Analyzing Key Factors of Influencing Digital Transformation in Taiwan's Traditional Manufacturing Industry in the Post-Pandemic Era

Review of Integrative Business & Economics Research

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ABSTRACT

In the post-pandemic era, Taiwan's manufacturing industry faces significant challenges and opportunities, making digital transformation essential. This study explores key factors influencing the digital transformation of Taiwan's traditional industries. Analyzing Taiwan's manufacturing sector, this study evaluates the importance of digital transformation in enhancing competitiveness and addressing environmental changes. Using the Analytic Hierarchy Process, the study compares the importance of key factors, establishing their priority in successful digital transformation. The findings highlight five main areas: leadership, processes, organizational structure, human resources, and technology. Leadership is crucial for clear vision, change management, communication, and data-driven decisions. Process automation, data integration, remote work, and scalability are essential. Organizational flexibility, cultural transformation, data-driven environments, and active employee participation are necessary. Investing in cloud computing, big data, AI, and digital security is critical. The results provide insights for businesses and policy recommendations to support technological innovation, talent development, and favorable policy environment.

Keywords: Post-pandemic era, Digital Transformation, Taiwan's Traditional Industries, Analytic Hierarchy Process.

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1. INTRODUCTION

The rapid development of the global economy and technology has made digital transformation a key strategy for businesses. The COVID-19 pandemic in 2020 severely disrupted global markets, especially manufacturing (Nandy & Sussan, 2022). Digital technology is now crucial for overcoming challenges and driving innovation. Taiwan, a key global manufacturing hub, faces challenges like supply chain resilience, labor shortages, and low efficiency (Paul & Chowdhury, 2020). Digital technology is crucial for enhancing production, supply chain management, and enterprise transformation in traditional industries like textiles, machinery, and electronics (Gereffi, Humphrey & Sturgeon, 2005). In the post-pandemic era, digital transformation is crucial. Remote work, automated production, data-driven decisions, and digital customer interactions are essential (Bartik et al., 2020). Beyond technology, it involves cultural, structural, and skill

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changes. Identifying key factors is vital for transforming Taiwan's traditional manufacturing industries.

This study analyzes key factors in Taiwan's traditional manufacturing digital transformation post-pandemic. Using questionnaires, expert interviews, and the Analytic Hierarchy Process (Huang & Lai, 2021), it examines leadership, process improvement, organizational structure, employee participation, and technological innovation. The aim is to assess their impact on competitiveness and market adaptation. This study is motivated by Taiwan's critical role in the global economy. Digital transformation success impacts the entire supply chain. The pandemic underscored digitalization's importance, requiring quick adaptation and improved resilience. This study aims to provide strategic recommendations to help Taiwan's manufacturing industry achieve successful digital transformation and maintain competitiveness post-pandemic.

This study aims to achieve the following objectives:

- Identify Key Factors: Use literature review and expert interviews to identify key factors influencing digital transformation in Taiwan's traditional manufacturing industries, covering leadership, process improvement, organizational structure, employee participation, and technological innovation.
- Evaluate Factor Importance: Apply the Analytic Hierarchy Process (AHP) to quantitatively determine the relative weight and impact of each factor, providing a scientific basis for enterprise decision-making.
- Analyze Factor Interactions: Examine interactions between key factors to understand their overall impact, identifying synergistic effects and potential conflicts.
- Propose Strategic Recommendations: Based on the findings, offer strategic recommendations for technology selection, organizational change, employee training, and policy support to guide feasible transformation pathways.
- This research offers new theories for academia, practical guidelines for enterprises, and policy recommendations to promote Taiwan's manufacturing sector's post-pandemic digital transformation.

2. LITERATURE REVIEW

This section reviews literatures on five key factors influencing digital transformation in the post-pandemic manufacturing sector: leadership, processes, organization, personnel, and technology.

- Leadership: Includes clear vision, change management, internal communication, and data-driven decision-making, underscoring senior executives' roles (Imran, Stare, & Gruden, 2021).
- Processes: Covers automation, data integration, remote work, and scalability, emphasizing process optimization for efficiency (Ren, Jing, & Zhang, 2023).
- Organization: Encompasses flexible structures, cultural transformation, data-driven environments, and employee engagement, highlighting structural and cultural adjustments (Imran, Stare, & Gruden, 2021).
- Personnel: Includes training, adaptability, innovative thinking, and teamwork, essential for skill enhancement and change adaptation (Guo & Chen, 2023).
- Technology: Comprises cloud computing, big data analytics, artificial intelligence, and digital security, emphasizing technological innovation (Armbrust et al., 2010).
- By synthesizing these key factors from the literature, this study will provide a theoretical foundation for analyzing their interrelationships and supporting the digital transformation of the manufacturing industry.

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2.1 Leadership

Effective leadership is crucial in digital transformation, particularly with senior executive support and involvement. It involves comprehensive changes in culture, strategy, and processes. The four main dimensions are:

I. Clear Vision: Leaders must establish a clear vision to align employees with digital transformation goals. Kouzes and Posner (2009) state that a clear vision motivates employees and enhances cohesion.
II. Change Management: Effective change management involves systematic planning, addressing resistance, and providing support, as noted by Burnes (2004). It includes strategy formulation and resource allocation.
III. Internal Communication: Efficient internal communication enhances engagement and transparency (Robbins and Judge, 2013). Leaders should establish open channels, share information timely, and encourage feedback.
IV. Data-Driven Decision Making: Data-driven decisions improve accuracy and effectiveness (Davenport and Harris, 2007). Leaders must collect, analyze, and interpret data for strategic planning and management.

Effective leadership through these dimensions is essential for successful digital transformation, addressing post-pandemic challenges, and seizing new opportunities.

2.2 Processes

Process optimization is crucial in digital transformation, enhancing efficiency and reducing costs. The four main dimensions are:

I. Automation: Automation technology improves production efficiency and reduces costs by replacing manual operations. Rifkin (2014) highlights that robots and automated equipment reduce labor demand while enhancing product quality.
II. Data Integration: Chen, Chung, and Storey (2012) emphasize that integrating data from various sources supports precise decision-making and maintains a competitive edge. It helps predict demand, manage inventory, and optimize resources.
III. Remote Work: Baruch (2000) notes that remote work increases flexibility and reduces costs, ensuring business continuity. Tools like video conferencing enable global teamwork, improving efficiency.
IV. Scalability: Mell and Grance (2011) highlight cloud computing's scalability, allowing flexible resource allocation to meet changing business needs. Companies can expand resources during peak times and scale down during off-peak periods.

Optimizing processes through automation, data integration, remote work, and scalability enhances efficiency and adaptability, making companies more competitive and resilient.

2.3 Organization

Adjusting organizational structure is crucial for digital transformation. Companies must reevaluate structures to embrace new technologies and business models. The four main dimensions are:

I. Flexible Structure: Burns and Stalker (1961) state that organic structures are vital in rapidly changing environments, enabling quick responses to market changes and innovations.
II. Cultural Change: Schein (2010) argues that aligning new technologies with organizational culture fosters innovation, risk-taking, and continuous learning, guided by leadership and employee participation.

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III. Data-Driven Environment: McAfee and Brynjolfsson (2012) emphasize using data for decision-making to enhance competitiveness, requiring investment in data infrastructure and analytics talent.
IV. Employee Involvement: Cotton (1993) highlights that active participation improves job satisfaction and productivity, increasing acceptance of change and fostering teamwork.

Flexibility, cultural change, data-driven environments, and employee involvement are essential for successful digital transformation, helping companies adapt and seize opportunities.

2.4 Personnel

Enhancing personnel capabilities is crucial for digital transformation, relying on adaptable talent. The four main dimensions are:

I. Employee Training: Noe (2010) highlights systematic training programs to help employees master new technologies, enhancing skills, job satisfaction, and loyalty.
II. Adaptability: Pulakos et al. (2000) emphasize adaptability for quick adjustment to new environments, essential in learning and applying new technologies.
III. Innovative Thinking: Amabile (1996) notes fostering innovation drives creativity and technological advancement. Encouraging experimentation generates new business opportunities.
IV. Teamwork: Salas et al. (2008) stress that teamwork promotes knowledge sharing and innovation. Effective collaboration integrates resources and improves efficiency.

Training, adaptability, innovation, and teamwork collectively drive digital transformation, helping companies meet challenges and achieve growth.

2.5 Technology

Technology drives digital transformation across four dimensions:

I. Cloud Computing: Armbrust et al. (2010) highlight its flexible resource management, reducing IT costs and enhancing agility, allowing enterprises to scale resources and improve efficiency.
II. Big Data Analytics: Manyika et al. (2011) explain it extracts valuable information, supporting decision-making, uncovering trends, customer behaviors, and operational issues, boosting competitiveness.
III. Artificial Intelligence: Russell and Norvig (2009) emphasize AI automates tasks and improves efficiency. It enhances productivity by optimizing supply chains, forecasting demand, and improving product quality.
IV. Digital Security: Anderson (2003) stresses robust security is essential. Measures include data encryption, access control, and network monitoring to prevent breaches and ensure data integrity.

These technologies collectively enhance efficiency and competitiveness, driving digital transformation.

2.6 Summary

This literature review forms the theoretical foundation for empirical studies. By reviewing literature and interviewing industry experts, the study identifies key factors in the digital transformation of Taiwan's traditional manufacturing industry post-pandemic. A survey investigates these factors, and results are analyzed using the Analytic Hierarchy Process (AHP) to determine their importance, interrelationships, and impact on transformation

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effectiveness.

3. METHODLOGY

This study identifies key factors influencing the digital transformation of Taiwan's traditional manufacturing industry post-pandemic through literature review and expert interviews. A questionnaire collected data, and the Analytic Hierarchy Process (AHP) was used to analyze the importance and interrelationships of these factors, assessing their impact on the success of digital transformation.

3.1 Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP), developed by Professor Thomas L. Saaty in 1971, is a quantitative method for multi-criteria decision-making. AHP breaks down complex decisions into multiple levels and criteria, using pairwise comparisons to determine the priority or weight of each alternative. Vargas (1990) emphasized four key characteristics for AHP analysis:

- Reciprocal Comparison: Preferences must satisfy reciprocity; if element A is preferred three times more than element B, then element B's preference is 1/3 of A's.
- Homogeneity: Comparisons must be meaningful and within a reasonable scale.
- Independence: Elements must be compared assuming mutual independence; if interdependence exists, it should be analyzed separately and then combined.
- Expectations: Clearly describe hierarchical relationships to achieve decision goals, ensuring all significant factors are included.

The AHP evaluation scale is divided into five primary levels: equally important, slightly important, moderately important, highly important, and extremely important, with nominal values of 1, 3, 5, 7, and 9 assigned respectively. The four intermediate values between these basic scales are assigned values of 2, 4, 6, and 8. The intensity and meaning of each scale are shown in Table 1 and Table 2 (Saaty, 1980 & 1990).

Table 1 Basic Form of the AHP Questionnaire

	Intensity																	
Part A	I.9		I.7		I.5		I.3		I.1		I.3		I.5		I.7		I.9	Part B
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	

Table 2 Meaning of AHP Evaluation Scales

Intensity of importance	Definition	Explanation
1	equal importance	Both comparison options have equally important contributions
3	weak importance	Experience and judgment slightly favor one option

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5	essential importance	Experience and judgment strongly favor one option
7	very strong importance	Shows a very strong preference for one option
9	absolute importance	Absolutely prefer one option
2、4、6、8	intermediate importance	Compromise Value

According to the perspectives of Saaty (1980, 1990 & 2008) and Vargas (1990), the Analytic Hierarchy Process (AHP) for decision-making can be divided into the following three stages:

A. First Stage: Establishing the Hierarchical Structure

The hierarchical structure clarifies complex issues by organizing factors into levels, aiding in analysis. The top level represents the evaluation goal, with lower levels containing factors. To avoid confusion, each level should have no more than seven factors, as individuals struggle to compare more items.

B. Second Stage: Calculating the Weights of Elements at Each Level. The calculation of the weights of elements can be divided into the following three steps:

- Establishing Pairwise Comparison Matrix: For elements at a specific level, pairwise comparisons are made using an element from the previous level as the reference.
- Calculating Eigenvalues and Eigenvectors: After completing the pairwise comparison matrix, the weights of each element are determined, and the eigenvectors are calculated using the eigenvalue method.
- Consistency Check: Verify logical consistency in pairwise comparisons using the Consistency Index (C.I.). Ensure the entire hierarchical structure's consistency, considering varying importance across levels.

C. Third Stage: Calculating the Weights of All Levels

After calculating the weights of all elements within each level, the overall weights of all levels are further calculated. Finally, based on the weights of each alternative, they are ranked to determine the most suitable option.

3.2 Research Structure

Based on a review and synthesis of relevant literature, this study identifies the key factors influencing the digital transformation of Taiwan's traditional manufacturing industry in the post-pandemic era. These factors include leadership (senior management), process, organization, personnel, and technology. The study employs a two-tier Analytic Hierarchy Process (AHP) to construct the research framework, as shown in Figure 1.

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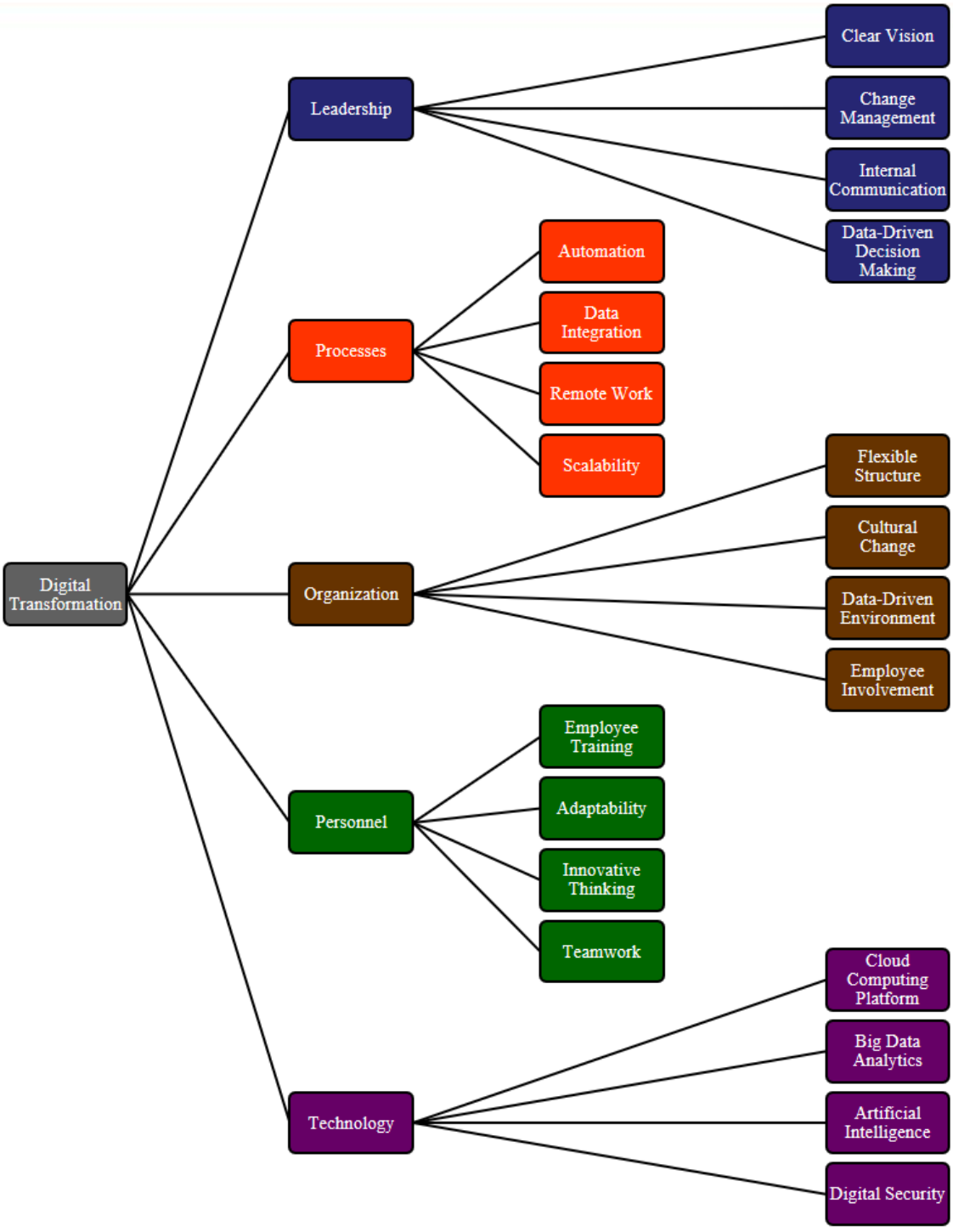

Figure 1 AHP Structure

3.3 Research Subjects and Data Collection Methods

This study targets Taiwan's traditional manufacturing companies, using judgment sampling. Questionnaires are emailed to senior and middle managers anonymously. To boost response rates, respondents are contacted by phone beforehand to explain the study's purpose and questionnaire content.

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4. RESEARCH RESULT

4.1 Survey Results

This study selected senior and middle managers with more than five years of working experience in Taiwan's traditional manufacturing industry as research subjects. The survey was conducted via email, and responses were collected anonymously to ensure the privacy and authenticity of the respondents' answers. A total of 52 questionnaires were distributed, 38 were returned, and 37 were valid, resulting in an effective response rate of 71.2%.

For data analysis, this study utilized Excel and Expert Choice 2000 software. These tools offer robust computational and analytical capabilities for performing Analytic Hierarchy Process (AHP). Using these software tools, this study accurately calculated and analyzed the weights and priorities of key factors affecting the digital transformation of Taiwan's traditional manufacturing industry in the post-pandemic era.

After analyzing valid questionnaires, the study categorized respondents' educational background, department, and years of experience (Table 3). The 37 respondents have extensive experiences in Taiwan's traditional manufacturing digital transformation, offering diverse and valuable insights, making the data highly representative and useful for reference.

Table 3 Respondents' Basic Information

Education Level	High School	College	University	Graduate Level and Above
No. of People	2	1	8	26
Department	Senior Executive	R&D	IT	Others
No. of People	15	8	5	9
Seniority	5~10 years	10~15 years	15~20 years	20 years or more
No. of People	3	5	7	22

The respondents' background and experience ensure the study's representativeness and reliability, enabling in-depth analysis of key factors influencing Taiwan's traditional manufacturing digital transformation post-pandemic. The findings offer valuable insights for companies and decision-makers to advance digital transformation and address market challenges, enhancing the study's credibility and academic value.

4.2 Main Criteria Weight and Ranking Analysis

Based on the five main criteria of "Leadership," "Processes," "Organization," "Personnel," and "Technology," this study analyzes the importance of factors influencing the digital transformation of Taiwan's traditional manufacturing industry in the post-pandemic era. The pairwise comparison matrix table, weight ranking table, and comparison chart of each criterion weight are presented in Table 4 and Table 5, respectively.

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Table 4 Pairwise comparison matrix table for main criteria

Pairwise Comparison Matrix	Leadership	Processes	Organization	Personnel	Technology	Hierarchy Weight	Overall Weight	Ranking
Leadership	1.000	4.205	3.165	2.580	2.092	0.421	0.421	1
Processes	0.238	1.000	1.829	0.877	1.099	0.151	0.151	3
Organization	0.316	0.547	1.000	0.996	0.991	0.125	0.125	5
Personnel	0.388	1.140	1.004	1.000	1.720	0.168	0.168	2
Technology	0.478	0.910	1.009	0.581	1.000	0.136	0.136	4

Table 5 Weight ranking table for main criteria

Goal	Ranking	Main Criterion	Weight
Digital Transformation	1	Leadership	0.421
	2	Personnel	0.168
	3	Processes	0.151
	4	Technology	0.136
	5	Organization	0.125

The research results indicate that "Leadership" is the most crucial factor influencing the digital transformation of Taiwan's traditional manufacturing industry in the post-pandemic era, with a weight value of 0.421. This is followed by "Personnel" and "Processes," with weight values of 0.168 and 0.151, respectively, which are relatively close. "Technology" has a weight value of 0.136, ranking fourth, while "Organization" has the lowest weight value of 0.125. Therefore, the results of this study show that "Leadership" is the most critical factor among the main criteria influencing digital transformation.

4.3 Sub-Criteria Weight and Ranking Analysis

4.3.1 Leadership-Related Criteria Weight and Ranking Analysis

Leadership includes "Clear Vision," "Change Management," "Internal Communication," and "Data-Driven Decision Making." These factors impact digital transformation. This study uses questionnaires and software tools, with pairwise comparison (Table 6) and weight ranking (Table 7), to optimize leadership. Understanding these elements helps enterprises develop strategies for successful digital transformation and long-term goals.

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Table 6 Leadership Pairwise Comparison Matrix Table

Pairwise Comparison Matrix	Clear Vision	Change Management	Internal Communication	Data-Driven Decision Making	Hierarchy Weight	Overall Weight	Ranking
Clear Vision	1.000	2.235	1.118	1.380	0.322	0.144	1
Change Management	0.447	1.000	0.828	1.169	0.197	0.085	3
Internal Communication	0.894	1.208	1.000	1.801	0.285	0.123	2
Data-Driven Decision Making	0.725	0.855	0.555	1.000	0.186	0.080	4

Table 7 Leadership Weight Ranking Table

Goal	Ranking	Main Criterion	Weight
Leadership	1	Clear Vision	0.322
	2	Internal Communication	0.285
	3	Change Management	0.197
	4	Data-Driven Decision Making	0.186

Among leadership sub-criteria, "Clear Vision" is the most critical factor with a priority weight of 0.322, highlighting its significant impact. "Internal Communication" follows with 0.285, emphasizing the role of effective communication. "Change Management" ranks third with 0.197, underscoring its importance in maintaining stability during digital transformation. "Data-Driven Decision Making" has the lowest weight at 0.186 but remains crucial in today's data-driven environment. The study shows that clear vision, communication, and change management are key for guiding organizations, while data-driven decisions are essential for enhancing leadership effectiveness.

4.3.2 Process-Related Criteria Weight and Ranking Analysis

The process includes "Automation," "Data Integration," "Remote Work," and "Scalability." Surveys and software analysis evaluated these factors. The Process Pairwise Comparison Matrix (Table 8) and Weight Ranking Table (Table 9) quantify their importance. These analyses help optimize processes, allocate resources effectively, and enhance efficiency.

Table 8 Process Pairwise Comparison Matrix Table

Pairwise Comparison Matrix	Automation	Data Integration	Remote Work	Scalability	Hierarchy Weight	Overall Weight	Ranking
Automation	1.000	0.951	2.335	1.327	0.307	0.045	2
Data Integration	1.052	1.000	2.507	1.852	0.349	0.051	1
Remote Work	0.428	0.399	1.000	0.639	0.125	0.020	4
Scalability	0.754	0.540	1.564	1.000	0.210	0.031	3

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Table 9 Process Weight Ranking Table

Goal	Ranking	Main Criterion	Weight
Processes	1	Data Integration	0.349
	2	Automation	0.307
	3	Scalability	0.210
	4	Remote Work	0.125

"Data Integration" is the most important factor in the process, with a weight of 0.349, highlighting its significant impact. "Automation" follows with 0.307, emphasizing efficiency and reduced manual intervention. "Scalability" ranks third at 0.210, crucial for maintaining flexibility amid business growth. "Remote Work," though lowest at 0.125, remains vital for modern work flexibility. The study shows that data integration enhances accuracy, automation reduces errors, scalability adapts to growth, and remote work supports collaboration. Enterprises should prioritize these factors to improve process efficiency and competitiveness.

4.3.3 Organization-Related Criteria Weight and Ranking Analysis

The organization includes "Flexible Structure," "Cultural Change," "Data-Driven Environment," and "Employee Involvement." Questionnaire and software analysis evaluated their importance. The Organization Pairwise Comparison Matrix (Table 10) and Weight Ranking Table (Table 11) quantify their importance. These analyses guide resource allocation, improve efficiency, and promote development, helping enterprises enhance effectiveness and competitiveness.

Table 10 Organization Pairwise Comparison Matrix Table

Pairwise Comparison Matrix	Flexible Structure	Cultural Change	Data-Driven Environment	Employee Involvement	Hierarchy Weight	Overall Weight	Ranking
Flexible Structure	1.000	1.515	1.003	0.535	0.214	0.025	3
Cultural Change	0.660	1.000	0.838	0.472	0.185	0.022	4
Data-Driven Environment	0.997	1.193	1.000	0.791	0.239	0.028	2
Employee Involvement	1.869	2.119	1.264	1.000	0.362	0.043	1

Table 11 Organization Weight Ranking Table

Goal	Ranking	Main Criterion	Weight
Organization	1	Employee Involvement	0.362
	2	Data-Driven Environment	0.239
	3	Flexible Structure	0.214
	4	Cultural Change	0.185

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"Employee Involvement" is the top organizational factor, with a weight of 0.362, significantly boosting effectiveness and satisfaction. "Data-Driven Environment" follows at 0.239, emphasizing accurate, timely decision-making. "Flexible Structure" weighs 0.214, crucial for adaptability. "Cultural Change" has the lowest weight at 0.185 but remains vital for competitiveness and innovation. Active employee participation enhances efficiency, while data-driven environments support decisions. Cultural change and flexible structures ensure responsiveness. Companies should integrate these factors to improve organizational effectiveness and competitiveness.

4.3.4 Personnel-Related Criteria Weight and Ranking Analysis

Personnel components include "Employee Training," "Adaptability," "Innovative thinking," and "Teamwork." Questionnaire and software analysis evaluated their importance. The Personnel Pairwise Comparison Matrix (Table 12) and Weight Ranking Table (Table 13) quantify their importance. These analyses guide optimizing human resources, improving efficiency, and promoting development. By analyzing these criteria, companies can create strategies to ensure each HR improvement brings significant benefits.

Table 12 Personnel Pairwise Comparison Matrix Table

Pairwise Comparison Matrix	Employee Training	Adaptability	Innovative Thinking	Teamwork	Hierarchy Weight	Overall Weight	Ranking
Employee Training	1.000	0.902	0.579	0.560	0.179	0.030	4
Adaptability	1.109	1.000	1.250	0.606	0.234	0.040	3
Innovative Thinking	1.727	0.800	1.000	0.765	0.248	0.042	2
Teamwork	1.786	1.650	1.307	1.000	0.339	0.057	1

Table 13 Personnel Weight Ranking Table

Goal	Ranking	Main Criterion	Weight
Personnel	1	Teamwork	0.339
	2	Innovative Thinking	0.248
	3	Adaptability	0.234
	4	Employee Training	0.179

"Teamwork" is the top personnel factor, with a weight of 0.339, significantly enhancing organizational efficiency and coordination. "Innovative Thinking" follows at 0.248, emphasizing problem-solving innovation. "Adaptability," at 0.234, is crucial for managing rapid changes. "Employee Training," though lowest at 0.179, is essential for skill development. The study shows "Teamwork" as the key criterion, improving collaboration. Innovative thinking drives new solutions, adaptability handles challenges, and training ensures continuous development. Companies should integrate these factors to boost personnel effectiveness and competitiveness.

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4.3.5 Technology-Related Criteria Weight and Ranking Analysis

Technical components include "Cloud Computing," "Big Data Analytics," "Artificial Intelligence," and "Digital Security." Questionnaire and software analysis evaluated their importance. The Technical Pairwise Comparison Matrix (Table 14) and Weight Ranking Table (Table 15) quantify their importance. These analyses guide optimizing technical strategies, resource allocation, and efforts, improving performance, and promoting development. Analyzing these criteria helps companies develop targeted strategies, ensuring each technical improvement brings substantial benefits, enhancing competitiveness and readiness for future challenges.

Table 14 Technology Pairwise Comparison Matrix Table

Pairwise Comparison Matrix	Cloud Computing Platform	Big Data Analytics	Artificial Intelligence	Digital Security	Hierarchy Weight	Overall Weight	Ranking
Cloud Computing Platform	1.000	0.578	0.824	0.676	0.181	0.024	4
Big Data Analytics	1.730	1.000	1.976	1.193	0.346	0.046	1
Artificial Intelligence	1.214	0.506	1.000	1.342	0.234	0.031	3
Digital Security	1.480	0.838	0.745	1.000	0.239	0.032	2

Table 15 Technology Weight Ranking Table

Goal	Ranking	Main Criterion	Weight
Technology	1	Big Data Analytics	0.346
	2	Digital Security	0.239
	3	Artificial Intelligence	0.234
	4	Cloud Computing Platform	0.181

"Big Data Analytics" is the top technology factor, with a weight of 0.346, significantly impacting applications. "Digital Security" follows at 0.239, stressing the need for data protection. "Artificial Intelligence," at 0.234, is essential for automation and innovation. "Cloud Computing," though lowest at 0.181, remains crucial for scalability. The study identifies "Big Data Analytics" as the key factor, warranting investment. Digital Security and AI require parallel development to build a strong technological foundation, helping enterprises drive long-term growth and success.

4.3.6 Overall Weight and Ranking Analysis of Each Criterion

The integrated arrangement of the overall weight indicators is shown in Table 16. The ranking of the overall indicator weights is displayed in Table 17. This arrangement allows for a clearer comparison of the importance of each indicator, providing more specific analytical insights.

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Table 16 Overall Weight Distribution of Criteria

Key Factors Influencing Digital Transformation	
Leadership (L:0.421)	Clear Vision (L:0.332)
	Change Management (L:0.197)
	Internal Communication (L:0.285)
	Data-Driven Decision Making (L:0.186)
Processes (L:0.151)	Automation (L:0.307)
	Data Integration (L:0.349)
	Remote Work (L:0.135)
	Scalability (L:0.210)
Organization (L:0.125)	Flexible Structure (L:0.214)
	Cultural Change (L:0.185)
	Data-Driven Environment (L:0.239)
	Employee Involvement (L:0.362)
Personnel (L:0.168)	Employee Training (L:0.179)
	Adaptability (L:0.234)
	Innovative Thinking (L:0.248)
	Teamwork (L:0.339)
Technology (L:0.136)	Cloud Computing Platform (L:0.181)
	Big Data Analytics (L:0.346)
	Artificial Intelligence (L:0.234)
	Digital Security (L:0.239)

Table 17 Composite Ranking of Overall Criteria Weights.

Main Criteria	Main Criteria Weight	Sub-Criteria	Overall Weight	Hierarchical Ranking	Overall Rank
Leadership	0.421	Clear Vision	0.144	1	1
Leadership	0.421	Internal Communication	0.123	2	2
Leadership	0.421	Change Management	0.085	3	3
Leadership	0.421	Data-Driven Decision Making	0.080	4	4
Personnel	0.168	Teamwork	0.057	1	5
Processes	0.151	Data Integration	0.051	1	6
Technology	0.136	Big Data Analytics	0.046	1	7
Processes	0.151	Automation	0.045	2	8

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Organization	0.125	Employee Involvement	0.043	1	9
Personnel	0.168	Innovative Thinking	0.042	2	10
Personnel	0.168	Adaptability	0.040	3	11
Technology	0.136	Digital Security	0.032	2	12
Technology	0.136	Artificial Intelligence	0.031	3	13
Processes	0.151	Scalability	0.031	3	14
Personnel	0.168	Employee Training	0.030	4	15
Organization	0.125	Data-Driven Environment	0.028	2	16
Organization	0.125	Flexible Structure	0.025	3	17
Technology	0.136	Cloud Computing Platform	0.024	4	18
Organization	0.125	Cultural Change	0.022	4	19
Processes	0.151	Remote Work	0.020	4	20

5. CONCLUSION & DISCUSSION

5.1 Conclusion

This study aims to explore the key factors influencing the digital transformation of Taiwan's traditional manufacturing industry in the post-pandemic era and to systematically analyze these factors using the Analytic Hierarchy Process (AHP). Based on a literature review and expert interviews, the study identified five main criteria: leadership, processes, organization, personnel, and technology. The main conclusions of this study are as follows:

- Leadership: Leadership is the most critical factor in digital transformation, with a weight of 0.421. Clear vision, internal communication, change management, and data-driven decision-making are key elements, with clear vision (0.332) being the most important. Leaders must have a clear vision to guide the organization and motivate employees toward shared goals.
- Processes: Processes rank as the third most important factor, with a weight of 0.151. Data integration, automation, scalability, and remote work are the four main elements affecting processes, with data integration having the highest weight of 0.349, highlighting its significant role in improving process efficiency and accuracy.
- Organization: Organizational structure factors have the lowest weight, at 0.125. Key elements include employee engagement, data-driven environment, cultural transformation, and flexible structure, with employee engagement (0.362) being the most important. Active employee involvement is essential for improving organizational effectiveness and satisfaction.
- Personnel: Personnel factors have a weight of 0.168, ranking second. Teamwork, innovative thinking, adaptability, and employee training are the four main aspects of personnel factors, with teamwork having the highest weight of 0.339, showing its importance in promoting organizational effectiveness and work coordination.
- Technology: Technology has a weight of 0.136, ranking fourth. However, big data analytics, digital security, artificial intelligence, and cloud computing platforms still play significant roles in digital transformation. Big data analytics has the highest

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weight of 0.346, emphasizing its significant impact on technology applications.

5.2 Discussion

The results of this study indicate that leadership is the most critical factor in the digital transformation of Taiwan's traditional manufacturing industry, consistent with the findings of Imran, Stare, and Gruden (2021). Effective leadership not only requires a clear vision but also outstanding capabilities in change management, internal communication, and data-driven decision-making. This suggests that companies should prioritize strengthening leadership development to ensure that leaders can effectively guide and support the transformation process. The high weight of clear vision (0.332) particularly underscores the importance of leadership in setting and communicating company goals and direction.

Process optimization is equally important in digital transformation. Data integration and automation are key means to enhance production efficiency and respond to market changes, aligning with the findings of Ren, Jing, and Zhang (2023). The high weight of data integration (0.349) highlights its significant role in improving process efficiency and accuracy. Companies should invest more in data integration and automation technologies to enhance overall operational efficiency. These improvements can reduce operating costs, improve product quality, and increase customer satisfaction.

Organizational structure and personnel factors also have a significant impact on digital transformation. Employee engagement and teamwork are crucial for enhancing organizational effectiveness. The high weight of employee engagement (0.362) indicates that active employee participation can significantly improve organizational effectiveness and employee satisfaction. Companies should focus on employee training and cultural development to foster innovative thinking and adaptability, which will enhance employees' adaptability and job satisfaction. Teamwork is also crucial in promoting organizational effectiveness and work coordination, demonstrating its core role in the digital transformation process.

Although the overall weight of technological factors is relatively low (0.136), their role in digital transformation should not be underestimated. Big data analytics and digital security are core components of technology applications. Companies should prioritize and invest in these areas to enhance technological performance and competitiveness. The high weight of big data analytics (0.346) emphasizes its significant impact on technology applications. Companies should actively adopt big data technologies to improve decision-making accuracy and effectiveness.

Considering these factors comprehensively, companies can formulate more comprehensive and effective digital transformation strategies to cope with the ever-changing market environment and challenges, achieving long-term development goals. Governments and policymakers should also provide corresponding support and guidance based on these research findings to promote the continuous upgrading and development of Taiwan's manufacturing industry.

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