บทความวิจัย

แนวทางการขับเคลื่อนองค์กรสู่นวัตกรรม ภาคธุรกิจอุตสาหกรรมในยุคดิจิทัล

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บทคัดย่อ

การวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาแนวทางการขับเคลื่อนองค์กรสู่นวัตกรรม ภาคธุรกิจอุตสาหกรรมในยุคดิจิทัล ดำเนินการวิจัยเชิงปริมาณสำรวจข้อมูลจากผู้ประกอบการภาคธุรกิจอุตสาหกรรมเครื่องมือที่ใช้ คือ แบบสอบถาม โดยใช้สถิติเชิงพหุ (Multivariate Statistics) วิเคราะห์องค์ประกอบเชิงยืนยัน (Confirmatory Factor Analysis; CFA) และการวิเคราะห์องค์ประกอบเชิงยืนยันอันดับสอง (Second-order Confirmatory Factor Analysis; S-CFA) แล้วจัดทำเป็นโมเดลสมการโครงสร้าง (Structural Equation Modeling; SEM) ผลการวิจัยพบว่าโมเดลสมการโครงสร้างแนวทางการขับเคลื่อนองค์กรสู่นวัตกรรมภาคธุรกิจอุตสาหกรรมในยุคดิจิทัล ข้อมูลเชิงประจักษ์มีความสอดคล้องกันโดยมีค่า p-value = 0.053, CMIN/DF = 1.282, GFI = 0.974 และ RMSEA = 0.024 มีนัยสำคัญทางสถิติที่ 0.001 ซึ่งผ่านตามเกณฑ์ที่กำหนด สำหรับผลการวิเคราะห์ตัวแปรภายในโมเดลที่ได้พัฒนาขึ้นใหม่ เมื่อพิจารณาอิทธิพลโดยรวมของโมเดลพบว่าด้านความร่วมมือเชิงนวัตกรรม (Innovative Cooperation) มีอิทธิพลทางตรงต่อด้านการเปลี่ยนผ่านดิจิทัล (Digital Transformation) มากที่สุด = 0.89 รองลงมา คือ ด้านผู้นำเชิงนวัตกรรมมีอิทธิพลทางตรงต่อด้านองค์กรแห่งการเรียนรู้ (Learning Organization) = 0.82 ด้านผู้นำเชิงนวัตกรรมมีอิทธิพลทางตรงต่อด้านความร่วมมือเชิงนวัตกรรม (Innovative Cooperation) = 0.53 และ ด้านองค์กรแห่งการเรียนรู้มีอิทธิพลทางตรงต่อ ด้านความร่วมมือเชิงนวัตกรรม = 0.41 ตามลำดับ จากการศึกษานี้จะทำให้ทราบถึงแนวทางการขับเคลื่อนองค์กรสู่นวัตกรรม ภาคธุรกิจอุตสาหกรรมในยุคดิจิทัลให้ทันต่อกระแสการเปลี่ยนแปลงของโลกท่ามกลางการเปลี่ยนผ่านเข้าสู่ยุคดิจิทัล ซึ่งองค์กรภาคธุรกิจต้องปรับตัวเพื่อความอยู่รอดในสภาพแวดล้อมที่เปลี่ยนไปอย่างรวดเร็ว

คำสำคัญ: ผู้นำเชิงนวัตกรรม องค์กรแห่งการเรียนรู้ การร่วมมือเชิงนวัตกรรม การเปลี่ยนผ่านดิจิทัล

การอ้างอิงบทความ: ชัยนาจ ปั้นสันเทียะ, "แนวทางการขับเคลื่อนองค์กรสู่นวัตกรรม ภาคธุรกิจอุตสาหกรรมในยุคดิจิทัล," *วารสารวิชาการพระจอมเกล้าพระนครเหนือ*, ปีที่ 36, ฉบับที่ 2, หน้า 1–17, เม.ย.–มิ.ย. 2569, เลขที่บทความ 262-078092, doi: 10.14416/j.kmutnb.2026.01.001.

วารสารวิชาการพระจอมเกล้าพระนครเหนือ ปีที่ 36 ฉบับที่ 2 เม.ย.–มิ.ย. 2569
The Journal of KMUTNB., Vol. 36, No. 2, Apr.–Jun. 2026

Research Article

Approach for Driving Organizations toward Innovation in the Industrial Business Sector during the Digital Era

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Received 3 September 2025; Revised 8 December 2025; Accepted 15 December 2025; Published online: 3 February 2026

Abstract

This study aims to examine the approach for driving organizations toward innovation in the industrial business sector in the digital era. A quantitative research method was employed, with data collected from industrial business entrepreneurs. The research instrument used was a questionnaire, and multivariate statistics were applied for data analysis. Confirmatory Factor Analysis (CFA) and Second-order Confirmatory Factor Analysis (S-CFA) were conducted, followed by the development of a Structural Equation Model (SEM). The research findings indicate that the structural equation model of the approach for driving organizations toward innovation in the industrial business sector in the digital era is consistent with empirical data. The model fit indices showed a *p*-value = 0.053, CMIN/DF = 1.282, GFI = 0.974, and RMSEA = 0.024, with statistical significance at the 0.001 level, meeting the specified criteria. Regarding the analysis of variables within the newly developed model, the overall influence analysis revealed that Innovative Cooperation had the highest direct effect on Digital Transformation (= 0.89), followed by Innovative Leader, which had a direct effect on Learning Organization (= 0.82). In addition, Innovative Leader had a direct effect on Innovative Cooperation (= 0.53), and Learning Organization had a direct effect on Innovative Cooperation (= 0.41), respectively. This study provides insights into the approach for driving organizations toward innovation in the industrial business sector in the digital era, enabling organizations to keep pace with global changes amid the transition to the digital era, in which industrial business organizations must adapt to survive in a rapidly changing environment.

Keywords: Innovative Leadership, Learning Organization, Innovative Cooperation, Digital Transformation

Please cite this article as: C. Pansantie, "Approach for driving organizations toward innovation in the industrial business sector during the digital era," *The Journal of KMUTNB*, vol. 36, no. 2, pp. 1–17, Apr.–Jun. 2026 (in Thai), Art. no. 262-078092, doi: 10.14416/j.kmutnb.2026.01.001.

1. Introduction

In the digital transformation era, the world places great importance on economic development driven by innovation and technology. Countries experiencing economic expansion also tend to grow in technology and innovation, which serve as key tools to create a competitive advantage. Organizations lacking innovation and creativity are likely to disappear over time. Most countries recognize the significance of policies, science, technology, and innovation in achieving sustainable development. Low-income and middle-income countries often have long-term plans to move towards higher income levels.

One major obstacle to increasing Thailand's competitiveness is the relatively low level of innovation. This may be due to insufficient attention to Research and Development (R&D) or its underutilization [1], as reflected in the 2023 Global Innovation Index, which ranked Thailand 43rd, the same as in 2022, and ranks 3rd in the ASEAN region, following Singapore (5th) and Malaysia (36th). In contrast, countries in the same region, such as Singapore and South Korea, have systematically emphasized innovation in their policies and successfully transformed their organizations. Both countries have been recognized by the [2], which ranks the world's leading innovative nations. Singapore was ranked 5th, and South Korea 10th, making Singapore one of the most innovative countries globally. Singapore also ranks highly in several areas, such as government effectiveness, access to Information and Communication Technology (ICT), unicorn valuation, and Venture Capital (VC) investment. These factors reflect strong policy support and an enabling environment that fosters innovation, while South Korea has become a central hub of global innovation.

Recognizing the importance of innovation, the [3] promoted a policy to drive an innovation-driven economy, aiming to increase citizens' incomes by 2036 in line with the 20-year national strategy. The policy focuses on strengthening the manufacturing, trade, and service sectors to enhance productivity and create sustainable, valuable jobs. Following this, [4] developed a science, research, and innovation plan to promote Innovation-Driven Enterprises (IDEs) to enhance the country's income, competitiveness, and self-reliance. The plan covers 2023–2027 and has three indicators: 1) an increase in the number of large innovation-based businesses with annual income of at least 1,000 million baht per business 2) total income of SMEs developed into innovation-based businesses reaching 75,000 million baht during the plan period and 3) total income of startups developed into innovation-based businesses reaching 87,500 million baht during the plan period.

Given the above, technology and innovation have become key drivers of economic growth and competitiveness, resulting in changes across economic and social aspects and prompting organizations to adapt. Driving organizations toward becoming innovation-driven enterprises is not merely about adopting new technologies, but also about cultivating an organizational culture that fosters creativity, continuous learning, and adaptability. These elements are crucial factors for organizational growth and sustainability in the digital era. Technology and innovation are important for strengthening Thailand's competitiveness. However, there is still limited research that looks closely at

how innovative leadership, learning organizations, innovation collaboration, and digital adaptation work together. Most existing studies examine these factors separately and mainly discuss them from a theoretical point of view.

Therefore, the researcher is interested in studying approaches to driving organizations toward innovation in the industrial business sector in the digital age. This study uses Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) to clearly show the relationships between the key factors involved. Aiming to enhance competitiveness within ASEAN and globally, and to cope with the highly competitive free trade environment, where businesses must adapt to survive in the rapidly changing technological and innovative landscape.

This study is of great significance as it provides insights into the factors and strategies that drive organizations toward becoming innovation-driven enterprises. The findings can contribute to the development of appropriate approaches and policies to promote and support the adoption of innovation in Thailand's industrial business sector, thereby enhancing competitiveness and fostering sustainable development in the future.

1.1 Research Objectives

1.1.1 To analyze the exploratory and confirmatory components of the approach for driving organizations towards innovation in the industrial business sector during the digital age.

1.1.2 To develop a structural equation model, an approach for driving organizations towards innovation in the industrial business sector during the digital age.

1.1.3 To examine the consistency of the structural equation model, an approach for driving organizations towards innovation in the industrial business sector during the digital age.

1.2 Literature Review

1.2.1 Innovative Leadership

Effective organizations rely on tactical and strategic thinking and the creation of a culture by leaders. Strategic thinking helps create and shape a vision for the future of the organization. A vision can emerge and move forward when leaders create a culture dedicated to supporting that vision. Culture is the environment in which the vision will be held. In turn, the vision may also define the character of the organization. [4] stated that Leadership attributes and skills required for the twenty-first century seven attributes seem to have emerged as being essential for leading in the twenty-first century: 1) systems thinker 2) change agent 3) innovator and risk-taker 4) servant and steward 5) polychronic coordinator 6) teacher, mentor, coach, and learner 7) visionary and vision-builder. [5] stated that technology and innovation are important in transforming businesses in the digital age. Therefore, leaders with innovative skills are important for leading organizations to change to achieve their goals. [6] stated that innovative leadership is the ability of leaders to create new ideas to support change and drive innovation implementation in the organization. This type of leader will create an atmosphere conducive to creativity, encourage employees' free expression, and be open to trying new things flexibly. It also

emphasizes building trust in the team and using technology or data to drive development. [7] studied the role of leaders in determining the nature and success of creative efforts. The impact of leadership on the nature and success of creative efforts is discussed. However, these articles also indicate that leadership in creative efforts is an extraordinarily complex activity. This article draws important conclusions about the nature of leaders, the interactions between leaders and followers, the effective direction of followers' activities, and the interactions between leaders and organizations.

1.2.2 Learning Organizations

New ideas do not come about without hard work and application. Organizations must constantly search for new sources of knowledge in all sorts of directions. [8] stated that knowledge can be acquired by literally buying another organization or sometimes by benchmarking. The principle behind benchmarking and the learning organization is that you uncover best practices. [9] mentioned that the learning organization is a concept for sustainable organizational development. It focuses on allowing all employees to develop skills and knowledge until they are proficient and can apply that knowledge to their work, which will help promote innovations within the organization. [10] mentioned a learning organization as an organization that focuses on working and learning at the same time. It aims to create knowledgeable individuals with systematic thinking and team learning as an important factor. [11] identified seven factors affecting the development of an organization into a learning organization: 1) appropriate organizational structure 2) shared vision 3) having a learning culture in the organization 4) an atmosphere conducive to learning 5) all employees participate in creating and transferring knowledge 6) applying technology and information systems to support learning and 7) teamwork.

1.2.3 Innovative Cooperation

Innovation cooperation is the most important determinant of a firm's likelihood of innovation after R&D spending. It has been confirmed that it has a significant positive effect on innovation activities for both domestic and international innovation cooperation. [12] innovation cooperation should be promoted more intensively in both public and private sectors cooperation, especially with customers, suppliers, and consultants, especially in countries where R&D spending is delayed. [13] innovative cooperation is a process in which organizations and individuals work together to create innovations for exchanging ideas, skills, and knowledge, not limited to within the same organization but also including cooperation with external partners, which helps expand opportunities for creating new things and increasing competitiveness. [14] said collaboration, sharing information, and exchanging knowledge with stakeholders through digital technology would help deliver services or products more efficiently. The collaborative culture encourages all types of innovation. [15] ICTs can be critical in enabling collaboration and managing innovations within and outside the firm, consistent with [16] research has confirmed that cooperation is necessary for most companies' innovation activities. Research has confirmed that cooperation is essential for most companies' innovation activities, which stimulates their competitiveness and business performance.

1.2.4 Digital Transformation

Digital transformation is a process, led by the CEO and top management team, of developing organizational and technology-based capabilities that allow a company to continuously improve its customer experience, reduce unit costs, and maintain a sustainable competitive advantage over the long term. [17] digital transformation occurs when businesses use technologies and innovations to create value for their products and services. [18] stated that digital transformation means the organization's adaptation to new technologies. The organization must create a culture emphasizing learning and innovation so employees can adapt effectively. Choosing the right technology for the nature of the business will help strengthen the organization's competitiveness. [19] stated that the most important factor in digital transformation is the attitude and cooperation of employees in the organization. Easier acceptance of new technologies is the potential and ability of employees to use resources and technologies effectively. [20] stated that organizations that can adapt to the needs of modern businesses would be able to compete in the market. Therefore, digital transformation is an important factor for business success.

1.3 Conceptual Framework

The research on the approach for driving organizations towards innovation in the industrial business sector during the digital age has a synthesis of elements as follows:

1.3.1 Conduct a comprehensive review of documents, theoretical concepts, and previous studies related to how organizations in the industrial business sector can be driven toward innovation in the digital age.

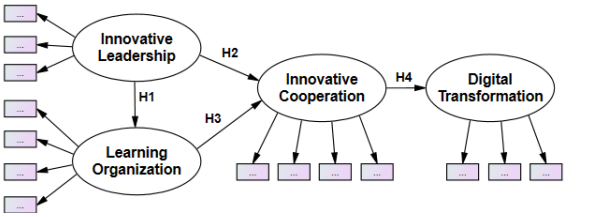

Figure 1 Research Conceptual Framework and Hypotheses.

1.3.2 Select variables and elements of the approach for driving organizations towards innovation in the industrial business sector during the digital age, which include learning organizations, innovative leadership, innovative cooperation, and digital transformation.

1.3.3 Use all four elements to determine the conceptual framework and Hypotheses for the research, as shown in Figure 1, presented as a hypothetical model of the approach for driving organizations towards innovation in the industrial business sector during the digital age, to be consistent with empirical data.

2. Materials and Methods

2.1 Population and Sampling

The population of this research consisted of industrial business operators in the Eastern Economic Corridor (EEC), totaling 188,115 cases [21]. The sample size was determined using the sample size table by Taro [22] at a 95% confidence level with a ±5% margin of error, resulting in a sample of 500 participants. Data were collected from January to July 2024 using a stratified sampling method, dividing the population into three subgroups

based on the provinces in the EEC: Chachoengsao, Chonburi, and Rayong [23]. Each subgroup shared similar characteristics, and simple random sampling was subsequently applied within each subgroup to obtain the desired proportion of samples [23].

2.2 Research Tools

The research instrument was a questionnaire developed using a five-point Likert scale, providing appropriate response options for participants [24]. The draft questionnaire and an evaluation form were reviewed by five experts with relevant knowledge and experience to assess their quality using the Index of Item-Objective Congruence (IOC). The IOC values ranged from 0.50 to 1.00, meeting the acceptable standard [25]. The questionnaire consists of three sections: 1) six questions on respondents' demographics 2) four questions on general operational characteristics and 3) 30 questions covering four dimensions: Innovative Leadership, Organizational Learning, Innovative Cooperation, and Digital Transformation. A pilot study was conducted with 30 participants sharing characteristics similar to the target population. The pilot study examined the discriminating power of checklist-type items, calculated standard deviations for rating-scale items, analyzed item-total correlations, and determined the reliability of the questionnaire. The discriminating power ranged from 0.59 to 0.72, and the overall reliability (Cronbach's alpha) was 0.96, indicating high internal consistency. Finally, the instrument was administered to the main sample, meeting acceptable standards for both reliability and validity [26].

2.3 Data Analysis

The researcher performed Exploratory Factor Analysis (EFA) by calculating the correlation coefficients of each variable, extracting components using the principal component method, and rotating the components with the Varimax rotation method. This was followed by confirmatory factor analysis and second-order CFA (S-CFA). Finally, a Structural Equation Model (SEM) was created using the AMOS program to examine the consistency of the developed structural model with empirical data.

3. Results and Discussion

The statistical methods used for data analysis were multivariate statistics to test the research hypotheses. These methods included causal path analysis, confirmatory factor analysis and second-order CFA to validate the indicators, followed by structural equation modeling to examine the consistency of the model with empirical data. The evaluation of model fit was based on the criteria proposed by Arbuckle [27], as presented in Table 1.

Table 1 Criteria for Evaluating the Goodness-of-Fit of the Structural Equation Model

Evaluating the Data–Model Fit	Criteria
CMIN–p (probability level of chi-square)	Greater than 0.05
CMIN/DF (relative chi-square)	Less than 2
GFI (Goodness-of-Fit Index)	Greater than 0.90
RMSEA (Root Mean Square Error of Approximation)	Less than 0.08

3.1 Results of the Exploratory Factor Analysis

Research results from objective 1. The exploratory component analysis used data from 30 questionnaires from a sample of 500 people by extracting components using the principal component analysis method and rotating the component axes using the Varimax method. The analysis results were considered from the weight of the components, the number of variables included, the variance of each component according to the specified criteria, and the name of each component was determined by considering the characteristics that those variables aimed at together according to the conceptual framework and theory. There were four components: Learning Organization, Innovative Leadership, Innovative Cooperation, and Digital Transformation. The researcher considered according to the specified criteria, namely: Each component must have at least three variables described [28], the cumulative variance percentage must be more than 60% [28], the component must have more than one eigenvalue [29], and the value of each variable in the component must have a weight (Factor Loading) of more than 0.3 [30]. Each component is ranked in order of the sum of variance values from highest to lowest, as shown in Table 2.

From Table 2, the results of the analysis of survey components, the approach for driving organizations towards innovation in the industrial business sector during the digital age, consist of twelve variables in the aspect of Learning Organizations, eight variables in the aspect of Innovative Leadership, five variables in the aspect of Innovative Cooperation, and five variables in the aspect of Digital Transformation, with no variable not passing the consideration according to the criteria. From the analysis of the survey on how to drive organizations toward innovation in the industrial business sector in the digital age, it was found that.

The learning organization component has the most variables and explains 47.34% of the total variance. This suggests that organizations that create a strong learning environment and support continuous skill development are better able to adapt to new technologies, which strengthens their readiness for innovation.

The leadership component has the second most variables and explains 5.29% of the total variance. This highlights the importance of visionary leadership in guiding the organization toward its goal

Table 2 The results of the exploratory factor analysis

Component Name	Number of Variables	Eigenvalues	Percentage of Variance	Cumulative Percentage of Variance
1. Learning Organization	12	14.20	47.34	47.34
2. Innovative Leadership	8	1.58	5.29	52.63
3. Innovative Cooperation	5	1.22	4.09	56.72
4. Digital Transformation	5	1.01	3.38	60.11
Total	30	18.01	60.11	-

of becoming more innovative.

The innovative collaboration component explains 4.09% of the variance, while digital transformation explains 3.38%. Even though these have fewer variables, the results show that collaboration among people is an important driver of organizational growth and development. With a strong technology foundation, organizations can move toward innovation more effectively.

3.2 Confirmatory factor analysis results

The confirmatory factor analysis results to examine the structural validity of the scale before adjusting the components showed that the *p*-value = 0.00, CMIN/DF = 1.77, GFI = 0.95, and RMSEA = 0.03, indicating that the model was not consistent with the empirical data. The researcher refined the components by reducing the observed variables from 30 to 14. This was done by removing variables with high Modification Indices (MI), since high MI values suggest redundancy or poor fit with the model structure. This adjustment helped ensure that the final components, or latent variables, fit the actual data more accurately. The confirmatory factor analysis results to examine the structural validity of the scale after adjusting the components showed that the *p*-value = 0.19, CMIN/DF = 1.14, GFI = 0.97, and RMSEA = 0.01, indicating that the model was consistent with the empirical data, as shown in Figure 2.

The researcher conducted a Second-order Confirmatory Factor Analysis (S-CFA) to examine the construct validity of the measure by adjusting the components by selecting the method of cutting out the inappropriate observed variables and

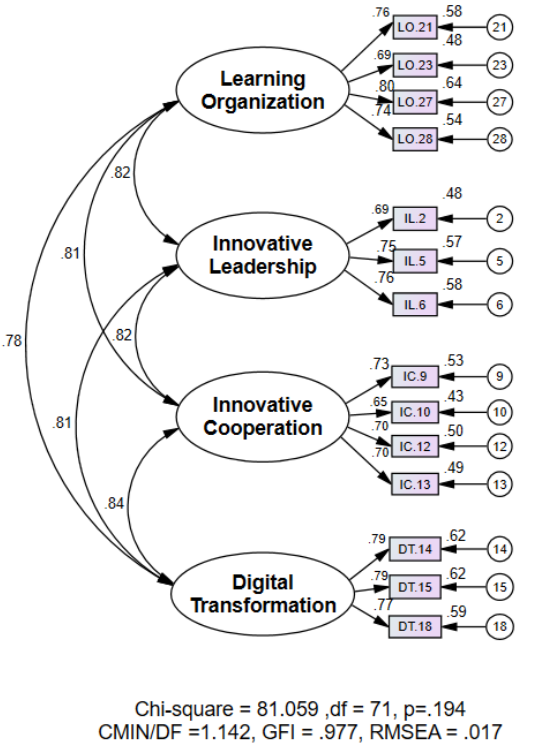

Figure 2 CFA model after modification in standardized mode.

connecting them with arrowheads so that the newly adjusted components or latent variables are most consistent with the empirical data. The results of the second-order confirmatory factor analysis found that the *p*-value = 0.18, CMIN/DF = 1.14, GFI = 0.97 and RMSEA = 0.01 indicating that the model is consistent with the empirical data as shown in Figure 3.

Figure 3 when considering the weight of each component, it was found that the component was between 0.88–0.92, which was statistically significant at the .001 level. Innovative Cooperation had the highest weight of 0.92, followed by Innovative Leadership with the highest weight of 0.91, Digital Transformation with a weight of 0.90,

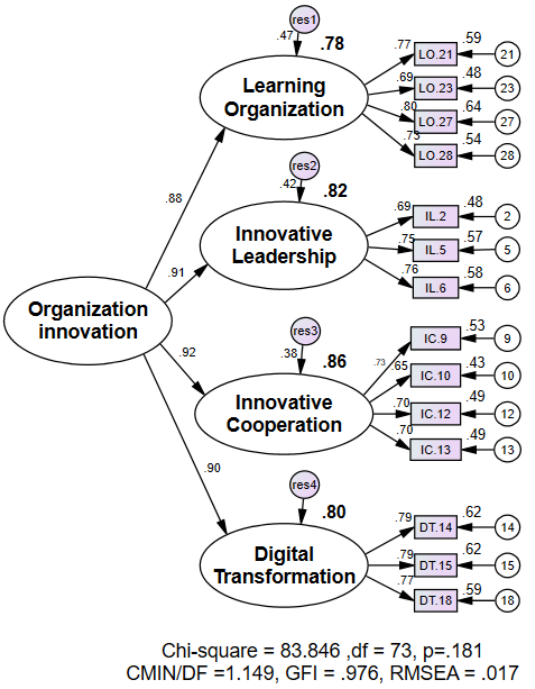

Figure 3 S-CFA model after modification in standardized mode.

and Learning Organization with 0.88, respectively. The variables of each component had a multiple correlation coefficient (R^2) between 0.43 and 0.64, indicating that all four components can be used as components of the approach for driving organizations towards innovation in the industrial sector during the digital age. All 14 variables are important

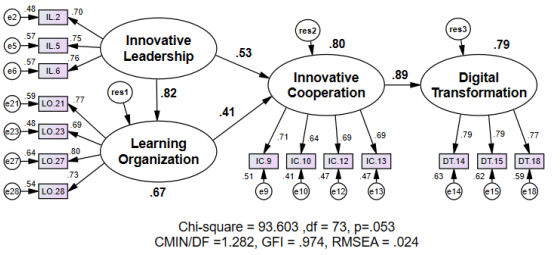

Figure 4 Structural equation model after modification in standardized mode.

variables of the approach to driving organizations toward innovation in the industrial business sector in the digital age.

3.3 Results of the Hypothesis Model Analysis

Research results from objective 2 to develop a structural equation model, the approach for driving organizations towards innovation in the industrial sector during the digital age, as follows: Structural equation model, a guideline for driving organizations towards innovation, the industrial business sector in the digital age, by analyzing the influence of various variables developed within the structural equation model (Structural Equation Modeling; SEM) as shown in Figure 4.

From Table 3 the hypothesis testing results were summarized as follows.

Table 3 Hypothesis test result of the structural equation model after modification

H	Path	Estimate		R^2	Variance	CR.	P
		Std	Unstd				
H1	Innovative Leadership ---> Learning Organization	0.82	0.78	0.67	0.07	11.829	***
H2	Innovative Leadership ---> Innovative Cooperation	0.53	0.47	0.80	0.03	5.741	***
H3	Learning Organization ---> Innovative Cooperation	0.41	0.39	0.80	0.03	4.765	***
H4	Innovative Cooperation ---> Digital Transformation	0.89	1.09	0.79	0.06	13.061	***

H1 testing result: The Innovative Leadership element showed a variance = 0.22 and influenced the Learning Organization element with a Standardized Regression Weight = 0.82 and squared multiple correlations (R^2) = 0.67 with a variance = 0.07 at the statistically significant level of 0.001. This shows that innovative and visionary leaders play a key role in helping organizations learn and adapt quickly.

H2 testing result: The Innovative Leadership element showed a variance = 0.22 and influenced the Innovative Cooperation element with a Standardized Regression Weight = 0.53 and squared multiple correlations (R^2) = 0.80 with a variance = 0.03 at the statistically significant level of 0.001. This shows that innovative leaders who build trust and encourage staff to share different ideas play an important role in strengthening collaboration among employees and teams.

H3 testing result: The Learning Organization element showed a variance = 0.07 and influenced the Innovative Cooperation element with a Standardized Regression Weight = 0.41 and squared multiple correlations (R^2) = 0.80 with a variance = 0.03 at the statistically significant level of 0.001. This shows that when organizations have policies that support teams in sharing knowledge and new ideas, it helps build strong innovative collaboration within the organization.

H4 testing result: The Innovative Cooperation element showed a variance = 0.03 and influenced the Digital Transformation element with a Standardized Regression Weight = 0.89 and squared multiple correlations (R^2) = 0.79 with a variance = 0.06 at the statistically significant level of 0.001. This shows that sharing knowledge and skills among employees is a form of innovative collaboration that plays an important role in supporting digital transformation in organizations.

Table 4 Observed Variables

Observed Variable Factors	Regression Weight	R^2
Innovative Leadership		
IL.2: Have an innovative vision.	0.70	0.48
IL.5: Support and promote teamwork among employees.	0.75	0.57
IL.6: Have knowledge and skills in modern technology and innovation.	0.76	0.57
Learning Organization		
LO.21: There is an environment conducive to learning.	0.77	0.59
LO.23: Applying modern technology and innovation to the organization.	0.69	0.48
LO.27: There is a budget to support innovation activities.	0.80	0.64
LO.28: Organize training to develop knowledge for employees regularly.	0.73	0.54
Innovative Cooperation		
IC.9: Provide opportunities for employees to present ideas for organizational development.	0.71	0.51

Table 4 Observed Variables (*Continued*)

Observed Variable Factors	Regression Weight	R^2
IC.10: Employees work in harmony.	0.64	0.41
IC.12: Employees learn to use innovations and technologies together.	0.69	0.47
IC.13: Employees regularly exchange ideas with their colleagues.	0.69	0.57
Digital Transformation		
DT.14: Employees can apply digital technology to their work.	0.79	0.63
DT.15: The organization has a digital system that supports automation.	0.79	0.62
DT.18: The organization has a network and digital platform that connects all departments.	0.77	0.59

The hypothesis results show that innovative leadership is the starting point for building a learning organization and encouraging innovative collaboration. These factors are essential for supporting digital transformation. The findings can serve as a guideline for helping organizations in the industrial sector move toward innovation in the digital age.

The mean and standardized regression weight result of the structural equation model for the four elements after modification in the standardized mode, sorted by the weighted score ranking, are presented in Table 4.

Research results from objective 3 to examine the consistency of the structural equation model, the approach for driving organizations towards innovation in the industrial business sector during the digital age. Analysis to examine the consistency of the structural equation model, guidelines for driving organizations towards innovation, and industrial business sector in the digital age From Figure 4, it appears that the empirical data are consistent with the *p*-value = 0.053, CMIN/DF = 1.282, GFI = 0.974 and RMSEA = 0.024, with statistical significance at 0.001, which is consistent with the literature and empirical data passing the specified criteria.

3.4 Discussion

3.4.1 Innovative Leadership Influences Learning Organization.

The study found that innovative leadership supports the regular use of innovations and modern technologies in the organization and organizes training to develop knowledge for employees regularly, resulting in a learning organization. This is consistent with [31], who mentioned that innovative leaders in digital businesses can use new technologies and innovations to develop the organization by setting appropriate innovation strategies, including promoting creativity in personnel to create new and useful innovations, which will lead to the creation of a learning organization that can grow and adapt continuously. [7] Innovative leaders create an atmosphere conducive to exchanging ideas and experimenting with new things, which are the main

characteristics of a learning organization. Leaders encourage employees to feel safe in learning from failure and use it as an opportunity to develop their leadership. They play an important role in creating an environment that will drive creativity in workers. They also create a sense of risk-taking and innovation among workers. [32] stated that innovative leaders demonstrate the ability to manage complex problems or opportunities and discover new or unprecedented ways of doing things. They can respond to and solve problems effectively in real situations, which helps create a learning organization by supporting employees to share knowledge, experiment with new ideas, and continuously develop their skills.

3.4.2 Innovative Leadership Influences Innovative Cooperation.

The study shows a clear link between innovative leaders and innovative cooperation, resulting from innovative leaders who have an innovative vision and support various activities and relationships to work in the same direction. This is consistent with [33] stated that innovative leaders not only set the direction for the organization but also act as motivators and inspire team members to work together, leading to innovative cooperation, which will lead to beneficial results for the organization. [34] stated that in the digital age, where innovation and technology are rapidly changing, innovative leaders not only have the skills to plan strategies and lead the organization to achieve its goals but also must be innovative participants, be able to work as a team, and listen to others' opinions. [7] stated that innovative leaders also play an influential and powerful role in shaping workers or employees in the industry, which involves providing support to employees with appropriate advice and resources and supporting their work. [35] it also helps workers gain the psychological safety needed for innovation when leaders actively participate in workers' work by supporting them. This builds trust and empowers employees to think outside the box and innovate. [36] stated that innovative leadership creates a safe environment for employees to take risks and share ideas. This feeling of psychological safety can lead to more creative and innovative employees.

3.4.3 Learning Organization Influences Innovative Cooperation.

The study found that to cope with the changing digital technology environment, organizations should create an environment where their personnel can continuously share new knowledge and skills. This is consistent with [10], who stated that a learning organization is a concept for sustainable organizational development, emphasizing that all employees in the organization develop various skills and knowledge to be proficient in their assigned work and promoting the exchange, transfer, and connection of various knowledge to create innovations to drive the organization to have business competitiveness. [11] stated that a learning organization is an organization that emphasizes both work and learning at the same time, focusing on developing personal knowledge, systematic thinking, and team learning. In addition, [37] stated that technology support organizations provide organizations with access to advanced software, hardware, digital platforms, and IT infrastructure that facilitate communication, connectivity, and efficiency.

Therefore, when people in an organization share knowledge and learn together, it encourages diverse perspectives and leads to new ideas. These behaviors support innovative collaboration and can eventually develop into real innovation within the organization.

3.4.4 Innovative Cooperation Influences Digital Transformation.

The study found that encouraging employees to co-create and disseminate innovations throughout the organization will help businesses gain a competitive advantage in digital transformation. This is consistent with [19], who stated that the most important factors in digital technology transformation are the attitudes and cooperation of employees in the organization. Easier acceptance of new technologies is the potential and ability of employees to use resources and technologies effectively. [14] stated that collaboration and sharing information to exchange knowledge based on working through digital technology would help deliver services or products faster, save costs, reduce the time needed to conduct business, help stimulate the economy, and create a competitive advantage. [38] stated that employees must participate in the transformation process and learn to manage digital systems and related innovations. [37] when employees working in the industry receive appropriate training and technology, they can create new ideas that are more capable of solving problems. For example, advanced technology tools help employees identify trends and insights that lead to creative solutions, while collaboration platforms provide a platform for associations to share information, which helps the industry grow and can enable digital transformation.

When employees are trained and encouraged to use technology correctly, supported by clear policies and strong leadership, innovative collaborations start to form. These collaborations then help leadership and learning organizations drive digital transformation.

4. Conclusion

In the rapid innovation and technology development era, industrial business organizations must adapt to the changing trends. From the study results, the guidelines for driving organizations toward innovation in the industrial business sector in the digital age were found that.

4.1 Innovative leadership must have a vision that creates a clear innovation strategy, encourage employees to work as a team, have innovation intelligence, solve problems in various situations quickly, and be able to apply innovation and modern technology to the business organization.

4.2 The organization should create an environment conducive to learning for employees. Training should be provided regularly to develop employees' skills and ensure efficient work.

4.3 Creating cooperation among employees to work as one is an important part of organizational development. Therefore, executives should allow employees to express their opinions and organize knowledge transfer between employees regularly. This will create new knowledge that will be useful for solving work problems and developing into innovations in the future.

4.4 To drive the organization towards innovation, it must have a ready technological infrastructure consisting of knowledgeable personnel

and necessary technologies such as hardware, software, automation systems, and comprehensive computer network systems. Therefore, the organization should allocate a sufficient budget to invest in such technologies and innovations.

The recommendations from this study can help industrial organizations drive innovation and strengthen their competitive advantage in the digital age.

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