Journal of
Social and Administrative Sciences
www.kspjournals.org

Volume 7 June 2020 Issue 2

Analyzing the influential factors of industry 4.0 in precision machinery industry

By Wen-Hsiang LAI [a] & Chao Hsuan CHEN [b†]

Abstract. Nowadays the science and technology progresses not only create the change to have a big impact on various industries, but also stimulate Industry 4.0 being applied in the manufacturing industry to achieve manufacturing efficiency and to reduce its cost to increase additional values. This study uses the Analytical Hierarchical Process (AHP) evaluation method, which considers four criteria layers: Internet of things factors, Automationfactors, Intelligent factors, Big data factors, and twelve influence factors in sub-layer are: perceived layer, network layer, application layer, field layer, management layer, control layer, process control visualization, system supervisory and control omni bearing, green energy manufacturing production, variety, volume, and velocity. Then, the relative risk indicator (RRI) is obtained by the Analytical Hierarchical Process method, and the overall risk indicator (ORI) can be obtained after introducing the evaluation value of each impact factor through the case. The research results confirm that the risk assessment values obtained the hierarchical analysis method are consistent. This research through the Analytic Hierarchy Process, then discusses Industry 4.0 pair of Taiwan's precision machinery industry management pattern institute emphatically face with target, expected will provide the existing machine manufacture industry as well as the future wants to invest the precision machine industry the management policy-maker reference value, also might take the government policy consideration factors and the machine manufacture industry scholars study the academic for reference.
Keywords. Industry 4.0, Precision machine industry, Analytic hierarchy process.
JEL. L22, M11, O14.

1. Introduction

The recent rise of Industry 4.0 has driven the output value of the precision machinery industry and accelerated its transformation and evolution. The early precision machinery industry focused on mass production, but the era of winning in recent years has begun to fall short of expectations, making Taiwan must go to wisdom. The development of the machinery industry is faced with the fate of being eliminated if it is not transformed, so the Taiwanese machinery industry is striving to integrate the overall solutions of automation and machine automation arm.With the

[a] Department of Business Administration, Feng Chia University. No. 100, Wunhua Rd., Situn Dist., Taichung City 40724, Taiwan, ROC.
☎. + 0092 311 5082056 ✉. whlai@fcu.edu.tw
[†b] Ph.D. Program of Business, Feng Chia University. No. 100, Wunhua Rd., Situn Dist., Taichung City 40724, Taiwan, ROC.
☎. *+31 70 4260591* ✉. cutemilly100429@gmail.com

rapid development of Internet of Things, 3D printing, artificial intelligence, automated robots, cloud data, biotechnology, etc., the fourth industrial revolution has come to the side, and in response to this era of tremendous change, smart manufacturing should be active first. One of the promoted works, with the model and service provided by smart manufacturing, has enabled the government to promote the "Smart Precision Machinery Industry Promotion Program" since July of the Republic of China. Its main purpose is to upgrade the Taiwan manufacturing industry from precision machinery. For the smart precision machinery industry, it is hoped that the part that can be extended to international cooperation and market opportunities is expected to expand the output value of its precision machinery industry.

In order to improve the production efficiency of the global manufacturing industry and reduce its cost and increase the added value of its industry, governments around the world have worked hard to transform the industry and drive the growth of its economy, proclaiming the official arrival of the fourth industrial revolution. And with the intelligent chemical factory as the core, plus automation, Internet of Things, and big data to form the structure of its industry 4.0, the smart factory can produce differentiated products on a large scale to meet the needs of different customers, and the production equipment can not only be borrowed. Networking and mutual communication, through the integration of big data and cloud computing, coupled with automation, to reduce expenditures and improve their efficiency, can also be managed and improved (Chen *et al.*, 2018).

The data processing and intelligentization of the manufacturing process is the most needed in the current industry. The manufacturing industry is currently shifting from mass production to customized production. The industry is rapidly improving its manufacturing technology and speed, and its application helps to increase the productivity of the industry. Industry 4.0 represents the fourth industrial revolution. This is defined as the new level of organization and control of the entire value chain of the product life cycle, and its adaptability is becoming more and more personalized towards the requirements of customers. Sustainability issues in the production process have become one of the main challenges facing the industry today. New industrial paradigms such as Industry 4.0 point to creating sustainable processes. Create a higher competitive advantage.

However, the transition from traditional manufacturing to industrial 4.0 manufacturers presents a number of obstacles that organizations must overcome some of their challenges in the sustainability of Industry 4.0 transition (Paravizo *et al.*, 2018).

Finally, in recent years, there is less research on the industry 4.0 as the main axis and the precision machinery industry as an example. Therefore, this research will take the precision machinery industry as the research object, and use the hierarchical analysis method (AHP) as the research method to find out of the solution and the problems faced, and then propose improvements to the problem to enable the industry to create a higher competitive advantage.

2. Literature review

The purpose of this study is to explore the key success factors of Industry 4.0 affecting the precision machinery industry. Therefore, this chapter explores through the literature that the precision machinery industry is the first country to drive the basic economy industry.

2.1. Industrial profile

For Taiwan, it is one of the important main players in the upgrading of the machinery industry. The machinery industry has always been regarded as one of the important indicators of the degree of industrialization of the country. Taiwan currently has nearly 240 precision tool machinery manufacturers gathered in the middle. In the region, the industrial manufacturing industry in a country is dominated by precision machinery (MIRL, 1998). It is a component such as machine tools, bearings, gears, special function machines, tool machinery, etc. Taiwan's precision machinery industry is typical. Technology-intensive characteristics, which is one of the key industries of Taiwan's economy, will therefore be the title of "mother of industry" and an essential industry for industrial powers. There will be definitely an important influence on the promotion of the national economy. From the overall concept of Industry 4.0, the transformation of the Internet of Things and Internet services, the production process is only one aspect. Simply put, a large number of automated robots, IoT sensors, supply chain Internet, and big data analytics are used to increase the productivity and quality of the manufacturing value chain (Du, 2016).

Throughout the production process, from sensing to consumer demand, design, order placement, raw material confirmation, production, shipment, etc., in addition to production line speed and quality control, we must maintain contact with the original material supply, even in response to orders. Or adjust the production of multiple production lines, as well as the information and orders for the delivery of raw materials through the Internet of Things. Human intervention can be used to assist in adjusting the supply or production status of raw materials. In the process of manufacturing, the Cyber-Physical System (CPS), which is calculated, communicated and controlled, is connected with the Internet of Things, and intelligently produces and manufactures smart factories to form smart manufacturing and services. New business opportunities and models, this is the concept of Industry 4.0.

In the future, we will face the global competition, the diversification of industries and the short-lived industrial trends. Countries around the world have begun to pay more attention to the manufacturing sector. In the face of these challenges, we will intelligentize precision machinery, Internet of Things, big data and automation to deepen development that has become the main trend.

2.2. Industry 4.0 impact on the precision machinery industry

The basic foundation of Industry 4.0 means that by connecting machines, systems and assets, the Internet of things, cloud computing and big data, organizations can create smart grid autonomous processes in the value chain that controls production. Within the framework of Industry 4.0, organizations will have the ability and autonomous arrangements to maintain and predict failures and adapt to new changes and planned changes outside the production process (Jazdi, 2014). In recent years, Germany has been actively creating a fully digital manufacturing system, and will integrate a large number of networks, software devices, Internet of things, cloud computing and big data to meet the needs of future changes (Ma, 2013).

Li (2017) said that big data is the core technology for implementing smart manufacturing. In the process of manufacturing systems, a large amount of data is generated in the process of problem occurrence and resolution, and then data is used to analyze data, predict demand, and use this data for integration. Industry and value chain, this is the thinking of Industry 4.0. Wu (2015) believes that no matter what kind of service industry or any type of mobile device, the demand of consumers will be brought to the direction of manufacturing products, and the most urgent use of online consumption, production, delivery, and inventory is almost every second. When all things are interconnected, the factory equipment can also respond to each other. This result makes manufacturing more efficient, and the rise of the Internet of Things can reduce initial expenditure costs and increase competition opportunities.

Scholar Lee *et al.*, (2014) used an automated machine as a collaborative community connection in an industrial 4.0 plant. This evolution requires the use of predictive tools that can be systematically processed into information using big data to explain its uncertainty. The manufacturing and intelligentization of IoT-based systems are two inevitable trends and challenges in manufacturing, the trend of manufacturing service transformation in the context of big data, and the intelligent preparation of predictive informatics tools for managing big data. To achieve transparency and productivity the Internet of Things, big data, automation and intelligence are becoming major assets in the modern manufacturing industry.

As the fourth industrial revolution or Industry 4.0 becomes the dominant reality, it will bring about a new paradigm shift. Industry 4.0 refers to the integration of multiple technologies and agents to achieve the common goal of improving the efficiency and responsiveness of production systems. This integration has the potential to revolutionize the way you plan and implement your business. Intelligent manufacturing represents the implementation of Industry 4.0 by the manufacturing industry. Internet of Things, big data, network physics systems, automated learning, additive manufacturing, and robotics are just a few of the factors involved in this revolution (Ahuett-Garza *et al.,* 2018).

According to the above-mentioned many scholars' literature, this study aims to use "Industry 4.0" proposed by various scholars as the main framework, from "The Internet of Things", "Big Data", "Intelligent" and "Automation". There are four aspects using the relative weights of these four facets and the weight of the sub-factors to find out the key factors that really affect Industry 4.0, as a reference for impact decision-making. This is the focus of research.

2.3. Industry 4.0 evaluation criterion for the precision machinery industry

This study is to explore the key influencing factors of Industry 4.0 for the precision machinery industry, use the four facets and understand the mutual weight relationship between the factors.

2.3.1. Internet of things of influencing factors

In 2020, there will be 25 billion devices connected to the Internet. These connections will facilitate the use of big data analytics, pre-planning, management and making informed decision-making autonomy to learn about several sectors of the service, such astransportation, smart cities. Smart home, smart health, self-protection, assisted living, e-education, retail, logistics, agriculture, automation, industrial manufacturing, and business and process management have benefited from various forms of the Internet of Things (Gubbia *et al.,* 2013). From the practical point of view, the Internet of Things can be conceptually divided into three layers of architecture, namely the sensing layer, the network layer and the application layer. These three layers perform their respective functions and at the same time lead each other.

2.3.2. Automation of influencing factors

Automation is an important and fundamental element of the industrial manufacturing industry. In industrial manufacturing that values the international market, automation can be used to reduce manpower and increase value to meet manufacturers' quality requirements. The main purpose of automation is to increase productivity and reduce costs. High productivity and low cost are the most effective of strong competitiveness. In 2017, the total industrial automation equipment market for automation equipment accounted for approximately 37.1%, followed by power transmission equipment for 32.9%, and motor and control for 30%, making total industrial capital expenditures grow 3% in 2017. In 2018, it continues to grow by 6%, and is expected to grow by 4% in 2019. Such a dazzling achievement is enough to represent the importance of automation to industry. Therefore, the basic operation structure of automation is divided into three levels: field level, control layer and management layer.

2.3.3. Intelligent of influence factors

Industry 4.0 does not want to replace manpower with robots. Instead, it uses human-machine synergy to move toward smart production. Whether it is inserting orders or urgent orders, you can grasp the status of the production line, grasp every business opportunity, and connect the value-to-delivery value creation network. Achieve the integration of products and their production system lifecycle engineering, avoid unnecessary waste, reduce inventory and shorten the delivery time of customized products to achieve the essence of Smart Factory (Zeng, 2015). In the face of industrial intelligence, it also focuses on environmental issues, so regardless of the control of the re-process, the operation of the system and the final green energy transformation, it is an indispensable part of the wisdom, so it will be intelligent. The basic operational structure is divided into process control visualization, system supervision and green energy manufacturing.

2.3.4. Big data on the influencing factors

Big data is one of the core technologies for realizing Industry 4.0. In the manufacturing system, various and large amounts of data will be generated during the occurrence and resolution of problems. After the information is built into a model, it will be turned into knowledge and established, and solved. To avoid the recurrence of problems, to integrate the industry chain and value chain by analyzing data, forecasting demand, predicting manufacturing, and using data, this is the thinking of Industry 4.0, and big data itself is not important, using big data to create its value. It is the most fundamental purpose. As big data technologies spur many companies to integrate their needs to create unimaginable economic benefits and realize great social value with high business potential, the use of big data in different industries generates enormous value and benefits, showing unprecedented social potential. In academia, it focuses on big data science issues and explains the importance of big data science. As for big data, although a well-recognized definition has not yet been proposed, the definition of big data is more representative in terms of three characteristics that should satisfy a large number of sexualities, diversity and immediacy (Zhang *et al.*, 2015).

This study focuses on the key factors affecting Industry 4.0. Through literature review, this study found that the Internet of Things is related to the application layer, network layer, and sensing layer. Automation is related to the field layer, control layer, and management layer. Visualization of intelligent and process management and control System monitoring is comprehensive and green energy manufacturing is relevant. Big data is related to diversity, mass and immediate factors.

3. Research method

The purpose of this study is to explore the key factors affecting the precision machinery industry in Industry 4.0. In addition to the research background, motivation, purpose and related literature, the other parts and related main contents are also reviewed and analyzed by the literature. And through the expert validity review method, give suggestions for the key factors and indicators of Industry 4.0 affecting the precision machinery industry, and then form a research questionnaire.Figure 1 shows the hierarchical structure in this study.

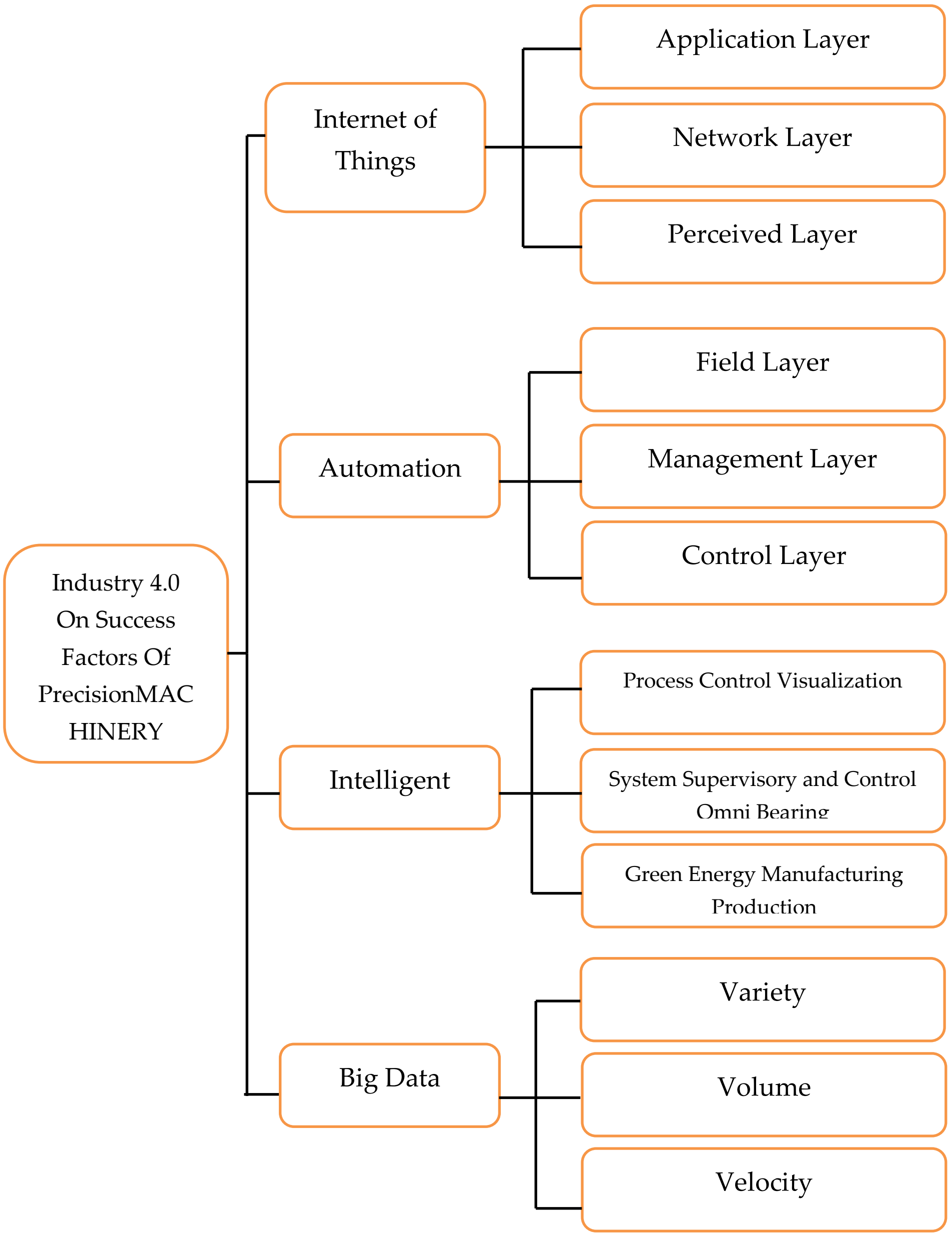

Figure 1. *Hierarchical Structure*

The study summarized the four main influencing factors of Industry 4.0 affecting the precision machinery industry through a literature review, summarized these four aspects, and defined their descriptions through operational definitions, and measured, quantified, and specified basic explanations and explanations. After the research hypothesis has been proposed, the research variant or term can be tested repeatedly. Table 1 lists the four influencing factors of Industry 4.0 affecting the precision machinery industry.

Table 1. *Four Influencing Factors of Industry 4.0 Affecting the Precision Machinery Industry*

Factor	Operational Definition	Literature Cited
Internet of Things	In this study, "Internet of Things" refers to the main purpose of connecting anyone, things, and things anytime, anywhere, thereby generating innovative new applications and services. It provides opportunities and challenges that many users and enterprise organizations need to solve.	Kouicem *et al.*, 2018; Atzori *et al.*, 2010; Gubbia *et al.*, 2013
Automation	In this study, "Automation" refers to the main purpose is to increase productivity and reduce costs. High-efficiency productivity and low cost are the greatest effectiveness of strong competitiveness	Löfving *et al.*, 2018; Zhang, 2017; Smart Industry, 2017
Intelligent	In this study, " Intelligent " refers to in the process of monitoring the product manufacturing process, it is improved, and in the process of enterprise promotion of intelligence and intelligence, in order to accelerate its industrial upgrading, transformation and enhance its industrial competitive advantage.	Zeng, 2015; Lin, 2017; Lin, 2012
Big Data	In this study, "Big Data" refers to a variety of large amounts of data will be generated during the occurrence and resolution of problems. After these messages are built into a model, they will be converted into knowledge and establishment, and the problem will be solved and avoided again. Data integration industry chain and value chain	Zaslavsky *et al.*, 2013; Zhang *et al.*, 2015; Torrecilla *et al.*, 2018

This study used the 12 sub-factors that influenced the precision machinery industry through Industry 4.0. These sub-factors are defined by their operational definitions, as shown in Table 2.

Table 2. *Industry 4.0 influences the sub-elements of the precision machinery industry*

Factor	Sub-factor	Operational Definition	Literature Cited
Internet of Things	Application Layer	In this study, the "Application Layer" refers to identify objects and collect information on various heterogeneous sensing data.	Zheng, 2011; Qi Feng Information,2015; Liu,2017; Wang *et al.*, 2016.
	Network Layer	In this study, the "Network Layer" refers to the data collected by the sensor is transmitted to the Internet, so that people can learn important information in real time, and it also allows users to have the ability to control items remotely, thereby achieving the effect of remote interaction.	
	Perceived Layer	In this study, the "Perceived Layer" refers to the integration of professional technology between the Internet of Things and the industry is to analyze and process the sensing data in the network layer according to the needs of the industry or users to provide specific services and achieve a wide range of	

		intelligence.	
Automation	Field Layer	In this study, the "Field Layer" refers to configuration at the field level, information collection and management, and later integration with the enterprise management platform are all parts that must be considered in automation planning to achieve the scope of benefits that automation can achieve.	Qi Feng Information, 2015; Xie, 2017; Lu, 2018; Zeller *et al.*, 2018.
	Management Layer	In this study, the "Management Layer" refers to in order to allow the manufacturing department to make changes and adjustments at any time according to the customer's order, and to meet its manufacturing needs, but also to coordinate the logistics configuration between the front-end and back-end factories, and finally to monitor the manufacturing process, this can reduce and reduce the management Information and errors.	
	Control Layer	In this study, the "Control Layer" refers to make use of the status of the field layer to make adjustments, settings and corrections in the control layer, which is the main concept of the control layer.	
Intelligent	Process Control Visualization	In this study, the "Process Control Visualization" refers to In the product manufacturing process, it can be directly displayed in front of the manager in real time, allowing the manager to fully control the status of the process, react and give feedback in real time, and at the same time the current status of system appliances can also be grasped in real time, allowing the manager to control the process At the same time, reduce the deviation caused by system failure	China Machine Robot Design Institute, 2018; Chen, 2016; Lin, 2012; Wang, 2014.
	System Supervisory and Control Omni Bearing	In this study, the "System Supervisory and Control Omni Bearing" refers to through the intelligent concept, the system can perform identification, analysis, reasoning, decision-making, and control functions, mainly by accumulating knowledge through the system platform, thereby establishing a database of equipment information and feedback.	
	Green Energy Manufacturing Production	In this study, the "Green Energy Manufacturing Production" refers to in the manufacturing process, more environmentally friendly materials are used to avoid pollution, and the entire supply chain must be recycled and reused to meet the green life cycle of the	

		product, and work with upstream and downstream manufacturers and customers to produce products that meet green manufacturing.	
Big Data	Variety	In this study, the "Variety" refers to analyze these diversified data, can interact with each other and find the correlation between the data.	Oussous *et al.*, 2017; Lin, 2016; Akhavan *et al.*, 2018; Khaloufi *et al.*, 2018.
	Volume	In this study, the "Volume" refers to collecting a large amount of data can further combine information with important environmental data, urban dynamic data and other parameters such as urban land use.	
	Velocity	In this study, the "Velocity" refers to technological advances have made new data faster and faster, accumulating, processing, storing and analyzing data at an unprecedented rate.	

This study is mainly to explore the key success factors of Industry 4.0 for the precision machinery industry. Therefore, this study mainly uses the Analytic Hierarchy Process (AHP) proposed by Saaty (1971), through relevant literature and through expert interviews. The questionnaire extracts guidelines for decision makers to conduct decision analysis. Finally, the AHP expert questionnaire is used to interview relevant personnel, and the hierarchical analysis method is used to estimate the importance of the criteria to select the most appropriate. AHP has a wide range of applications due to its simple theory, easy operation and practicality.

The Analytic Hierarchy Process (AHP) was developed by Professor Thomas L. Saaty in 1971. The main development objectives are applied to decision-making problems in uncertain situations and with many evaluation criteria, to systematically address these complex problems. The hierarchical analysis is given by different levels and comprehensively evaluated through quantitative judgments to provide decision makers with the choice of appropriate solutions while reducing the risk of decision errors. The theory of hierarchical analysis is simple and practical, so it has been widely used by research institutions in various countries since its development. Deng & Zeng (1989) pointed out that the purpose of the hierarchical analysis method is to systematically classify complex problems, then list different hierarchical structures and subdivide them into quantitative methods, and then evaluate them after research. Choose the appropriate program. The purpose of this study is to explore the connotation characteristics, theoretical basis and current development of the hierarchical analysis method. For decision makers, the hierarchical structure helps to understand things, but in the face of choosing appropriate solutions, it must be based on certain Benchmarking, the evaluation of each alternative to determine the superiority of each alternative, to find the appropriate solution, if only decided on a single level, it will lead to wrong decisions, and wrong decisions than no decisions Come more seriously.

Professor Saaty develops the basic assumptions of the hierarchical analysis method. The hierarchical analysis method can be applied to the following 12 questions, which mainly include the following items:

1. Setting Priorities
2. Generating a Set of Alternative
3. Choosing a Best Policy Alternative
4. Determining Requirement
5. Allocating Resources
6. Predicting Outcomes and Risk Assessment
7. Measuring Performance
8. Designing systems
9. Ensuring system Stability
10. Optimizing
11. Planning
12. Conflict Resolution

The hierarchical program analysis method simplifies the complicated system into a simple hierarchical system, and brings together the opinions and considerations of experts and decision makers. The pairwise comparison between the factors is performed on the nominal scale. For the comparison matrix, the eigenvector and the eigenvalue are obtained, and the eigenvector represents the priority order among the factors in a certain level, and the pairwise comparison matrix is used to evaluate the pairwise comparison. The strength of the matrix's consistency, its evaluation results can be used as a reference for decision-making information and re-evaluation (Wu, 2000).

4. Empirical analysis

A total of 20 questionnaires were issued in this study. After the AHP questionnaire was collected, there were 16 questionnaires, and the consistency check of each questionnaire was calculated and verified. The results were logically consistent. Therefore, a total of 16 questionnaires were valid AHP questionnaires. Analyze and rank the relative weights of each level of indicators. The statistics of the AHP questionnaire are shown in Table 3.

Table 3. *AHPquestionnaire response rates and effective response ratestatistical*

Company object	convenience sampling	questionnaires and collected	response rates	valid samples	effective response rate
Technology	10	8	80%	8	100%
Motor	10	8	80%	8	100%

This study explores the key factors affecting the precision machinery industry by Industry 4.0, establishes an AHP hierarchy of 4 assessment facets and 12 key factors, and then designs and uses questionnaires to conduct opinion surveys. There is relevant cognitive experience to fill in the object, and the recycling questionnaire is analyzed by Expert Choice 2000 Enterprise v10.1 software. A pairwise comparison matrix is established to analyze the calculated feature vector and the eigenvalue, and the obtained data is corrected by the consistency check and the hierarchical structure consistency check, and the weight of each index can be calculated to assist in selecting the optimal decision plan. In Table 4-8.

Table 4. *AHP (for evaluating key aspects of precision machinery industry impacted by Industry 4.0) pairwise comparison matrix*

	Internet of Things	Automation	Intelligent	Big Data
Internet of Things	1	5.8	4.44	4.06
Automation	0.17	1	1.62	1.53
Intelligent	0.23	0.62	1	1.47
Big Data	0.25	0.65	0.68	1

Notes: C.I=0.040 C.R=0.070

Industry 4.0 affects the overall appearance of the precision machinery industry. From the research results, we can find that the biggest difference between intelligence and automation is their control and use of various types of data; the concepts of the Internet of Things and big data still account quite an important part.

Table 5. *AHP (key factors of Internet of Things applied to Industry 4.0 evaluation criteria) pairwise comparison matrix*

	Application Layer	Network Layer	Perceived Layer
Application Layer	1	1.45	3.71
Network Layer	0.69	1	3.61
Perceived Layer	0.27	0.28	1

Notes: C.I=0.006 C.R=0.011

The research and analysis results show that in the architecture of the Internet of Things, it confirms that the practical operations and their importance are in accordance with the definition, that is, the balance between the application layer, the network layer, and the sensing layer, which are related and implicated. The order of the definition makes it meaningful in practical experience.

Table 6. *AHP (key factors ofAutomation applicationto Industry 4.0 evaluation criterion) pairwise comparison matrix*

	Field Layer	Management Layer	Control Layer
Field Layer	1	3.37	3.41
Management Layer	0.3	1	0.29
Control Layer	0.29	3.46	1

Notes: C.I=0.088 C.R=0.153

To achieve true automation, there must be a complete set of supporting measures, from the beginning of on-site management and control to the mid-end management configuration and the final control equipment. Based on practical experience, the questionnaire believes that if there is no complete on-site level and management Supporting, it is impossible to have a complete set of automation.

Table 7. *AHP (key factors ofIntelligent applicationto Industry 4.0 evaluation criterion) pairwise comparison matrix*

	Process Control Visualization	System Supervisory and Control Omni Bearing	Green Energy Manufacturing Production
Process Control Visualization	1	7	7
System Supervisory and Control Omni Bearing	0.14	1	5
Green Energy Manufacturing Production	0.14	0.2	1

Notes: C.I=0.030 C.R=0.052

In addition to greening and environmental protection with upstream and downstream manufacturers, waste recycling to reuse treatment to form a product life cycle, extending to green process management, smart environmental monitoring and supply chain collaborative management, etc. To create green products that are environmentally friendly.

Table 8. *AHP (key factors of Big Data applicationto Industry 4.0 evaluation criterion) pairwise comparison matrix*

	Variety	Volume	Velocity
Variety	1	1.81	1.40
Volume	0.55	1	0.34
Velocity	0.71	2.93	1

Notes: C.I=0.037 C.R=0.064

Source diversity handles data with high speed and large capacity, has its data and actual authenticity, and creates its value to make it more applicable on multiple levels. This is the nature of big data. There is no correct and complete standard to set the size of big data, and the size of the data is not the focus of big data. "Value" is the meaning of big data.The consistency index is less than 0.1 in line with AHP analysis.

5. Conclusions

The recent rise of Industry 4.0 has driven the output value of the precision machinery industry and accelerated its transformation and evolution. The early precision machinery industry focused on mass production, but the era of winning in recent years has begun to fall short of expectations, making Taiwan go to wisdom. The development of the machinery industry is faced with the fate of being eliminated if it is not transformed, so the Taiwanese machinery industry is striving to integrate the overall solutions of automation and machine automation arm. With the rapid development of Internet of Things, 3D printing, artificial intelligence, automated robots, cloud data, biotechnology, etc., the fourth industrial revolution has come to the side, and in response to this era of tremendous change, smart manufacturing should be active first. One of the promoted works, with the model and service provided by smart manufacturing, has enabled the government to promote the "Smart Precision Machinery Industry Promotion Program" since July of the Republic of China. Its main purpose is to upgrade the Taiwan manufacturing industry from precision machinery. For the smart precision machinery industry, it is hoped that the part that can be extended to international cooperation and market opportunities is expected to expand the output value of its precision machinery industry.

The results of this study are summarized as follows:

1. In the evaluation of the key factors affecting the precision machinery industry in Industry 4.0, four criteria layers factors are set, including twelve influence, and the risk assessment is more reliable in this way.

2. Among the four criteria layers facets, the key factors affecting Industry 4.0 and precision machinery industry are ranked as follows: (1) field layer (2) process control visualization (3) application layer(4) variety (5) velocity (6) network layer (7) system supervisory and control omni bearing (8) management layer (9) volume (10) perceived layer (11) control layer (12) green energy manufacturing production.It can be seen that when planning the precision machinery industry, special attention should be paid to the needs of the industrial site and its related management and control before making relative changes and adjustments.Secondly pay attention to the production and quality control of the industry, and pay attention to changes in the market in a timely manner, so that the various requirements of customers can be corrected in real time, thereby increasing its value. Finally, protecting and paying attention to the environment is also an important part of corporate growth.

3. This research uses four major facets to find out that the evaluation results that affect the precision machinery industry are consistent with each other, and the relevant factors inferred from the four facets are similar to the assessment of expert questionnaires, which confirms that the research method has a certain degree reliability and practicality.

The data processing and intelligentization of the manufacturing process is the most needed in the current industry. The manufacturing industry is currently shifting from mass production to customized production. The industry is rapidly improving its manufacturing technology and speed, and its application helps to increase the productivity of the industry. Industry 4.0 represents the fourth industrial revolution. This is defined as the new level of organization and control of the entire value chain of the product life cycle, and its adaptability is becoming more and more personalized towards the requirements of customers. Sustainability issues in the production process have become one of the main challenges facing the industry today. New industrial paradigms such as Industry 4.0 point to creating sustainable processes. Create a higher competitive advantage. In the future, fuzzy theory can be used to analyze and use various factors and attribution functions and followed up with more experts' opinions and different perspectives to conduct a risk assessment.

References

Akhavan-Hejazi, H., & Mohsenian-Rad, H. (2018). Power systems big data analytics: An assessment of paradigm shift barriers and prospects. *Energy Reports*, 4, 91-100. doi. 10.1016/j.egyr.2017.11.002

Ahuett-Garza, H., & Kurfess, T. (2018). A brief discussion on the trends of habilitating technologies for Industry 4.0 and Smart manufacturing. *Manufacturing Letters*, 15(Part B), 60-63.doi. 10.1016/j.mfglet.2018.02.011

Atzori, L., Iera, A., & Morabito, G. (2010). The internet of things: a survey. *Comput. Networks* 54 (15), 2787-2805. doi. 10.1016/j.comnet.2010.05.010

Chen, T., Yang, Y., & Dong, Z. (2018). Machine tool industry 4.0 patent trend analysis, *Intellectual Property Rights Monthly*, 229(1),63-78.

Chen, J. (2016). On the inspiration of "Industry 4.0" to promote "green manufacturing" in China, and the Office of Energy Saving and Carbon Reduction Promotion of the Ministry of Economic Affairs.

Du, Z. (2016). Ten minutes to understand what is Industry 4.0, regional industry integration development plan. [Retrieved from].

Deng, Z., & Zeng, G. (1989). Connotation characteristics and application of hierarchical analysis (AHP). *Chinese Journal of Statistics*, 27(6), 5-22.

Gubbia, J., Buyya, R., Marusica, B.S., & Palaniswamia, M., (2013). Internet of things (IoT): A vision, architectural elements, and future directions. *Future Gener. Comput Syst*. 29(7), 1645–1660. doi.10.1016/j.future.2013.01.010

Jazdi, N. (2014). Cyber physical systems in the context of Industry 4.0. *In Automation, Quality and Testing, Robotics, 2014 IEEE International Conference*, 1-4. doi.10.1109/AQTR.2014.6857843

Kouicem, D.E., Bouabdallah, A., & Lakhlef, H. (2018). Internet of things security: A top-down survey. *Computer Networks*. 141, 199-221. doi.10.1016/j.comnet.2018.03.012

Khaloufi, H., Abouelmehdi, K., Beni-hssane, A., & Saadi, M. (2018). Security model for Big Healthcare Data Lifecycle. *Procedia Computer Science*, 141, 294-301. doi.10.1016/j.procs.2018.10.199

Lin, M. (2017). "Industrial Big Data" Book Excerpt: Wisdom Transformation and Value Innovation in the Industry 4.0 Era, Enterprise Communication.

Lee, J., Kao, H. A., & Yang, S. (2014). Service innovation and smart analytics for industry 4.0 and big data environment. *Procedia Cirp*, 16, 3-8. doi. 10.1016/j.procir.2014.02.001

Liu, H. (2017). Integrating the internet of things Architecture and Intelligent Home Appliance Controller in Energy Management System Research, National Kaohsiung University of Applied Sciences' Electrical Engineering Degree Thesis, 1-76.

Löfving, M., Almström, P., Jarebrant, C., Wadman, B., & Widfeldt, M. (2018). Evaluation of flexible automation for small batch production. *Procedia Manufacturing*, 25, 177-184. doi. 10.1016/j.promfg.2018.06.072

Lu, M. (2018). The coming of the Industry 4.0 era: Machinery Industry 4.0, [Retrieved from].

Lin, J. (2012). The era of smart manufacturing is coming, the equipment becomes smarter, DIGITIMES planning, [Retrieved from].

Lin, J. (2017). The impact of industrial intelligence and digitalization on the employment market, *Economic Prospects*, 172, 48-51.

Lin, E. (2016). From storage, mining to communication, leading a new face of the industry: Big Data (Big Data). [Retrieved from].

MIRL, (1998). Taiwan Yearbook of Machine Tools Research Report. Taiwan: Industrial Technology Research Institute.

Ma, R. (2013). Looking at the opportunities and challenges of Taiwan industry from the trend of international wisdom manufacturing. *Electrical and Electronic Environmental Development Association*. [Retrieved from].

Oussous, A., Benjelloun, F. Z., Lahcen, A. A., & Belfkih, S. (2017). Big Data technologies: A survey. *Journal of King Saud University-Computer and Information Sciences*. 30(4), 431-448. doi. 10.1016/j.jksuci.2017.06.001

Paravizo, E., Chaim, O.C., Braatz, D., Muschard, B., & Rozenfeld, H. (2018). Exploring gamification to support manufacturing education on industry 4.0 as an enabler for

innovation and sustainability. *Procedia Manufacturing*, 21, 438-445. doi. 10.1016/j.promfg.2018.02.142
Qi-Feng Information, (2015). From the internet to the internet of things. [Retrieved from].
Saaty, T.L. (1971). *The Analytic Hierarchy Process*, New Your. Prentice Hall Inc., 142-167.
Smart Industry, (2017), the top ten trends of the global industrial automation industry in 2017. [Retrieved from].
Torrecilla, J.L., & Romo, J. (2018). Data learning from big data. *Statistics & Probability Letters*, 136, 15-19.doi. 10.1016/j.spl.2018.02.038
Wu, W. (2000). *The Third Edition of the Enterprise Research Method*, Huatai Culture.
Wang, M. (2014). The manufacturer fully deployed the smart factory. [Retrieved from].
Wang, S., Wang S., Zhang Z., & Lu K. (2016). Using situational awareness and information feedback mechanisms to improve the quality of e-commerce services in the Internet of Things, *International Journal of Information Technology*, 10(2), 44-51.
Wu, Y. (2015). Smart factories make the production process smarter! *Digital Age*, 249(2), 245-256.
Xie, M. (2017). Analyzing industrial automation from the communication level, DIGITIMES project, [Retrieved from].
Zaslavsky, A., Perera, C., & Georgakopoulos, D. (2013). Sensing as a service and big data. arXiv: 1301.0159. [Retrieved from].
Zhang, Y., Luo, H., & He, Y. (2015). A system for tender price evaluation ofconstruction project based on big data. *Procedia Engineering*, 123, 606-614. doi. 10.1016/j.proeng.2015.10.114
Zhang, H. (2017). Automation exhibition, Delta's smart production line will be unveiled, Business Times, [Retrieved from].
Zeng, Y. (2015). The era of Industry 4.0: automation, intelligence, system virtuality and reality, is to make smart manufacturing! ARES Newsletter, [Retrieved from].
Zeller, A., & Weyrich, M. (2018). Composition of Modular Models for Verification of Distributed Automation Systems. *Procedia Manufacturing*, 17, 870-877. doi.10.1016/j.promfg.2018.10.139
Zeng, Y. (2015). Industry 4.0 Era: Automation, intelligence, and system virtualization are just smart manufacturing! Zitong Electronic News.
Zhang, Y., Luo, H., & He, Y. (2015). A system for tender price evaluation ofconstruction project based on big data. *Procedia Engineering*, 123, 606-614. doi.10.1016/j.proeng.2015.10.114
Zheng, Y. (2011). An analysis of the Internet of Things technology, i-Thome. [Retrieved from].