

# **Importance of Education and Qualification Systems to Embrace a Holistic Approach of Human, Technology, Management and Rule Formation for Advancing Safety, Health, and Well-being at Work**

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## **1 FOREWARD**

The concept of safety has evolved to meet the social conditions and needs of each era, resulting in a variety of management approaches and technologies. In terms of management, one of the most notable trends is "Vision Zero", an approach that aims to realize "safety, health, and wellbeing". On the technological side, the concept of "collaborative safety" is one of the most notable trends in recent years, as it emphasizes the realization of wellbeing one step beyond simply achieving safety for workers. What is important here is a new concept of "safety in the broadest sense", which not only aims at "safety" but also at achieving the trinity of "safety, health, and wellbeing". In this context, one of the essential elements in approaches based on these concepts is human resources, namely the education, training, and qualification of personnel. This applies not only to designers and engineers of machinery and systems but also to those who manage the working environment and people, especially those in leadership roles. In Japan, following the establishment of the Safety Assessor (SA) qualification system in 2004 to develop human resources with knowledge and competence in the field of machinery safety, we have created new qualification systems in line with the changing times, such as the Robot Safety Assessor (RSA) in 2018 for the robotics field, and the Safety Officer (SO) qualification system in fiscal 2019 aimed at qualifying the safety management capabilities of organizational managers. These qualifications have been adopted company-wide by global enterprises, realizing the participation of not only engineers but also top management in achieving "safety, health, and well-being" for workers.

This paper focuses on the progress and future prospects of personnel qualifications in relation to the new era's concept of "safety, health, and well-being". It introduces Japan's efforts and current status in this area with case studies and reports on future prospects.

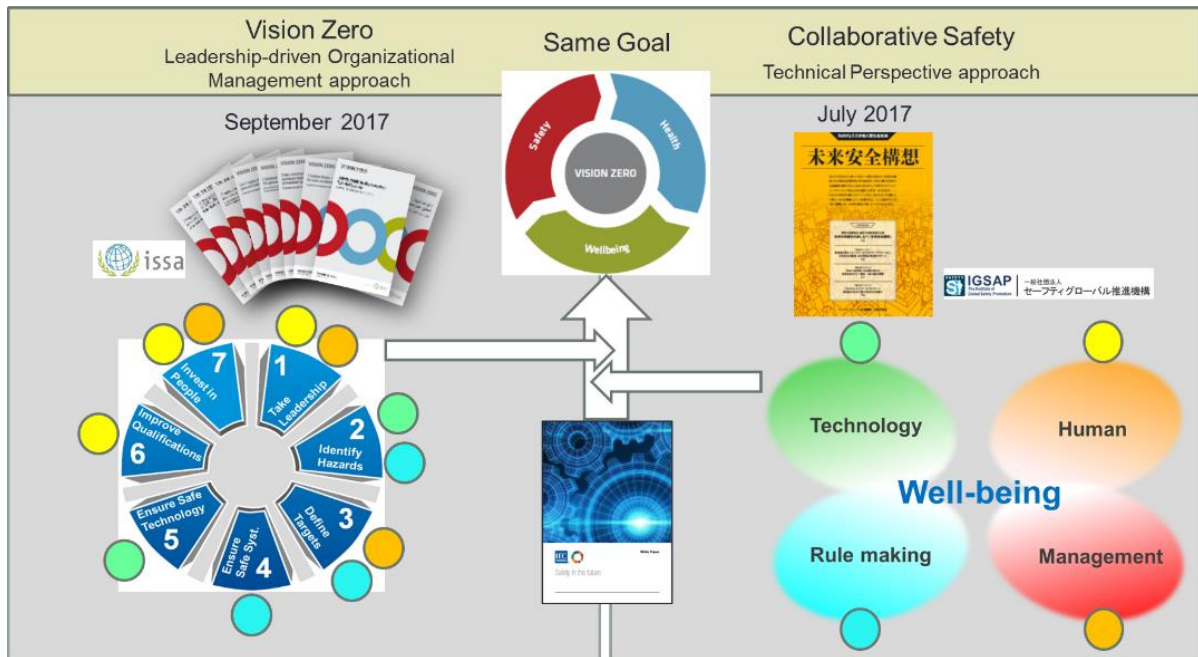
## **2 A MAJOR GLOBAL TREND, “VISION ZERO”**

In terms of safety management and corporate governance, the "Vision Zero" concept, proposed by organizations such as DGUV at the 20th World Congress on Safety and Health at Work held in 2014, has evolved into the idea that organizational leaders should actively promote workers' "safety, health, and well-being". As a concrete example, at the A+A Congress & Exhibition held in Dusseldorf in October 2023, presentations by DGUV and KAN conveyed an atmosphere of promoting Vision Zero across Germany. Additionally, presentations by organizations such as ISSA, FIOH, and ORP also centered around the theme of Vision Zero.

Furthermore, at the 23rd World Congress on Safety and Health at Work held in Sydney in November 2023, promoting "safety, health, and well-being" through Vision Zero was the most important theme and can be considered the most notable trend. At this Sydney conference, ISSA newly recognized organizations and companies that have made outstanding contributions to promoting Vision Zero. The fact that DGUV was awarded the first Vision Zero Award by ISSA for their achievements is clear evidence of Germany's accomplishments.

## **3 A NEW APPROACH TO SAFETY, “COLLABORATIVE SAFETY”**

In terms of safety technology, safety measures have evolved in line with technological advancements. Machinery safety and functional safety, which ensure safety through properly designed equipment and devices, have been



**Figure 1.** Vision Zero and Collaborative Safety share the Same Goal: Safety, Health, Well-being  
Leadership-driven Organizational Management approach vs. Technical Perspective approach

highly effective and widely practiced in manufacturing industries, forming the core of current machine system safety assurance.

In recent years, as evident from the widespread use of collaborative robots and autonomous mobile robots (AMRs), environments where humans and machines coexist without physical guards have become common not only in manufacturing but also in construction, civil engineering, and various service industries. In such situations without guards or physical boundaries between humans and machines, it is crucial to eliminate concerns about human safety and fear, and to achieve "safety, health, and well-being".

The new concept of "Collaborative Safety", which connects and optimizes humans, machines, and the environment through information and communication technology (ICT), is effective in realizing this. Proposed in 2015 and presented by Professor Masao Mukaidono at SIAS 2018, this concept has subsequently led to visible improvements in worker well-being in Japan through the introduction of "Collaborative Safety" in various fields and the development of various technologies. Additionally, international standardization activities for "Collaborative Safety" were initiated in IEC ACOS (Advisory Committee on Safety) in 2017, and in 2020, IEC published the white paper "Safety in the Future". Currently, discussions on publishing a guide are underway in the Collaborative Safety task force of IEC ACOS, and standardization discussions are also being considered in IEC/SyC SM/ahG 7 (Systems Committee Smart Manufacturing/ad hoc Group for Collaborative Safety for Smart Manufacturing).

#### 4 SAFETY, HEALTH, AND WELLBEING

As shown in **Figure 1**, both the "Vision Zero" and "Collaborative Safety" approaches aim to achieve the same goal of "safety, health, and well-being."

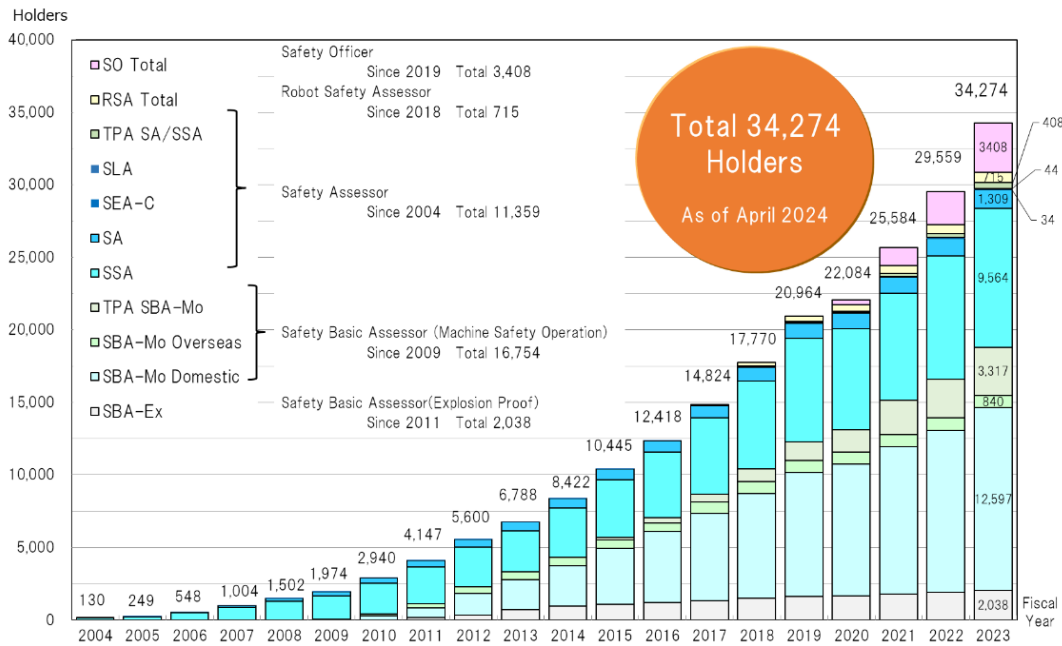
And for the realization of this goal, "human resources" is an important element in both approaches. The importance of human resources is emphasized in "Vision Zero" with the 6th of the 7 golden rules: "Improve Qualification – Develop Competence!". In "Collaborative Safety", human resources are positioned as one of the four aspects of a holistic approach, along with technology, management, and rule formation. Particularly in the increasingly prevalent environments where humans and machines coexist, a qualification system that demonstrates the competence of personnel is essential for assigning appropriate personnel to various environments.

In other words, human resource development is indispensable for achieving "safety, health, and well-being", and in the flexible environment of recent times, qualification systems play an important role.

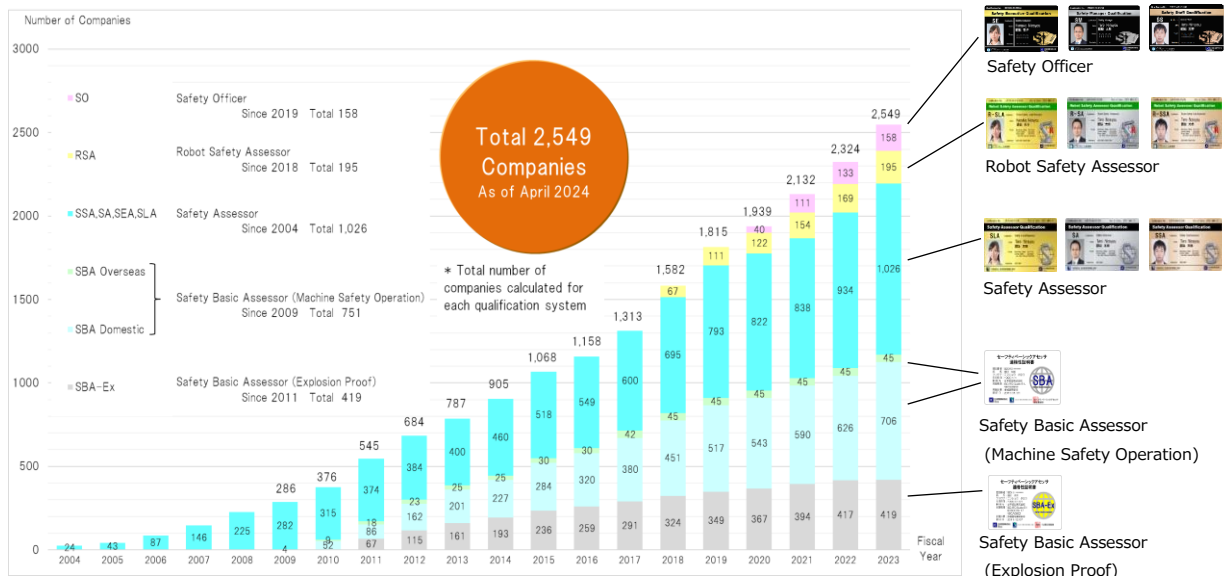
#### 5 PERSONNEL QUALIFICATIONS

Personnel qualifications are not only useful for human resource development but also crucial in fairly assessing the achievement and competence of human resource development. In Japan, in cooperation with the Ministry of Economy, Trade and Industry (METI), and led by the Nippon Electric Control Equipment Industries Association

(NECA), we started with the Safety Assessor (SA) system in 2004 to demonstrate competence in machinery safety. This was followed by the development and social implementation of the Safety Basic Assessor; (SBA-Mo) for basic technical competence of machine operation and (SBA-Ex) for basic technical competence of explosion proof, the Robot Safety Assessor (RSA) to assess robotics safety competence, and in 2020, the Safety Officer (SO) qualification system aimed at qualifying the safety management capabilities of organizational managers. These qualifications have been accepted by many global companies, and the number of qualified personnel has steadily increased, exceeding a cumulative total of approximately 35,000 (See **Figure 2**) as of 2023, with over 2,500 companies (See **Figure 3**) having adopted these qualifications. Moreover, this is not limited to Japan, with 4,500 qualified individuals and over 100 companies adopting these qualifications in various Asian countries (Indonesia, Taiwan, South Korea, Thailand, China, the Philippines, and India).



**Figure 2. Trend of Total Number of Qualified Personnel**



**Figure 3. Trend of Total Number of Companies adopting Personnel Qualifications**

The following are case studies of companies that have successfully used the SA, SBA, and RSA qualification systems for technical personnel and the SO qualification system for management personnel.

## 5.1 Utilization of Safety Personnel Qualifications of Technical Aspects

As qualifications to assess technical competence, the SA and SBA qualification systems were developed for machinery safety personnel. These qualifications test knowledge and skills related to risk assessment and risk reduction measures based on international safety standards, which are essential for ensuring safety in manufacturing sites. They have been adopted not only in Japan but also at production bases across Asia, with over 30,000 qualified individuals.

Many companies, such as AGC introduced at SIAS 2015, have actively incorporated the SA qualification system into their internal human resource development from the early stages of its establishment, resulting in significant improvements in the safety and productivity of manufacturing sites. Here, we present a recent case study of NSK Ltd., a global bearing manufacturer, where the introduction of the SA qualification system (SSA, SA, SEA) has achieved remarkable results in improving safety at manufacturing sites.

Traditionally, their safety and health initiatives focused on "Japanese traditional" safety awareness activities such as KY (risk prediction) activities, finger-pointing and calling, and safety patrols. However, they were not actively engaged in machinery safety measures based on international safety standards.

While they understood the need for machinery safety measures, they lacked sufficient knowledge and understanding of risk assessment as defined by the standards. Although they were enthusiastic in their activities, their approach was predominantly reactive.

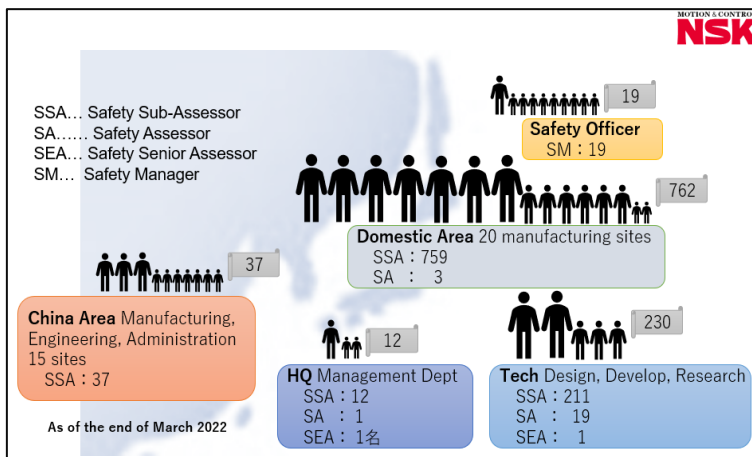
To establish a rational risk assessment and risk reduction based on international standards, they planned to utilize the SA qualification system (starting with SSA) to develop personnel with higher skills. As shown in **Figure 4**, they fostered personnel with machinery safety competence at domestic and overseas sites.

After education and training of SA qualified personnel in each area, these SA qualified personnel took the lead in practicing risk assessment, solidifying their machinery safety competence. Subsequently, they re-implemented safety measures for on-site equipment, starting with the highest-risk equipment.

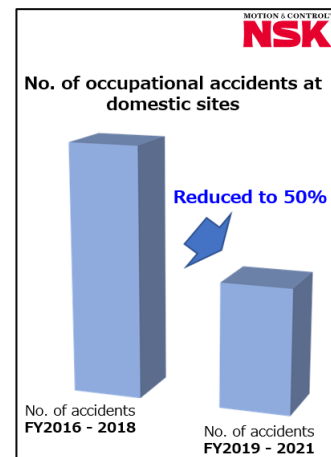
As a result of training over 1,000 SA qualified personnel (SSA, SA, SEA) by the end of FY2021, the average number of domestic occupational accidents from FY2019 to FY2021 over a three-year period was reduced by half compared to the previous three-year period (See **Figure 5**). They analyze that one of the major factors that led to this achievement was the activation of risk communication among personnel with the same knowledge and abilities.

## 5.2 Utilization of Safety Personnel Qualifications of Management Aspects

For the cultivation of a solid safety culture and prevention culture within a company, it is not enough for engineers to understand safety; the commitment of top management, which is most emphasized by Vision Zero, is essential.



**Figure 4.** Status of personnel qualifications for machinery safety at NSK Ltd.



**Figure 5.** Transition in the No. of Occupational Accidents at NSK Ltd.

(These figures are based on slides prepared by NSK Ltd.)



**Figure 6.** Safety Culture Goals- Utilizing Safety Officer qualification system to promote safety human resource development for managerial and supervisory levels in Nitto Group  
(This figure is based on slides prepared by Nitto Denko Corporation)

This section provides an overview of the Safety Officer (SO) qualification system, which qualifies the safety management skills of organizational managers, and examples of its use.

The Safety Officer qualification system consists of the following three levels:

- Safety Executive (SE): Top management qualification
- Safety Manager (SM): Manager qualification
- Safety Staff (SS): General Staff employee qualification

The knowledge required for these qualification systems is defined as "Safenology" by IGSAP Chair, Masao Mukaidono. It is classified into four categories: Basic Safenology (philosophical aspect), Management Safenology (organizational aspect: behavior), Society Safenology (organizational aspect: framework), and Structural Safenology (technical aspect). The qualification is awarded upon the achievement of the level-specific knowledge acquisition. The SO qualification, launched in 2019, has been accepted by over 150 companies, with the number of qualified personnel exceeding 3,000.

This case study presents the experience of Nitto Denko Corporation, a global manufacturer of advanced materials and electronic devices, which has implemented a management personnel qualification system to achieve its safety culture goals.

The Nitto Group shares the value of "Safety First" and is committed to daily operations from this perspective. They are addressing safety measures from three perspectives: "Safe Machinery (technology) ", "Safety Sensitivity (people) ", and "Safety Procedures (systems/organization) ".

Specifically, as shown in **Figure 6**, their goal for the company's safety culture is to transition from a reactive type to a leader-driven autonomous type, and ultimately to a (fully) autonomous type where each group employee can independently practice safe behavior. The SO qualification system has been selected and is being used as an important tool to achieve this goal.

According to their report of 2022, as of the end of September 2020, 482 managers held SO qualifications (SE: 56, SM: 426). And there were 1,100 SA/SBA qualified personnel (SA: 28, SSA: 58, SBA: 1,014), mainly in engineering and technical positions. By introducing the SA/SBA qualifications for engineers, and the SO qualification for managers, they have recognized the effectiveness in improving safety knowledge and behavioral transformation (competency), activating mutual communication between managers and engineers, and creating role models of safety behavior for managers. According to their report, top management and managers are currently in the stage of demonstrating captaincy and leading employees (Leader-Independent in **Figure 6**), and the construction of a safety culture is halfway through the process. As of May 2024, the number of qualified employees has doubled, with more than 1,200 SO qualified employees and approximately 1,900 SA and SBA qualified employees, indicating that the company is making steady progress toward achieving its safety culture goals.

## 6 CONCLUSION

In recent years, in addition to the traditionally emphasized safety and health, well-being has become a goal for society and companies, and this trend is undoubtedly increasing. This is evident from the fact that, for the first time in the history of World Expos, a global citizen-level event themed "Safety, Health, and Well-being" will be held at the Osaka Kansai Expo 2025 in July 2025. This is being promoted by The Global Initiative for Safety, Health, and Well-being at EXPO2025 and beyond (GISHW), in which around 30 organizations worldwide (ILO, WHO, ISSA, DGUV, IOSH, FIOH, etc.) are participating and driving the initiative. The concept has shifted from the traditional view of safety and health, which aims to eliminate negative aspects as much as possible, to additionally embracing positive aspects that can make society and people happier as much as possible.

In the future, the goal of "safety, health, and well-being" that we aim for will be universal and fundamentally unchanged.

However, with the increasing speed of technological innovation and rapid changes in social situations, the environment will become more diverse and fluid. In such circumstances, establishing human resource development, educational means, and personnel qualifications that are adapted to the various environments of the time will contribute to the achievement of "safety, health, and well-being".

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