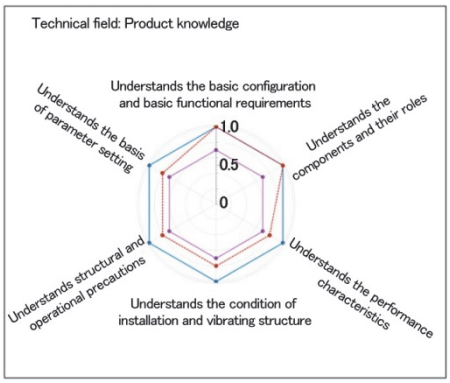
Initiatives for Human Resource Development Utilizing IT Systems in Nuclear Technology



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To properly maintain the required quality and improve the reliability of nuclear power, it is important, as a plant manufacturer operating a nuclear business, to make sure that our past experience and lessons are all inherited and reflected in our activities. For this purpose, we have been strongly conscious of maintaining and further improving our technical capabilities, and have taken on various projects in which on-the-job and off-the-job training are combined. Considering the prevailing situation surrounding nuclear power, we have built a system to continuously facilitate the passing on of all expertise without fail, as part of our efforts in this regard.

This report describes our undertaking to pass on expertise to subsequent generations utilizing the systems in our nuclear power business.

1. Introduction

The Paris Agreement, which dictates co-operation among all countries in the world to mitigate climate change, was adopted in 2015. As a long-term goal, the agreement aims to reduce emissions of greenhouse gases so as to "achieve a balance between anthropogenic emissions by sources and removals by sinks such as forests of greenhouse gases." In Japan, it is also required to proceed with various projects to reduce greenhouse gas emissions. Under such circumstances, nuclear power generation, which can supply power in a stable but less-costly manner while emitting less greenhouse gas, is an essential power source for our country.

Regarding nuclear power plants in Japan, with the assurance of safety based on the new regulations implemented in 2013 after the 2011 Great East Japan Earthquake, approved plants are gradually starting operations. Once operations are resumed at all existing plants, it will also become necessary to construct new ones in order to fulfill the expected roles in realizing a carbon-neutral society and supplying power in a stable manner for the years to come. To properly respond to such needs in society, we think it is our responsibility to provide safe, secure and high-quality products and services in all the fields related to the existing and newly-constructed plants.

With this understanding, it is extremely crucial to improve the technical capabilities pivotal to providing high-quality products and services and ensure the continuous passing on of expertise over the years to come. Therefore, we have taken on the challenge of organizing such expertise in even more detail and setting up a program through which young engineers can inherit this expertise without fail (i.e., the establishment of a systematic method).

2. Technical database and individual training management

There are two key points when making sure that all expertise is passed on without omitting anything. The first is to identify all the technical knowledge and skills that should be passed on and the second is to plan which ones should be passed on to whom and in what way before execution and to perform the plan. To proceed without fail, we are promoting the following procedures:

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(1) Reorganize the required technologies related to the nuclear power business
(2) Create a database based on the technical proficiency of each engineer
(3) Visualize technical capabilities in 5 or 10 years from now, considering the ages of the engineers in each technical field
(4) Formulate training plans for young engineers based on the results of the above

2.1 Reorganize the required technologies related to the nuclear power business

When passing on expertise to young employees, we usually identify the technical knowledge and skills vital to our nuclear power business. This time, however, in order to reinforce this process, we have reorganized the knowledge and skills that are required to create technical documents. Specifically, a system has been adopted to detail them without leaving anything out including the elements that are conventionally made up for by experience and rearrange the knowledge and skills that are directly connected to their practical execution as technical requirements. Each design department lists all the documents and the technical requirements are sorted out from the perspective mentioned above to see which ones are included in which documents. Moreover, if there are new technical requirements that are (or are expected to be) necessitated by regulatory requirement changes, they are also organized. The number of technical knowledge points/skills required for our nuclear power business extracted by this process—in terms of design, construction, maintenance and project management—amounted to several thousand.

2.2 Create a database based on the technical proficiency of each engineer and visualize the technical capabilities of the organization

In Section 2.1, the technical requirements required for our nuclear power business are sorted out. The next step is to create a database with the addition of organized information about the level of technical proficiency of the engineers in charge of each technique. This can visualize the age, number and proficiency level of engineers for each technical element, which allows us to see not only the technical capabilities of individuals, but also those of an organization obtained as the sum total of the technical capabilities of individuals. Moreover, by considering the number of engineers and the level of proficiency required to perform each of the technical elements, the sufficiency of the technical capabilities of each organization can also be shown by radar chart.

2.3 Visualize changes in the technical capabilities over years to come

Regarding each technical element, the ages of engineers is added as another factor for consideration to the information obtained in Section 2.2, which visualizes, with the use of a radar chart, how the number of engineers will change over 5 or 10 years from now. As this allows us to see the age ratio of each engineer group, we can identify the preferential technical fields in which the training of young engineers for the relevant technique is required to make the age ratio optimal.

The procedure described in Sections 2.1 to 2.3 is termed the “technical mapping system.” As shown in **Figure 1**, we systematically manage our technical capabilities.

2.4 Training management of young engineers

Based on the results of the above, a training plan is formulated for each of the young engineers who are to inherit the technical knowledge and skills, thereby promoting the cultivation of human resources with skills optimal for both the organization and the employees themselves. The use of this training scheme clarifies technical knowledge/skills to be learned by employees (those prioritized by the visualization results in Section 2.3 or those to be learned by young engineers for their career development), the methods to be used for learning them (specific on-the-job or off-the-job training) and the schedule. Truly efficient cultivation of personnel can thus be realized. As shown in **Figure 2**, our management system (“training management system”) operating in a coordinated manner with the aforementioned technical mapping system can ensure the passing on of all the technical knowledge/skills considered as priorities from an organizational perspective in the course of training.

Young engineers in training can understand what technical knowledge/skills are required in the organizations they belong to and understand clearly and in detail the knowledge/skills including those conventionally learned through actual work experience. This gives a means to envision their future selves, motivating them to further improve their technical capabilities.

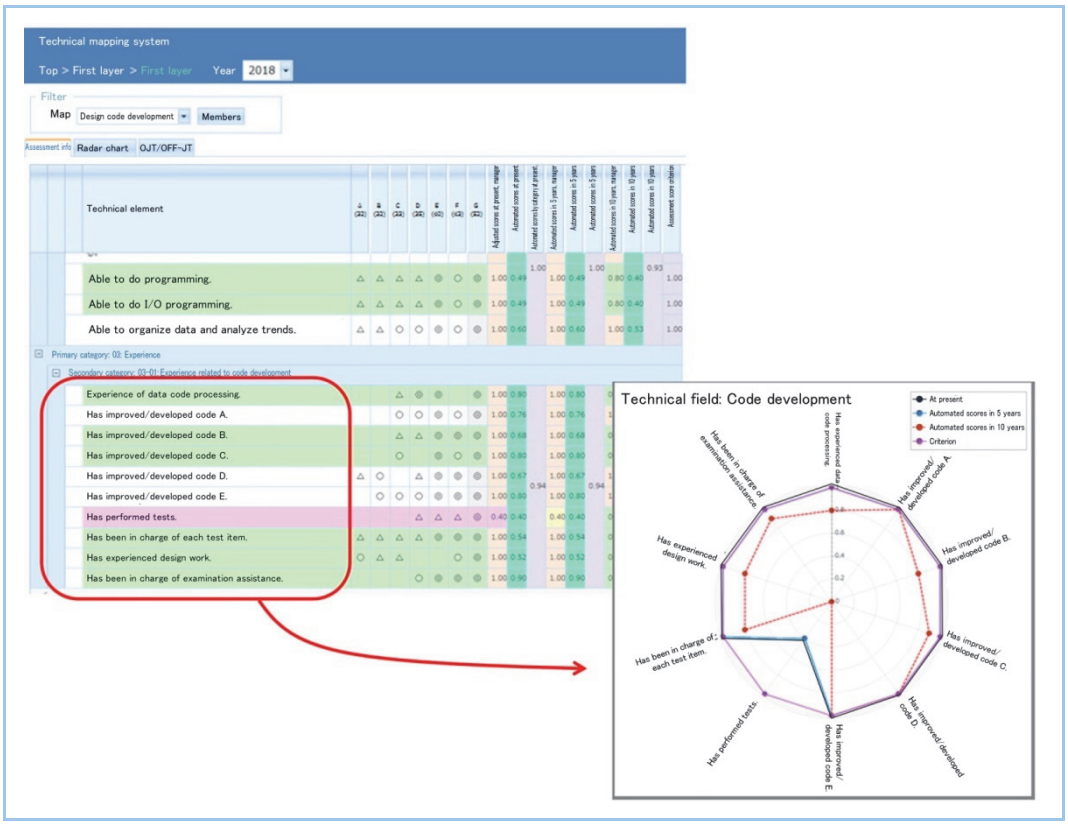

Figure 1 Technical map

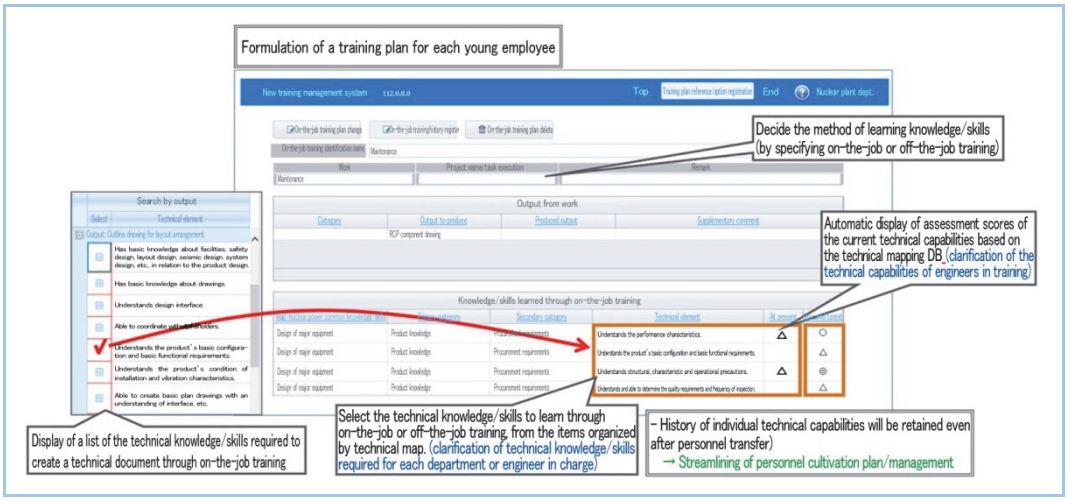

Figure 2 Training management system

At the end of each business year, follow-up regarding annual training history/results is conducted for each young engineer. The coordinated operation of the training management system and the technical mapping system allows the input of training history/results in the former system to be instantly reflected in the level of technical proficiency shown in the database of the latter system.

3. Effectiveness of our activities

With regard to the elemental technical knowledge and skills essential to each technical field, detailed visualization by technical map has provided a clear vision in terms of what knowledge/skills are required and how their levels can be rated. This visualization turns technical knowledge/skills into systematic knowledge. Such systematic knowledge-based training management realizes the planned passing on of expertise in a fine-tuned manner. Moreover, in addition to training management combined with reorganized technical requirements, we are considering methodological approaches to the passing on of expertise. It should not only be carried out through normal on-the-job or off-the-job training, but also by means that are flexible depending

on the purpose. For example, young engineers are exposed to similar work experiences outside the nuclear power business by making use of interactive opportunities among personnel, and are also given opportunities to create/organize collections of design expertise that are more detailed than existing in-house manuals together with skilled engineers. These activities can help us to comprehensively and efficiently maintain our technical capabilities over the years to come; capabilities that used to be naturally learned and passed on in the past during the nuclear power plant construction boom.

4. Future prospects

As described so far, this undertaking involves managing a great deal of information including the technical knowledge/skills vital to our nuclear power business, the level of technical proficiency of engineers and individual training plans. The number of technical knowledge/skills alone amounts to several thousand. It requires a great deal of time and effort to obtain cross-sectoral understanding of such information about all personnel from skilled to young employees and engage them in suitable projects. We will proceed with the introduction of AI applications in order to manage such big data more effectively and efficiently.

From the perspective of organizational technical capabilities, a function expected to be realized by AI is push notifications to managers regarding a technical field in which the future reinforcement of technical capabilities is desired according to the conditions input in the AI, such as the deployment of engineers. Other functions include support in planning training or the optimal utilization of human resources to realize the ideal personnel ratio. Moreover, from the perspective of individual training plans, we are about to realize a function to analyze the difference between the technical capabilities of many of our skilled engineers and those of engineers to be trained as their successors, and enable AI to suggest the optimal solution to filling any such capability gaps (e.g., education, on-the-job training and personnel transfer for upskilling).

5. Conclusion

As part of efforts for the reinforcement of the foundations of nuclear technology, we have created a database of the results of reorganized several thousand technical knowledge/skills required for our nuclear power business and have built a technical mapping system in database form. Through the use of this system, changes in the technical capabilities of each technical field can be visualized over the years to come, based on the current level of technical capabilities and the ages of engineers. Moreover, we have also built a management system (training management system) in which each of the technical knowledge/skills organized by technical map is linked with training plans for individual engineers, thereby enabling extremely efficient and systematic training management of individual engineers that ensures the technical capabilities of the organization. These activities can help us to efficiently and comprehensively maintain our technical capabilities over the years to come; capabilities that used to be naturally learned and passed on in the past when nuclear power plant construction was booming.