INSTITUTE OF LABOR, OCCUPATIONAL SAFETY AND HEALTH, MINISTRY OF LABOR

Strategic planning 2022-2025

Professionalism、Innovation、Ambition

ILOSH

I.Introduction

Given the impact of the COVID-19 epidemic, the world has fundamentally changed. Countries worldwide have been deeply affected by the new coronavirus pandemic since 2020, causing major challenges at all levels of the economy and society. The development of many industries has experienced crises, which has also affected the employment security and rights of workers. However, at the same time, countries worldwide has continued to accelerate the development of Industry 4.0 and digital technology by actively carrying out the infrastructure development for national strength and to enhance national competitiveness. Therefore, how to turn the crisis into opportunities and responding to changes in the new world situation is currently the most important task of the government's policy planning. Labor development and labor security, which are the most critical elements of industrial development, are thus even more important.

The Executive Yuan's has the following policies for"Promoting the protection of the rights and interests for workers in the new economic model, creating a friendly workplace environment, having a good understanding of the industry development and labor market demand, constructing a blueprint of careers for youth, and promoting work for middle-aged and senior citizens". It also has a National Science and Technology Development Program, to endow academic research with the goals of improving scientific and technological standards, stimulating economic development, strengthening ecological protection, enhancing life and well-being, enhancing national competitiveness and promoting the sustainable development of human society. Therefore, in accordance to these policies, the Ministry of Labor (hereinafter referred to as"MOL") actively promotes the 3S Policies where workers can have a workplace environment of "Secure Work", "Safe Workplace" and "Safe Labor" as part of the national development.The Labor and Occupational Safety and Health Research Institute (hereinafter referred to as the Institute), in accordance with the Ministry's 3S policies, conducts research strategy planning for 2022-2025, assists the MOL to promote workforce improvement, protects labor-management harmony in response to the new challenges in the post-epidemic era, and carries out new development of our country.

The strategic planning of ILOSH for 2022-2025 has undergone many internal and external meetings and discussions with the valuable opinions of researchers, experts and scholars being collected. By having a good understanding of forward-looking emerging labor market trends, we will actively promote labor policy and legal research, and promote labor fairness and just social development. It will also include promoting of research and development of forward-looking workplace safety and health technologies, reducing workplace hazards, innovative interactions and digital labor and safety and health displays, and improving a human-oriented and safe workplace environment. It will use research results to develop various labor policy drafts, improve safety and health systems, construct disaster reduction (prevention) technologies and methods, deepen the labor safety knowledge of our nationals, create independent, fair and just labor relations, and protect labor rights.

II.Problem analysis and strategic goals

In response to the post-epidemic era, the globalized environment and industrial changes, demographic changes, and the application of new materials and new manufacturing processes, it is expected that these factors will have a profound impact on labor and occupational safety and health issues in the future. As the only labor and occupational safety research government organization domestically, below is the SWOT analysis of the Strengths, Weaknesses, Opportunities and Threats compared with in terms of human resources funding, research and technologies, and research capabilities when compared with those of advance nations, private organizations, and schools and institutions. This is shown in Table 1.

Given that the current research manpower and funding in the institute still need to be improved and that it is impossible to conduct large-scale research and investigation work that consumes extensive manpower, research will adopt the approach of "diversified division of labor and close cooperation". It will strengthen the analysis of administrative data of government departments and combine the power of industry, government, academia and private sector in order to carry out cross-field and cross-organization division of labor cooperation and to use existing key core technologies to assist in the improvement of business units and companies. Therefore, the plan is to combine the applied research on emerging issues led by the ministry's policies and to enable various research results to have practical value. Policy advice and guidance will be provided with the expectations to achieve the following strategic goals:

(1)Look forward to the economic, trade and social situation to have good understanding of the labor market demand, monitor the labor market flow to provide high-quality and sufficient labor, and strengthen the labor supply and demand mechanism to promote stable labor employment.
(2)To have a good understanding of the development trend of new-type labor relations, study and analyze the important factors that protect the rights and interests of both employers and employees, and promote equal rights in the workplace and work-life balance.
(3)Research and analyze the important factors of occupational disasters, promote high-risk workplace safety assessment and smart monitoring technology, and develop tools to support occupational safety work.
(4)Develop occupational health smart technologies, reduce occupational health risks, and apply human factors engineering to build a comfortable workplace.
(5)Establish emerging occupational disease monitoring technologies and workplace hazardous substance exposure assessment technologies to correctly assess work place hazards and reduce the incidence of labor occupational diseases.
(6)Strengthen occupational safety and health exhibition, promote labor safety and health awareness, and enhance international exchanges and cooperation.

Table 1 SWOT Analysis

Strength

1.Many of our research colleagues are qualified as labor inspectors and can enter public institutions to conduct necessary investigations and visits.

2.Professional research personnel have good quality and rich experiences, 55% of whom have more than 10 years of qualifications, and 91.7% have doctoral and master degrees.

3.The institute has more than 40 professional laboratories, with many core research technologies such as industrial ventilation, sampling analysis, hypothetical structure safety mechanics, human factors engineering, protective equipment effectiveness analysis, and construction frame safety protec tion.

4.We are responsible for the operation of the Labor Data Science Center of the Ministry, and work closely with the Ministry of Health and Welfare, the Ministry of Interior, the Ministry of Education, the Ministry of Finance, and the Council of Agriculture, and have obtained some administrative data from each ministry

5.Cooperation agreements have been signed with domestic and foreign occupational safety and health organizations, and can have a good understanding of forward-looking research topics.

Weakness

1.We have responsibilities to cover research in the fields of labor and occupational safety and health, but the organization al structure has not improved simultaneously, and the research manpower and basic maintenance of the budget need to be actively sought.

2.The manpower was originally based on the background of occupational safety and health, and the labor cross-field research experience is still insufficient. It is necessary to strengthen the problem analysis ability through cooperative labor policy research.

3.Some research machinery and equipment are outdated and urgently need to be updated, which gradually forms the limit of research and development technology.

4.Occupational disease prevention research needs to integrate hazardous substance exposure data, but the current exposure data is not easily available to obtain.

5.Some research results require long-term research and development and are not easy to implement in a short time for application or regulatory revision. There must be strengthen ing of research performance with external communication.

Opportunity

1.Through the gradual opening of laboratory space and equip ment in cooperation with research universities, three-region cooperation centers in North, Central and South are established to cope with the limitations of future research manpower.

2.Preliminary research has been conducted on the aging, fewer children, and climate change facing the country, as well as the long-term concerns of indigenous people, atypical and low-income labor issues.

3.The platform economy promotes the matching of supply and demand and promotes new employment opportunities; the rise of remote work brings innovative business models and provides diverse research topics.

4.The increasing willingness of labor and employment groups to participate will help improve the quality of research in the labor field.

5.The rapid development of advanced technologies such as the cloud, big data, and the Internet of Things can help strengthen the application of results through the combination of different professions.

6.The technological application of internet video can be used to conduct large-scale research, surveys and interviews regardless of the location and number of people.

7.Through the exchange and cooperation agreements between domestic and foreign institutions, international exchanges and personnel visits can be promoted, which is conducive to international integration and the introduction of the latest technology.

Threat

1.Our research and development alternative service manpower will become zero in 2024, and it is urgent to supplement general research manpower.

2.The advent of the digital age such as 5G, AI, and electric vehicles will change the characteristics of employment and increase the complexity of research.

3.The international industrial supply chain has changed, industries are relocated and high-quality talents go overseas to work more, and it is not easy to implement research on transnational labor rights and social security policies.

4.In response to the passage of the Act for Protecting Worker of Occupational Accidents, new institution legal persons are added in the field of occupational safety and health, and research funding may be affected and excluded.

5.Counseling and promotion of some research results are limited by the difficulties in the industry's process changes and increased costs. At the same time, it is affected by the economy, which increases the difficulties in its promotion and application.

6.Various new chemical substances, new technologies and systems are constantly being used, and working environment hazards, labor conditions and job market factors become more complicated.

7.In response to changes in work content, type, field, and time caused by the prevention of emerging infectious diseases, this has increased the difficulty of clarifying research problems and proposing solutions.

III.Research Themes and Topics

Based on the aforementioned SWOT analysis results, the current research and development trends at home and abroad are collected, and the current research and expected research results of our institute are used. The research areas of this period is divided into 6 main research themes and 19 topics (Figure 1). The research content is based on the administrative goals of the MOL for "Secure Work", "Safe Workplace" and "Safe Work", which are formulated with the relevant research results and technical research completed by the institute. There will be coordinating the use of the research and development of relevant domestic units and technical support from domestic and foreign experts to promote stable labor supply and demand, protecting labor rights, and integrating safety and health technology resources to achieve occupational disasters and occupational injury prevention, and also strengthening assistance and guidance for industry improvement, and promoting technical consultation service, promoting the popularization of safety knowledge, enhancing safety culture and increasing international visibility.

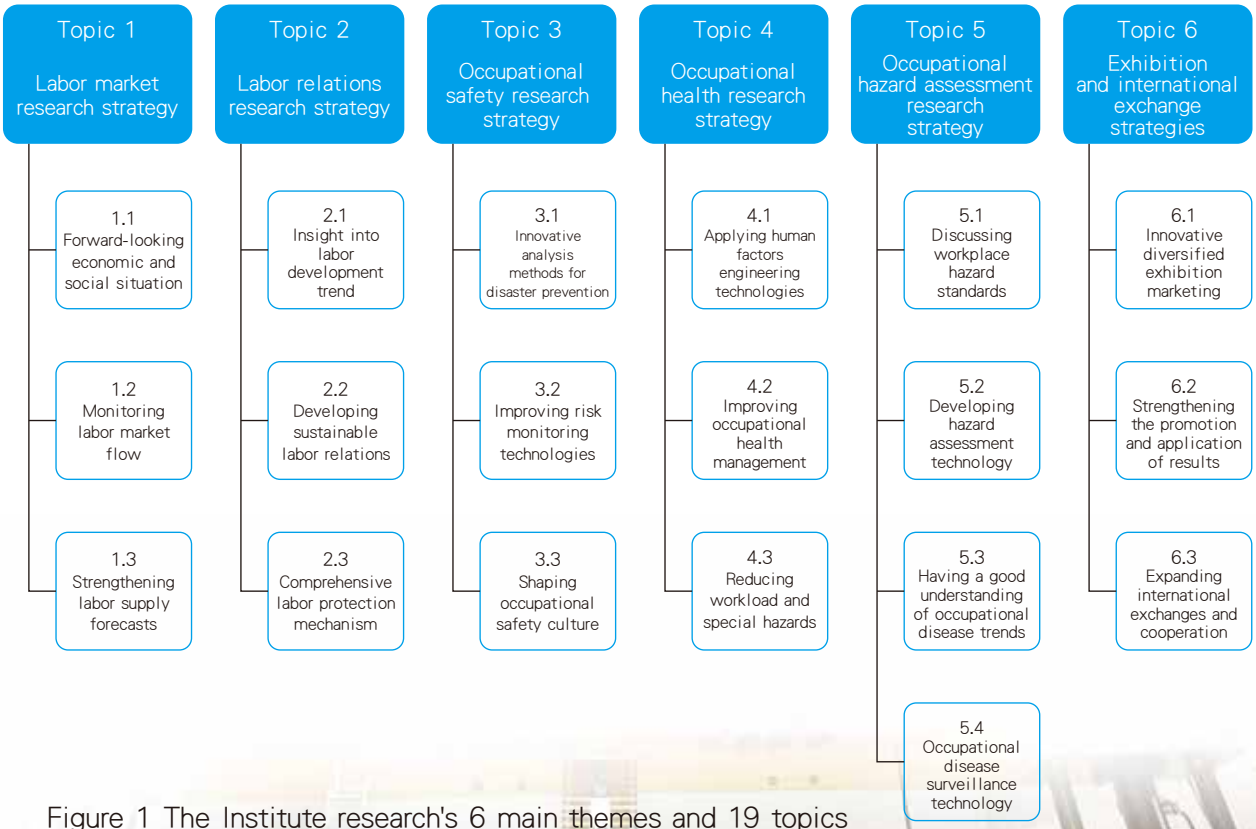
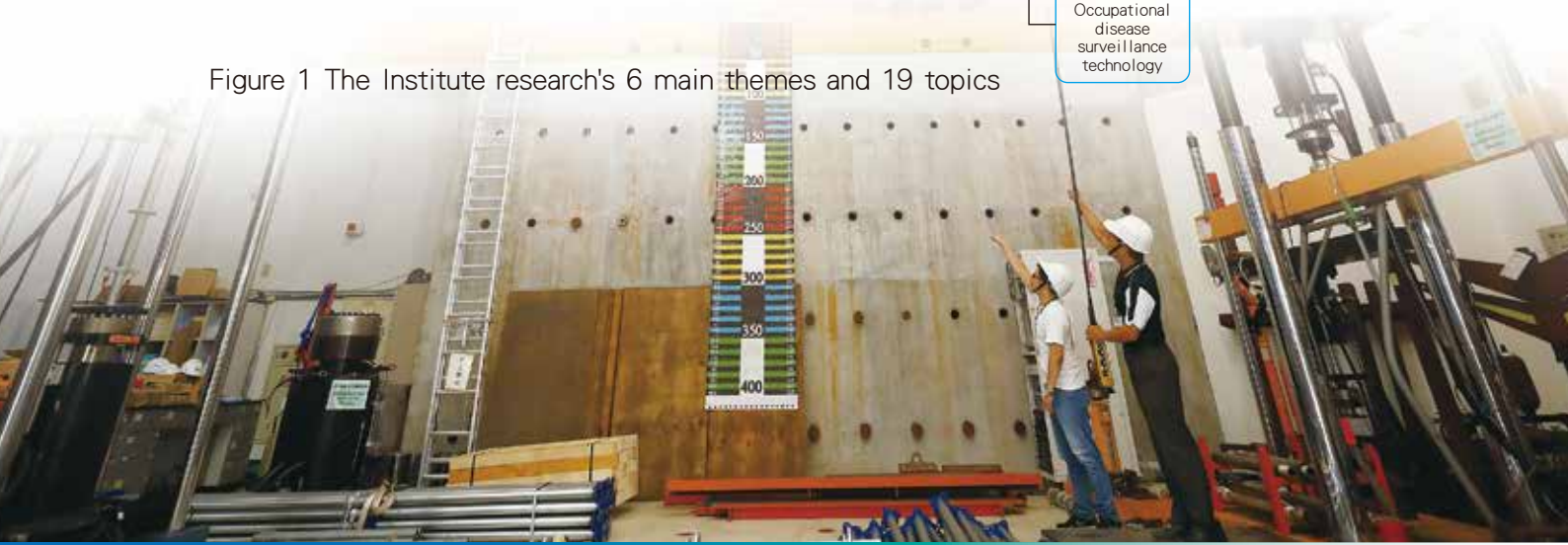


Figure 1 The Institute research's 6 main themes and 19 topics



1. Labor market research strategy

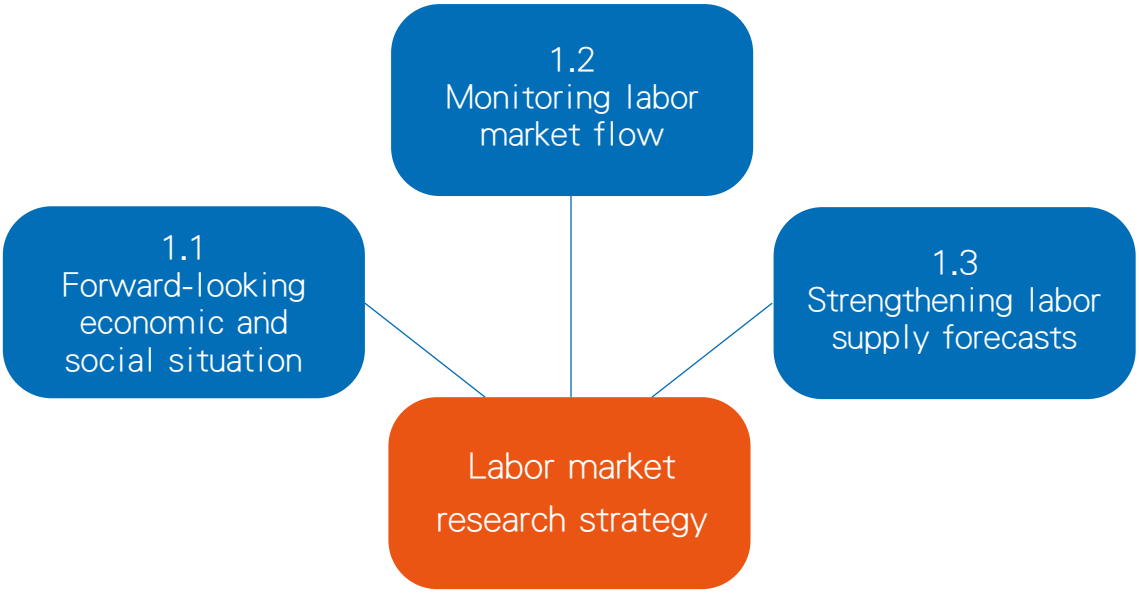


Figure 2 Labor market research strategy

In response to changes in the overall social and economic situation and the rapid development of industrial technology, we will have a good understanding of future development trend through the 2030 employment trend and outlook research. Three topics of labor market research strategies are formulated in order to promote stable labor supply and demand:

1.1 Forward-looking economic and social situation

Changes in international economic and trade competition and increased economic uncertainty have an impact on business operations and investment, and impact the industrial supply chain. In addition, the rapid development of digital technology and the desire of enterprises for digital and cross-domain talents create many job opportunities. Moreover, the demographic structure of the elderly with fewer children has led to demographic changes, and some industries are facing the challenge of lack of labor. In order to respond to the needs of socio-economic changes and industrial transformation, and promote a sound job market environment, we will develop a good understanding of the future labor market through three research directions: global socio-economic situation observation, technological development and industrial manpower demand, and aging with fewer children leading to industrial manpower shortage. These will develop a good understanding of demands and new opportunities and assess the impact of possible impacts to provide reference for policy research and discussion.

Table 2 Forward-looking economic and social situation

Research areas	Explanation
1.1.1 Global economic, trade, and social situation	The following will be conducted: regularly collecting important global economic situations, continue to observe regional economic development, having a good understanding of the movement of major countries' industrial supply chains and the transnational movement of talents; and monitoring the impact and threats of infectious diseases and environmental changes on the labor market.
1.1.2 Technology development and industrial manpower needs	The following will be conducted: targeting the development of emerging technologies such as digital technology (such as AIOT, 5G) and green energy economy (such as offshore wind power, electric vehicles), having a good understanding of the key talents leading the development of science and technology, cross-domain innovation fields, etc., analyzing and evaluate the types and numbers of specialized technical personnel required by the industry as the direction guiding the transformation of talents, strengthening the analysis of the impact of new technology on the labor market and the effect of occupational replacement, and proposing research and countermeasures.
1.1.3 Aging and fewer children and shortage of industry manpower	The following will be conducted: analyzing the industrial characteristics of the aging of the domestic labor force and the talent technology gap, understanding the tolerance of different occupational characteristics in the labor age, research and compare the policies and practices of major countries in the world in response to the elderly and fewer children and their overall impact on labor participation, research on the serious shortage of labor in key domestic industries, such as the shortage of workers in the construction industry and the shortage of manpower for care services, and research and development of related manpower supplement mechanisms and solutions to serve as a reference direction for policy planning.

1.2 Monitoring labor market flow

Our country has abundant higher education resources and abundant vocational training capacity. However, technological innovation progresses and the industrial structure changes rapidly. The requirements of enterprises for human quality professional functions are advancing with the times, digital skills, cross-field expertise, and problem solving capabilities being the talents the industry is looking for. On the other hand, the introduction of foreign labor to fill the 3K basic work that our people do not want to do, but in cases of countries competing for foreign high-quality labor and border control in response to the epidemic, which will affect the introduction of foreign workers to our country. In order to promote an adequate and high-quality labor supply in the industry, three research areas including labor stock flow monitoring and analysis, occupational cultivation and development, and transnational labor mobility will be carried out to study the future development direction of industrial labor supply structure adjustment and occupation improvement for recommendations for human resource planning guidelines and policies.

Table 3 Monitoring labor market flow

Research areas	Explanation
1.2.1 Labor stock flow monitoring and analysis	Through the employment tracking database, we regularly analyze the industrial labor supply situation, industrial labor migration situation, industrial population growth and decline trends, job search and waiting period, and labor withdrawal withholding and salary changes. Through analysis of the industrial economic situation, we also assess the supply situation of the labor market.
1.2.2 Occupational cultivation and development	For key talents required by nation's key industries, emerging industries and enterprises, we analyze related professional functions as a reference for related vocational training or curriculum development; analyze the employment and salary situation of vocational training and related certificates; and track related careers to carry out research to evaluate the effectiveness of training, licenses, and innovative training models. We also develop an understanding the gap between youth and student laborers' vocational skills and industry needs and put forward policy recommendations for human resource planning in a timely manner.
1.2.3 Transnational labor mobility	We will develop a good understanding of the incentives of key countries' preferential policies for talent recruitment, analyze the restructuring of the industrial supply chain and assess the trends of our nationals going overseas, discuss feasible strategies to encourage the return of talents, and provide policy suggestions for reference. We also collect policies by key countries for the introduction of foreign workers and assess the challenges and impacts that may be faced by the difficulties of foreign migrant workers in the future, for use as situation analysis information for policy planning.

1.3 Strengthening labor supply forecasts

The domestic employment service market is becoming increasingly diversified, promoting the development of high-quality employment services, reducing the waiting time for job seekers, and assisting companies in recruiting the talents they need to stabilize their business operations. In addition, due to the diminishing demographic dividend, it is necessary to strengthen the development of the employment of potential labor groups to appropriately supplement the labor market gap. Moreover, under the circumstances of accelerated industrial transformation and the rise of platform economy, atypical employment patterns are diversified, and the employment safety of disadvantaged groups needs to be paid attention to. In order to promote stable employment of our people, three research areas will be carried out for the domestic employment matching market, potential labor force development, and marginal labor employment safety to promote potential labor employment, and for recommendations to develop policy plans for the employment security gaps of marginal disadvantaged people.

Table 4 Strengthening labor supply forecast

Research areas	Explanation
1.3.1 Domestic job matching market	The following will be conducted: understand the current development of the private employment service industry market, collect and compare major domestic labor banking institutions, foreign employment matching platforms, and emerging labor intermediary service platforms, to develop a good understanding of the service target markets and service project characteristics of different employment matching units, and explore the characteristics, functions, and benefits of job search and transfer of different employment matching units, and study the market segmentation and social function positioning of the employment matchmaking in the public and private sectors.
1.3.2 Potential labor force development	For labor groups who retire early and are willing to continue to work, we will investigate and analyze their occupational ability characteristics and employment intentions, we will understand their obstacles and difficulties in job hunting and analyze opportunities that can be invested in the job market. Regarding the promotion of women' s participation in housework, we will discuss the problem of women of higher education leaving the labor market, focus on industries with large occupational gender gaps, and analyze key factors affecting personal career development.
1.3.3 Employment security for marginal and disadvantaged workers	We will discuss the employment issues, job search obstacles, vocational training motivations of specific groups (gig economy employees, low-paid freelance workers, dispatched workers, rehabilitated people, etc.); understand their vocational training and employment matching needs to help increase employment in order to promote employment.

2. Labor Relations Research Strategy

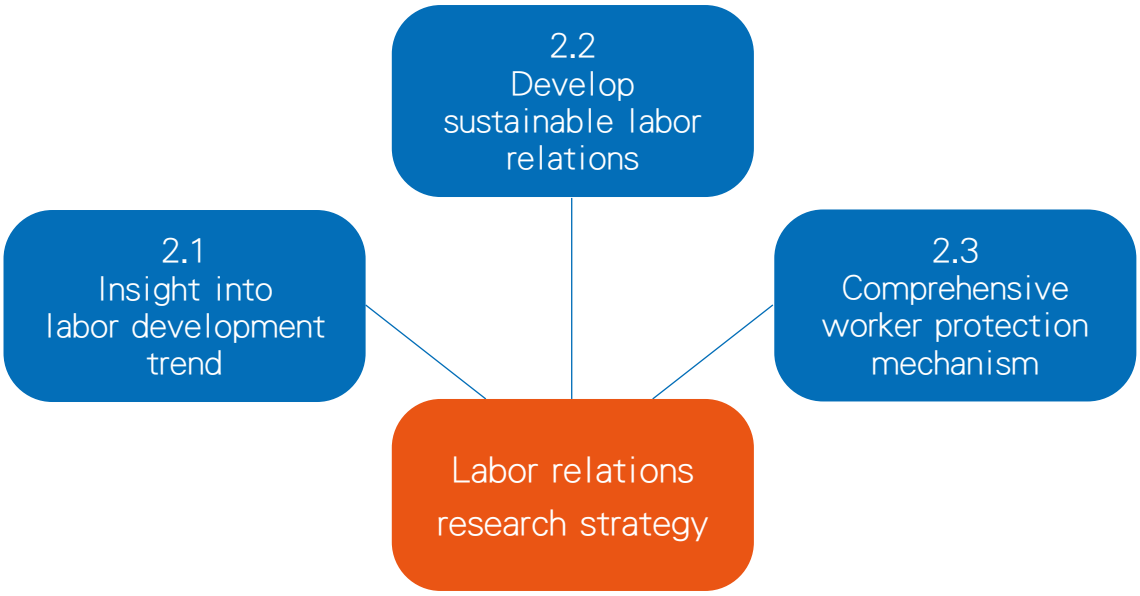


Figure 3 Labor relations research strategy

By adhering to the implementation of the Ministry's policies and key national policies, we will develop good understanding of the development trend of new types of labor-management relations, study and analyze the important factors affecting the protection of the rights and interests of labor and management, and develop good understanding of the development trend of labor issues as soon as possible. We put forward relevant policy recommendations and formulate the following 3 topics:

2.1 Insight into labor development trend

Under the trend of globalization and the rapid development of digital technology and Industry 4.0, it has led to changes in the industrial economic structure, which has had a major impact on traditional labor relations and has also catalyzed new work patterns and labor relations. This has led to emerging work methods such as gig economy and human resources, human-machine collaboration, etc., which will emerge even more in the future.

While responding to global changes and technological development, we should also have a good understanding of labor development trends, plan nationwide surveys and studies, and ensure the labor rights of new-type laborers. Flexible labor strategies should also keep pace with the times.

Table 5 Insight into labor development trend

Research areas	Explanation
2.1.1 Research on new types of labor relations	With the development of digital technology, the rise of the platform economy and human-machine collaboration have become a new trend. In addition to driving the transformation of enterprises, it also promotes the emergence of new work styles. The focus of this area is about discussing new types of labor behavior, employment relations, contractual norms, labor standards and related labor laws and other issues, and proposes response mechanisms, while taking into account the impact on collective labor relations, so as to have a good understanding of the development trend of labor relations in new types of work. In response to this, we will seek sustainable labor related policies in the digital age.
2.1.2 Research on the trend of workplace equality	Equality in employment, equal rights in the workplace, and dignified labor are universal values globally. After the Industry 4.0 era, the development of artificial intelligence technology has brought many impacts and challenges. For example, there are concerns about discrimination caused by the introduction of artificial intelligence (AI) technology when companies recruit talents. This project focuses on the continuous collection of employment discrimination issues in our country, including employment equality after COVID-19 patients recover and new foreign discrimination projects, with the goal of eliminating differential treatment, understanding the trend of workplace equality, and implementing employment equality and friendly workplaces, and working hard to expand social equality and social protection to reflect the concept of dignified labor and practice employment equality.

2.2 Sustainable development of labor relations

Stabilizing labor-management relations and seeking sustainable development together is the highest level of labor relations. In order to quickly, appropriately and effectively handle labor disputes, protect the rights and interests of labor and management, and promote harmony, relevant research needs to be continuously strengthened.

Table 6 Sustainable development of labor relations

Research areas	Explanation
2.2.1 Collective labor relations research	Industry 4.0 and the new types of industrial democracy pose challenges to traditional collective labor relations; for example, it is not easy to clarify the employers of platform workers, and it is difficult for them to exercise their collective labor rights.Therefore, in addition to continuing to discuss traditional collective labor relations and to derive labor relations under new work types in response to new economic models and technological developments, this project focuses on exploring the development and challenges of the following: proposing solution models in response to how unions work, labor disputes, large number of dismissals, and unfair labor practices and developing independent fair labor relations and social partnerships to strengthen labor standards.
2.2.2 Work life balance research	While pursuing profit in business operations, it also necessary to take into account the promotion of work-life balance and the improvement of the Quality of Work Life (QWL). Especially in the post-epidemic era, it is increasingly important to strengthen corporate competitiveness and sustainable operations, and to protect workers to maintain a healthy work and lifestyle. This project focuses on research on dividends and corporate welfare, improving work-life balance, analyzing the Employee Welfare Fund (Employee Welfare Fund) system, paying attention to the actual needs of workers from all walks of life in the workplace, and creating a happy workplace.

2.3 Comprehensive labor protection system

The impact of society, economy, culture, legal system and related non-human factors (such as the epidemic), as well as the transformation of the demographic structure, and the problems of unstable employment caused by the elasticity of the labor market, has a direct impact on worker economic security. How to improve the labor insurance system and annuity finances and ensure the economic safety of labor is truly a top priority.

For non-traditional work types of specific target workers, their labor conditions and benchmarks are difficult to be on the same level as traditional labor relations. It is necessary to comprehensively understand their current conditions and possible disputes, and propose resolution strategies to protect labor rights.

Table 7 Comprehensive labor protection mechanism

Research areas	Explanation
2.3.1 Research on the maintenance of labor economic safety	Faced with the problems of unstable employment and low wages brought about by the elasticity of the labor market in our country, through discussing and assessing the status of important national systems and my country's employment insurance, labor insurance system reform and labor pension related systems are done. Also, research and analysis of strengthening the labor annuity system to protect labor the elderly care and life, and then developing a good understanding of the labor economic safety protection model, financial processing and payment calculation methods, etc., are used to more appropriately protect labor economic safety.
2.3.2 Targeted labor protection research	Following the United Nations "2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs)" to formulate the "Leave No One Behind" (LNOB) policy, and referring to the sustainable development of Taiwan goal, protection of disadvantaged groups is continued. This is also the strengthening of protection of labor rights and strengthening the dignity for all types of workers, such as occupational disaster workers, mentally and physically handicapped workers, middle-aged and other atypical workers, and other labor rights protection and dignified labor. Through relevant investigation and research, the nature of various industries is will be understood well in order to provide the workers' due protection and the demands of special workers.

3. Occupational Safety Research Strategy

Figure 4 Occupational safety research strategy

Considering the experience and strategies of various countries in the world in improving occupational safety, and considering the current policy priorities and mid-range governance plans of the Ministry, in response to the latest trends in occupational disasters in my country, improving safety and disaster prevention technology is specially formulated, and the popularization of safety knowledge and the promotion of safety culture are promoted. The following three topics are described as follows:

3.1 Innovative analysis methods for disaster prevention

Driven by Industry 4.0 and emerging industries, the economic structure of the entire industry is undergoing rapid changes. Under the alternate impact of industrial new and old work hazards, it has a major impact on workplace safety, and workplace disaster prevention relies on good real-time understanding of the latest occupational disaster trends.

In response to the advent of the digital age, use of information technology to build an occupational disaster database, use of big data analysis, data mining and other technologies to instantly understand the latest industry trends are done. Use of innovative methods to share safety knowledge will be an important means of precision disaster prevention.

Table 8 Innovative analysis methods for disaster prevention

Research areas	Explanation
3.1.1 Establishing a digital occupational disaster database	Statistics and analysis of occupational disasters are the focus of preventing occupational disasters. With the advancement of information technology in recent years, occupational disaster data can be digitized and database constructed to improve the quality of disaster analysis. This project focuses on collecting various related occupational disaster data, classifying and coding, and establishing a digital occupational disaster big data database.
3.1.2 Big data analysis of occupational disasters	The following is done: cooperating with relevant academic research groups to conduct occupational disaster causal analysis and data statistics research, using big data analysis, data exploration and other technologies to quantitatively analyze the latest trends of occupational disasters, and development of an online disaster prevention information platform to provide real-time occupational disaster statistics analysis, industrial safety warning and safety information.
3.1.3 Sharing of innovative safety information	The popularization of safety knowledge can enhance safety awareness and promote the effectiveness of safety management. Its real-time, interactive and innovative promotion methods are effective means to improve safe communication. This project focuses on the development of VR or AR 3D virtual reality safety teaching materials, provides the use of advocacy and education, and studies the use of online networks or social media to build interactive safety knowledge sharing or e-learning websites.

3.2 Improving risk monitoring technologies

Work with high operational safety risks often occurs in certain specific targets, such as specific industries, fields, and personnel. Countries all over the world are also actively and diversifying the identification of these high-risk operation targets. Related topics such as micro-construction industry, fishermen's offshore operations, offshore wind power, robot collaborative operations, foreign workers, aboriginals, middle-aged workers and other workplace safety issues have received widespread attention.
Identifying these high-risk targets in a diversified manners, focusing on these industries, fields, and personnel and improving safety assessment and smart monitoring technologies are the goals for improving safety and disaster prevention technology research.

Table 9 Improving risk monitoring technologies

Research areas	Explanation
3.2.1 Diversified identification of high-risk targets	High-risk targets in the workplace have different safety risks due to different industrial characteristics and labor attributes. It is necessary to diversify the identification of high-risk targets in the workplace, and target the work safety of specific industries such as micro or small and medium-sized enterprises, fisheries, emerging industries, construction industries, and manufacturing industries. There should be studies done for work characteristics and hazards for prevention for special personnel such as indigenous people, foreign workers, women, young people, middle-aged and senior citizens, etc.
3.2.2 High-hazard work safety assessment and risk management	Work safety, research risk assessment and risk management methods are conducted for specific or cross-domain operations or equipment, such as offshore wind power, electrostatic explosion prevention, robot collaboration, underwater operations, manufacturing processes, fire and explosion, green energy equipment, sewers, etc. These efforts are conducted to improve the information technology of safety assessment and risk management for high-hazard operations in our country.
3.2.3 Improving smart security monitoring and management technology	n order to improve our country' workplace safety intelligent monitoring and safety intervention technologies, this program focuses on the use of the latest technological tools such as the Internet of Things, artificial intelligence, and electronic fences to develop intelligent safety monitoring technologies. Also, in response to international trends, active and passive indicators of safety management and the effectiveness of safety interventions are conducted, and also planning for subsequent promotion and application.

3.3 Shaping occupational safety culture

To carry out workplace safety and disaster prevention work, in addition to having good technology, it also relies on high-quality tools to assist in the formulation of safety decisions. The development of such tools, such as online hazard assessment, emergency response decision support, safety cost analysis and optimization, will provide the best assistance to safety and disaster prevention for workers.
Finally, through education, training, counseling, and advocacy, the overall safety culture can be shaped. Consequently, the safety of various industries, fields and operators can be improved and the occurrence of occupational accidents can be reduced.

Table 10 Shaping occupational safety culture

Research areas	Explanation
3.3.1 Developing online interactive tools to increase safety awareness	To improve the effectiveness of workplace disaster prevention, research and development will be conducted, on topics such as the development of online real-time and interactive hazard prevention tools, which can be used by the industry through the Internet. At the same time, in order to enhance the safety awareness of workers, online work safety information in multiple languages will be developed to enhance the safety awareness of workers of all ethnic groups.
3.3.2 Research on safety decision support tools	Cross-field occupational disaster cost surveys and emergency response countermeasures research will be conducted. This is done to classify the direct and indirect costs of occupational accidents to understand their impact on society, enterprises and labor, and to discuss the impact assessment of major industrial accidents and related costs. Also, research on optimal analysis tools for safety investment decisions and emergency response measures, etc. will be conducted.
3.3.3 Shaping hazard prevention culture	It is important to shape the culture of hazard prevention and to enhance the workplace safety awareness of various industries or supply chain groups. This project focuses on the methods for evaluating, improving or shaping workplace safety culture. It also organizes safety education, training, counseling, and advocacy activities in alliance with related safety groups, and will gradually transform work safety to become general knowledge for the entire population through education, and then becoming a habit for all and enhancing safety culture.

4. Occupational health research strategy

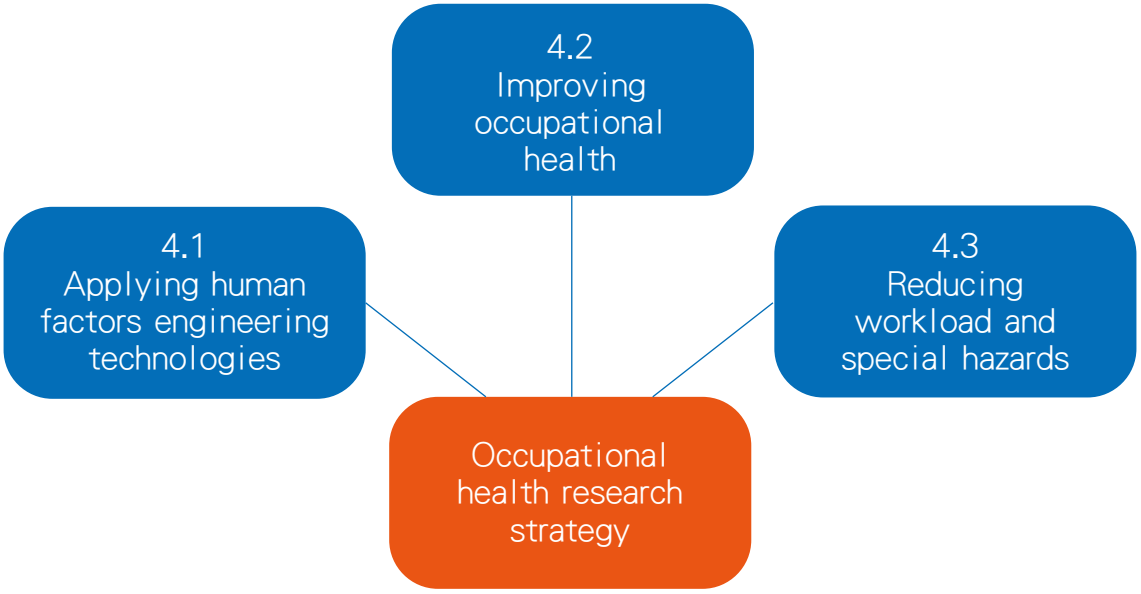


Figure 5 Occupational health research strategy

In response to the occupational health and technology application trends that have a wide impact on labor, three issues have been formulated for occupational health. These will apply science and technology to the existing theories and norms, having a good understanding of the harmful factors extended under the development trend of society and technology, and discussion of issues such as identification, evaluation and control. In addition, recommendations for improvement and sustainable technological development will be provided. These are explained below:

4.1 Applying human factors engineering technologies

Taiwan is in line with the trends of advanced countries. The most important occupational health problem is occupational musculoskeletal injuries. The strategy will apply human factors engineering technology to improve workplace posture, repetition and load and other factors that cause occupational musculoskeletal injuries. Human factors engineering technology will also be applied to improve occupational safety and health management and occupational disaster prevention technologies such as slips and falls. We will continue to invest in research and introduce smart technologies to develop new assessment techniques, which will be applied to the assessment and improvement of exposure factors to occupational musculoskeletal injuries, human-machine interface design, and management systems. Through extensive exposure inspection and analysis, more convenient assessment and improvement tools will be provided, and improvement and management strategies can be studied more pragmatically to reduce the impact to workers

Table 11 Applying human factors engineering technologies

Research areas	Explanation
4.1.1 Application of human body size measurement	An anthropometric database of Taiwanese workers will be established. Through standard measurement methods and application of anthropometric data, recommendations for the planning of related facilities in the workplace are proposed. Smart technology will be used to develop convenient designs, improve work posture, job design, and force and human-machine interface issues, in order to prevent accidents and to build a comfortable workplace.
4.1.2 Preventing musculoskeletal injuries	Measurement methods and standards for musculoskeletal injuries will be established in order to improve human factors engineering assessment techniques and to assist in evaluating human factors engineering exposure issues such as posture, force, repeatability, and environmental configuration. Prevention and control techniques and management measures for musculoskeletal injuries will be developed with application of science and technology to develop improvement strategies. Technical guidelines and training resources will be established to provide references for the prevention of musculoskeletal injuries.
4.1.3 Improving the safetyand performance of the human-machine interface	In response to the rapid development of human-machine collaboration, there will be assistance provided in analyzing possible human-machine interface risks such as equipment, personnel, and management, and to preventive techniques such as slips and falls. Recommendations for improvement will be proposed, and improvement for providing design, operation and management will be recommended to avoid possible harm caused by incoordination.

4.2 Improving occupational health management

Implementation of improvement is the fundamental issue of occupational health. In the past, occupational health research has been conducted for a series of studies on industrial ventilation and sanitary protective equipment. It is also initially used in the workplace and will continue to be refined in the future and review with updates of relevant technical information. However, all countries still attach importance to traditional respiratory hazards and on how to prevent the worsening of respiratory diseases caused by occupational hazards, such as cancer, allergies or obstructive pneumonia, etc. In Taiwan, due to $PM_{2.5}$ and infection factors, all parties still pay attention to the control and management of respiratory hazards. Therefore, there will be continued attention of the occupational health management technology of respiratory hazards. The study will apply technologies to help improve occupational health management techniques, to provide more feasible and simple strategies or techniques, and to assist implementation in the operating environment through supporting measures and management systems.

Table 12 Improving occupational health management

Research areas	Explanation
4.2.1 Implementing ventilation control	The following will be conducted: consolidating the ventilation research data of our institute, applying it to the workplace, providing technical support, refining related technologies; working with technological development, applying the development of lower ventilation measurement methods, implementing ventilation facility management, developing new ventilation technologies, studying exposure response of high-risk groups' countermeasures, and evaluating conversion applications.
4.2.2 Improving the performance of the protective gear	The following will be conducted: discussing how technology can improve the performance of protective gear and management response technology, clarifying the use and management of extended protective gear such as epidemics, applying technology to improve the comfort of protective gear, and discussing the selection of protective gear and the development of management technology to ensure the correct selection of protective gear.
4.2.3 Paying attention to emerging and potential hazards	The following will be conducted: collecting special hazards of social or international concern, such as long-term photos, welding, naphthalene, ceramic fibers, artificial stones, and agricultural hazards, finding farmers' local occupational diseases, raising farmers' awareness of occupational disaster prevention, applying existing technologies to initially assess exposure, providing recommendations for improvement strategies to avoid possible risks and their spreading, having a good understanding of Taiwan's specific occupational health issues, and conducting exchange and comparison with other countries.

4.3 Reducing workload and special hazards

New technologies or social developments often extend to many impact factors of health regarding workload, which directly and indirectly reflect the feelings of workers. The feelings are a complex health impact factor and are gradually being viewed with importance. The research will apply emerging technologies to develop convenient and feasible evaluation strategies and make appropriate adjustments according to the operating environment in order for it to assist in understanding the initial overview of the operating environment. Then the traditional assessment methods are adjusted to gradually understand the operations or industries that may be affected, and then the concept of occupational health will be applied. Finally, recommendations will be provided for improving management and reducing possible risks.

Table 13 Reducing workload and special hazards

Research areas	Explanation
4.3.1 Applying smart monitoring to prevent work overload	The following will be conducted: collecting overwork prevention countermeasures in various countries, exploring relevant laws and regulations and work regulations in our country, developing labor fatigue monitoring technologies and technical standards, evaluating specific workload situations such as platform/micro self-employment/rmote/elderly workers, establishing labor fatigue stand for high-risk industries, establishing labor physiology monitoring platform and norm database, developing appropriate measures, and providing reference for self-management of high-workload labor.
4.3.2 Managing noise and vibration exposure	The following will be conducted: understanding the noise and vibration hazard characteristics and influencing factors of a specific operating environment and developing improvement strategies, having a good understanding of emerging technologies that can detect noise and vibration, transforming and integrating applications into convenient and feasible work environment assessment tools, establishing standard methods for workplace noise and vibration measurement, assessing actual exposure, providing management applications, developing evaluation strategies for wearing effectiveness of hearing protection and developing noise and vibration control materials and technologies.
4.3.3 Responding to high and low temperatures and non-ionizing radiation	The following will be conducted: analyzing high and low temperature and non-ionizing radiation hazard cases and specifications, developing a good understanding of measurement methods and exposure status, discussing the impact on labor and hazard control and protection techniques, evaluating high and low temperature and non-ionizing radiation blocking technologies, and introducing management and training measures such as partner systems and independent health management to prevent high and low temperature and non-ionizing radiation hazards.

5. Occupational hazard assessment research strategy

Figure 6 Occupational hazard assessment research strategy

This strategy refers to the National Institute for Occupational Safety and Health (NIOSH) and other advanced countries in the world for occupational hazard assessment (including exposure assessment of chemical harmful factors in the workplace, epidemiology, occupational disease monitoring technology and health promotion, etc.) experiences and strategies. This is conducted to respond to new trends in the future and improve occupational hazard assessment research, and 4 topics have been specially formulated, which are described as follows:

5.1 Discussing workplace hazard standards

In order to protect workers from excessive exposure to various hazards in the work environment, research is conducted by collecting and reviewing literature, providing academic evidence, and establishing recommended exposure limits (Recommended Exposure Limit, REL) for chemical and physical hazards in the workplace in our working. These will serve as the theoretical basis and reference for the MOL to revise our country's "Permissible Exposure Limit" (PEL). The research strategy will refer to the hazard standards of emerging hazardous substances (such as halogen hydrocarbons, CMR substances, or nano substances, etc.) that are of concern to major countries or occupational health organizations (such as ACGIH TLVs, NIOSH RELs) as subjects of discussion. The following is a breakdown of dust, organic compounds, specific chemical substances and emerging hazardous substances.

Table 14 Discussing workplace hazard standards

Research areas	Explanation
5.1.1 Crystalline free silica (respirable dust)	The deposition of crystalline free silica in the lungs can cause lung tissue fibrosis. In response to the fact that advanced countries in the world have lowered the allowable exposure standards for crystalline free silica, our country plans to explore the differences between the allowable exposure standards for crystalline free silica and other countries and proposes recommended values.
5.1.2 Halogen-containing hydrocarbons (organic compounds)	Halogen-containing hydrocarbons (such as chloroform, carbon tetrachloride, 1,2-dichloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethylene, trichloroethylene, etc.) can cause nervous system, liver and kidney diseases and other health effects. The permissible exposure standards for halogen-containing hydrocarbons in our country have not been reviewed and revised for many years. The plan is to explore the revision of permissible exposure standards and propose recommended values.
5.1.3 Emerging hazard targets (CMR substances)	The nano industry, high-tech and green energy industries use all kinds of emerging raw materials or metal hazards (such as carbon nanotubes, rare metals, rare earth elements: Gallium, Germanium, Indium, etc.), that may contain substances that cause cancer, cell mutation, and reproductive hazards (Substances of Carcinogenic, Mutagenic or Toxic for Reproduction) for the human body. Therefore, the plan explores whether the domestic allowable exposure standards for relevant metals and elements are sufficient to protect workers due to differences in work patterns and changes in labor exposure.
5.1.4 Specific chemicals	Specific chemical substances (such as inorganic acids: sulfuric acid, hydrochloric acid, nitric acid, etc.) are highly hazardous and used in large quantities in our country. The plan is to review the allowable exposure standards of such chemical substances in the country and make recommendations.

5.2 Developing hazard assessment technology

In order to prevent occupational diseases and allow workers to work in a safe workplace environment, occupational hazard assessment is an important task; the important basis for the assessment is scientific data. In order to collect reliable hazard exposure data, effective assessment techniques must be developed. The plan is to establish work environment monitoring technology and labor biological detection technology to measure the degree of exposure to hazards during labor operations, and to ensure that labor operations meet legal standards to achieve the purpose of protecting workers. In addition to the traditional laboratory instrumental analysis technology, the assessment technology also incorporates methods and strategies for rapid acquisition of labor exposure hazard data such as direct reading of the instrument.

Table 15 Developing hazard assessment technology

Research areas	Explanation
5.2.1 Reviewing the current sampling and analysis techniques	Given the wide variety of chemical hazards, there are currently more than 200 technical documents on sampling and analysis methods in our country. However, some of the technologies and materials used in the content or the regulations and standards cited are out of date and should be reviewed and revised.
5.2.2 Introducing advanced international evaluation technology	With the evolution of the concept of environmental protection in science and technology, sampling and analysis techniques are also moving towards shortening the detection time or using sampling and analysis methods with environmental protection concepts to replace the traditional long-term sampling or solvent desorption methods in the past. In the future, the plan is to introduce mature foreign environmental monitoring tools (such as passive sampling or direct-reading monitoring) to improve the technical level of domestic occupational hazard assessment.
5.2.3 Developing localized mixed storage assessment technology	At present, sampling and analysis techniques for working environment are mostly based on a single type to establish sampling and laboratory quality assurance/quality control specifications. However, there are more than a single type of solvent used in workplaces. In this environment where multiple types of harmful substances exist, it is recommended to establish sampling and analysis quality assurance technical specifications for reference by environmental monitoring agencies to improve the quality of current sampling and analysis data.

5.3 Having a good understanding of occupational disease trends

Occupational diseases have a long incubation period and are often caused by multiple factors, which are not easily attributed to work factors. Moreover, the causality is not easy to identify, and the degree of personal interference is not easy to separate. The plan is to effectively use the relevant large-scale national "massive data" database and combine it with epidemiological research methods in order to have a good understanding of the trend of occupational diseases.

Table 16 Having a good understanding of occupational disease trends

Research areas	Explanation
5.3.1 Constructing a list of industries and potentially high-risk occupation-related diseases (including ICD codes)	Possible high-risk occupational-related diseases by industry can be established. Although the Occupational Disease Reference Guide provides the International Classification of Diseases (ICD) (ICD9 or ICD10) for 169 types of occupational diseases, only some diseases in the Occupational Disease Reference Guide provide the types of occupations in which the occupational diseases are likely to occur. Therefore, it is necessary to gradually conduct large-scale cross-sectional sampling of occupational diseases through questionnaire surveys to obtain occupational records.
5.3.2 Establishing a local occupational cancer estimation model	The "International Labor Organization" (ILO), the European Union, the United Kingdom and other advanced countries have established "occupational cancer estimation model" as the basis for promoting occupational disease prevention strategies. It is necessary to verify the local occupational cancer risk based through quantification.
5.3.3 Establishing the trend and harm of occupational diseases for long-term night workers	Compared with 2019, the number of people working at night has increased in 2020. It is necessary to explore the correlation between short-term and acute illnesses of long-term night workers and work occupations, conduct occupational disease trend and hazard analysis, and propose amendments to specific health check items for workers.
5.3.4 Integrating huge amounts of government data and connect with large-scale cross-sectional surveys that the government has built	Multiple government data or large-scale cross-sectional questionnaire surveys are linked up to construct and discover potential high-risk occupational related diseases to make up for the lack of occupation, work experience, past medical history, life history, inspection items and other fields in the labor insurance database. This will also lead to breakthroughs the current research that only focuses on occupations, supplements the occupation and life history that are not available in the labor insurance database, and further understands the relationship between disease and occupation.

5.4 Occupational disease surveillance technology

Harmful substances in the labor working environment are the main cause of labor occupational diseases. In this regard, monitoring and interventional assessment of occupational hazards of emerging occupational diseases will be conducted, and the investigation of the reference standards for the identification of occupational diseases caused by chemical hazards will continue to be completed in order to increase the rate of occupational disease detection. In addition, the following will also be conducted: continuing to propose preventive measures related to labor occupational diseases, investigating the current status of labor health protection regulations, conducting workplace health management and evaluation, and proposing improvements and amendments to laws and regulations.

Table 17 Occupational disease surveillance technology

Research areas	Explanation
5.4.1 National cognitive survey on safety and health of labor environment	Investigations on workers' perceptions and effects of hazards in the work environment are conducted. This is done in order to understand the work safety and health status of workers to conduct surveys and statistical work on the perception and impact of work environment hazards, health inspections, safety and health education such as safety and health management, physical and mental health, and health behaviors, etc. This is to serve as a reference for occupational safety and health policies and research.
5.4.2 Establishing occupational cerebrocardiovascular disease surveillance	Work environment measurement and cerebral cardiovascular physiological index monitoring are used to explore the dose effect of the worker's cardiovascular system caused by exposure to nanoparticle and chemical hazards. It also establishes monitoring technology for occupational diseases of high-risk groups, continues to complete the reference standards for the identification of occupational diseases caused by chemical hazards, and proposes relevant preventive measures for labor occupational diseases.
5.4.3 Workers' silicosis surveillance	Both the number of occupational disease benefits for labor silicosis and the number of suspected occupational disease notification system cases in our country are increasing year by year. It is necessary to screen domestic labor cases and high-risk institutions suffering from silicosis, and have a good understanding occupational crystalline free silicon dioxide exposure worker to establish free silicon dioxide exposure monitoring database.
5.4.4 Workplace health management and evaluation research	In order to identify and monitor high-risk groups in the workplace and further develop workplace health management measures, labor workplace hazard factors and health risk assessments are conducted. This is done to have a good understanding of the health hazards of high-risk groups, and proposing of health promotion plans for the work ability of specific groups to improve the suitability of specific groups in the workplace. In addition, the workplace health management research will be integrated to improve the implementation of laws and regulations to promote workplace health management.

6. Exhibition and international exchange strategies

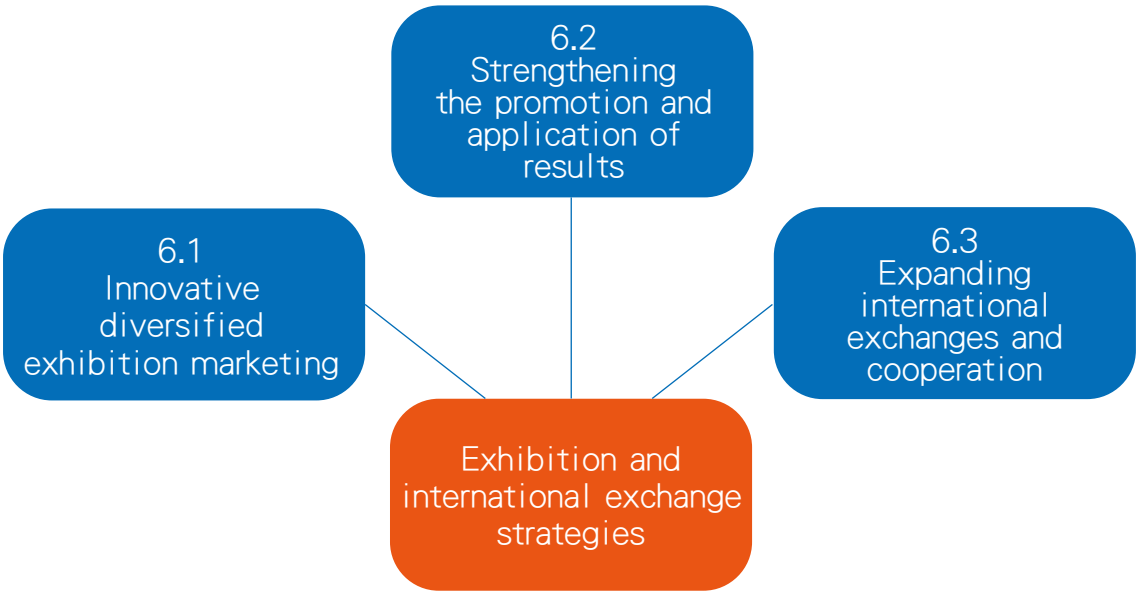


Figure 7 Exhibition and international exchange strategies

In response to the advent of the post-epidemic era, in order to increase the level of promotion services and international cooperation and the application of new technologies and diversified marketing methods, the following 3 aspects are planned: seminars and signing international cooperation agreements, etc.; exhibitions and promotion; and international exchanges. It is expected that the research results of our institute can be effectively promoted and used to strengthen the dissemination of labor and occupational safety and health knowledge, and to promote industrial participation and international cooperative research and exchanges.

6.1 Innovative diversified exhibition marketing

Occupational safety and health exhibition and promotion education with multiple active marketing methods are promoted, targeting workers, workers of specific ethnic groups, and the general public, etc. This is done to promote and market the research and development results of our institute as the main body, effectively promoting the public's awareness of workplace safety and health. Also, there will be a deepening of the promotion of basic safety and health education for future workers such as students and vocational training students.

It is expected that 2022-2025, there will be development and enrichment of the theme exhibition content. This will be done through various display items such as human engineering, high temperature, ventilation, noise, template support falling hazards, mechanical operation trapping, rolling hazards, dust fire explosion hazards, etc. The display items are vivid, lively, and VR, 3D stereoscopic digital technology multiple display methods in order to strengthen people's awareness of labor and occupational safety and health and to implement the goal of national work safety. This will be combined with themes such as "ethnicity, culture and work" and "safe and healthy workplace" in the post-epidemic era, with planning and production of real-world displays, and responding to the development of the pulse of society at any time.

Table 18 Innovative diversified exhibition marketing

Research areas	Explanation
6.1.1 Expanding the popular science exhibition tour	Occupational disaster prevention exhibitions will be conducted through working with museums and county and city governments. In addition to workers, high school and vocational school students, it will be expanded to primary and secondary schools and the general public to make them aware of how to ensure their own safety at work, and to further enable the all to understand the safety and health problems and preventive measures in the workplace. There will be continued communications with the Fisheries Agency, the Council of Agriculture, the Council of Indigenous People, and other ministries to cooperate with the county and city governments and labor groups, encourage high-risk industry workers, specific ethnic groups, etc. to visit the Occupational Safety Exhibition Center and implement safety and health education and training.
6.1.2 Strengthening the thematic fixed location exhibition	The research results of our institute will be transformed into exhibits and handling the display of specific ethnic groups such as fishermen, aboriginals, and migrant workers. In addition, cross-industry cooperation with county and city governments or non-governmental organizations will be jointly conducted for thematic exhibitions for nurses, postal staff, cleaning team members or religious and cultural activities. This is done in conjunction with related special festivals, such as the aboriginal harvest festival, the International Nurses Day, and the Thank you Clean Day, etc., to conduct relevant occupational safety and health exhibitions.

6.2 Strengthening the promotion and application of results

The research program of our institute is divided into two major strategies: "Priority Research Fields for Policy Support" and "Common Research Aspects of Forward-looking Trends". Priority research topics are formed from recommended topics by the ministry and its affiliates or collecting domestic and foreign development trends. The research results of each year are provided for reference by relevant business units in charge and their follow-up participation situation is compiled as a reference direction for the subsequent planning and implementation of the institute.

The research and development results produced by our institute every year, in addition to being used for labor and occupational safety and health regulations and policy formulation or revision reference, will also have transfer of technology to various institutions through various methods such as press conference newsletters or quarterly publications; this will reduce the cost of enterprise application technology achievements. Under this premise, the first priority is to strengthen the protection and management of intellectual property rights, lay the foundation for research and development capabilities, and focus on developing multiple promotion channels. Research technologies will be transformed into popularized and generalized data with actual applications to target industries to improve domestic labor and occupational safety and health standards.

Table 19 Strengthening the promotion and application of results

Research areas	Explanation
6.2.1 Implementing administrative support applications	Horizontal communication and coordination will be strengthened with all units of the ministry and priority research topics will be conducted. The 6 aspects will be done: use of the research results of our institute to discuss the 6 aspects of policy research, regulation amendments, and references of education and training, publicity, guidelines and other administrative service references. Through administrative procedures, results presentations and seminars, relevant administrative units are provided with applications for reference.
6.2.2 Enhancing the promotion of diversified technologies	The research and development results produced by our institute every year are used to strengthen the protection and management of intellectual property as the basic data for technology application/technology transfer. Diversified promotion and marketing channels are developed through academic seminars, technology marketing demonstrations, patent competitions, etc., to effectively reach the demand side of technology transfer research results. Technical consulting and coaching team will be established to integrate mature technologies and direct on-site visits to provide consulting and coaching according to industry types, system procedures, and business unit needs, and to customize R&D technologies to be used.

6.3 Expanding international exchanges and cooperation

Faced with internationalization and globalization, international marketing and integration must be done urgently. Based on our solid research and development results, we actively participate in the activities of non-official organizations and academic institutions. Through international exhibitions, academic conferences, opening up the field of international dialogue, and strengthening bilateral ties with relevant institutions in specific regions or countries, cooperation and exchange relationships can be effectively deepened. Examples include: becoming a member of the Labor and Employment Relations Association (LERA), and cooperating with the European Foundation for the Improvement of Living and Working Conditions (Eurofound) and the Research Institute for Work and Society of KU Leuven (HIVA) through signing bilateral cooperation agreements, etc. With research partners that have unique advantages and high-quality R&D strategies, we enhance the international visibility of our country's workers and occupational safety and health research results.

Table 20 Expanding international exchanges and cooperation

Research areas	Explanation
6.3.1 Strengthening international promotion and participation	There will be active participation in academic activities of Asian Occupational Safety and Health Research Institutes Meeting (AOSHRI), Labor and Employment Relations Association (LERA), International Occupational Hygiene Association (IOHA), and International Commission on Occupational Health (ICOH). There will be publication of academic papers, expansion of international dialogue network, and marketing of our country's labor and occupational safety and health research results through international large-scale technical exhibitions and activities. Also, there will be research consulting and technical services provided to enhance international visibility.
6.3.2 Strengthening bilateral research cooperation	There will be continued cooperation through exchange of personnel visits and exchanges, joint academic seminars, and access to online database references and translation authorization for our country, etc. with the European Foundation for the Improvement of Living and Working Conditions (Eurofound), the National Institute for Occupational Safety and Health (NIOSH), and the Research Institute for Work and Society of KU Leuven in Belgium, HIVA), and other institutions. We will actively provide research results and discoveries in our country, conduct survey information and scientific research and development results sharing, and establish a continuous, close and mutually beneficial cooperative research mechanism to share experiences in labor policy planning and occupational disaster risk reduction.

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