should be interpreted as associative rather than conclusively causal. We have tried to mitigate these limitations through careful survey design and post-hoc analyses, but they remain important qualifiers to our conclusions.

6. 2. FUTURE RESEARCH

Building on this study's insights, future research should address the above limitations and explore new avenues to deepen understanding of digital transformation in industrial logistics. One important direction is to undertake longitudinal studies that track firms over an extended period (e.g. 3–5 years). A longitudinal or panel design would allow researchers to observe how digital adoption and its impacts evolve over time, providing evidence of long-term causality and the sustainability of benefits. For instance, instead of a one-off survey, a study could follow a cohort of manufacturing and logistics firms as they implement digital initiatives, measuring performance outcomes at multiple intervals. Such a design can capture lag effects (where performance improvements might only materialize after a certain time) and feedback loops of technology adoption. Scholars have noted that relatively few longitudinal studies on digital transformation have been conducted, and more are needed to understand dynamic effects and cumulative changes. By employing a longitudinal approach, future research could determine whether early gains from digitization persist or grow, and how organizational capabilities adapt during the transformation journey. Another fruitful avenue is to broaden the scope of functional areas examined in digital transformation research. The present study focused primarily on operations and supply chain logistics; however, digital transformation in industry is a holistic process that also encompasses functions like marketing, research & development (R&D),

and customer service. Future studies should investigate how digital tools in these domains contribute to overall performance. For example, the integration of digital marketing analytics and CRM (Customer Relationship Management) systems can significantly enhance how firms engage with customers and customize offerings. Incorporating variables for marketing digitization – such as use of big data analytics for market trends or online CRM adoption – would shed light on the front-end of digital transformation. Similarly, R&D and engineering functions are being transformed by technologies like Product Lifecycle Management (PLM) software, computer-aided design (CAD), and simulation (often dubbed Industry 4.0 in design and engineering). Including measures of digital R&D (e.g. adoption of PLM, use of digital twins or AI in product development) could reveal impacts on innovation outcomes or product quality. Additionally, post-sales and service processes offer an emerging frontier for industrial digitalization: IoT-based monitoring of equipment in the field, predictive maintenance services, and digital platforms for after-sales support can all drive value. Future research could assess how implementing IoT in after-sales service (for instance, using sensor data from sold machinery to optimize maintenance) affects customer satisfaction and retention. By extending the analysis to these internal functions – marketing, R&D, and after-service – scholars can develop a more comprehensive model of digital transformation's effects across the entire value chain. There is evidence that logistics providers who embrace end-to-end digital integration (from internal operations to customer-facing interfaces) achieve higher agility and customer satisfaction. Therefore, examining these additional domains will not only fill a gap in the literature but also provide practical insights into enterprise-wide transformation strategies. A third recommendation is to apply more innovative and rigorous research designs to isolate the impact of digital initiatives. One approach is to conduct quasi-experimental studies or pilot projects in collaboration with industry. For example, researchers could partner with a technology hub or a large firm to implement a pilot digital logistics project (such as a new TMS or IoT tracking system) in a controlled setting, and compare performance before and after implementation or against a control group. In Kazakhstan, an ideal setting might be the Astana Hub or a regional industrial park where a digital logistics solution is introduced on a trial basis. Such a quasi-natural experiment would allow the use of difference-in-differences analysis or similar techniques to more confidently attribute any observed improvements (e.g. faster delivery times, lower inventory levels) to the digital intervention itself. This method helps address causality concerns by observing changes relative to a baseline or control. It also provides rich qualitative insights – by monitoring the pilot closely, researchers can learn about implementation challenges, user adoption issues, and contextual factors that are difficult to capture in broad surveys. Supporting this idea, international organizations and industry groups often advocate pilot programs to demonstrate the benefits of supply chain digitization in developing regions. For instance, the World Economic Forum has facilitated pilot initiatives in emerging markets to showcase digital solutions in supply chains, which in turn helps build trust and momentum for wider adoption. Academic studies can leverage similar pilots to collect data. Future research using case-based experiments or action research in live organizational settings will complement survey findings with causally robust and granular evidence. In summary, future investigations should seek to overcome current research gaps by adopting longitudinal designs, expanding the functional breadth of analysis, and employing quasi-experimental methods or pilot case studies. These approaches will provide a deeper and more nuanced understanding of industrial digital transformation. They can reveal how the impacts of digitalization unfold over time, how various business functions synergize in a digital strategy, and what practical obstacles or facilitators emerge during implementation. Such knowledge is invaluable for both theory and practice – it would help refine academic models of digital transformation and guide policymakers and managers in designing interventions (e.g. targeted training or pilot subsidy programs) to accelerate digital

innovation in Kazakhstan's industrial and logistics sectors. By exploring these avenues, future research will build on the foundation laid by this study and contribute to the evolving narrative of how developing economies navigate the opportunities and challenges of the digital age.

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